The mutual effect of irrigation water requirements and anti-respirations type on peanut plants grown on sandy soils

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Abstract: Two field experiments were carried out on a newly reclaimed sand soil under drip irrigation system at El Ismailia Agricultural Research Station, El 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 (*Arachishypogaea*, Giza 5 *c.v*) during the agricultural growing season of 2016 and 2017 to evaluate foliar application of anti-respiration abscisic acid and chitosan 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^3acre^{-1})on soil nutritional status, some growth characteristics, seeds productivity, oil seed quantity and quality, increase water use efficiency, taking a full advantage of available water and net benefit of return and create ways to improve drought tolerance of peanut plant under sandy soil conditions. Data obtained showed that: 1- From the data obtained, it is clear that nutritional status as soil content can be influenced considerably by soil type, water irrigation system as well as types of hydro-gel at different rate of soil application under study. Revealed highly significant on macro-nutrients (N, P and K) and micro-nutrients (Fe, Mn and Zn) content in soil throughout the irrigation water 100% applied at drip irrigation system; 2- Regard to interaction between treatments under study data illustrated that higher effect on peanut all plant growth characteristics under study when applied the irrigation water at high rate 100% (1152 m^3acre^{-1}) accompanied with spray chitosan at low rate of 5 mg l^{-1} and abssic acid at 10 mg l^{-1}; 3- Concerning 100 peanut seeds and yield the application of two anti-respiration (chitosan and abcissic acid) combined with 100 and 75% irrigation water at 2% application rate of hydro-gel resulted was in a significant increases; 4- Regard to peanut seed quality, however, the highest value of irrigation water, 1125 m^3acre^{-1}, was associated with the combined effect of 100% irrigation quantity and 5mg l^{-1} of chitosan as anti-respiration increase oil seed content and crude protein with both oleic acid and iodine value than other treatments under study; 5- The results obtained of macro-nutrients (N, P and K) and micro-nutrias (Fe, Mn and Zn) content of peanut plants, data showed that irrigating peanut plants by 1125 m^3acre^{-1} and application of hydro-gel at rate of 2% with foliar spray of 5 mg l^{-1} chitosan and 15 mg l^{-1}abcissic macro-nutrients (N, P and K) acid micronutrients (Fe, Mn and Zn) content of peanut resulted in remarkable increases. Nerveless, decreasing the amount of irrigation water from 1125 to 884 m^3acre^{-1} decreased the micro nutrients content; 6-Fromthe above mentioned could be conclude that the application irrigation water at 100% (1125 m^3acre^{-1}) accompanied with anti-respiration chitosan or abcissic acid both of each at low rates were more effect than that obtained in term of water use efficiency is sandy soil condition grown with peanut plants.

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1. Introduction

Peanut (*Arachishypogeae* 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**).

Anti-transpirant materials are compounds that are designed to reduce transpiration. It is well known that leaf surfaces containing tiny openings called stoma. These openings are where plants take in carbon dioxide and release oxygen and water during photosynthesis. Nearly 99 per cent of the water absorbed by the plant is lost in transpiration (**Davenport *et al.*, 1972**).

Most of anti-transpirant materials can be categories into four types; 1) Stomatal closing type such as phenyl mercuric acetate and herbicides like Atrazine in low concentration serve as anti-transpirants by inducing stomatal closing (**Khalid, 2015**); 2) Film forming type such as plasticethyl alcohol and waxy material which hinder escaping water vapor from plant leaves (**Abdullah *et al.*, 2015**), 3) Reflectance type such as kaolin spray, hydrated lime, calcium carbonate, magnesium carbonate, zincs sulphate *etc*. These materials increase leaf reflectance, sequentially reduce water losses via stoma (**Maamoun and Hassan, 2013**) and 4) Growth retardant such as cycocel and abscisic acid *etc.* (**Menon and Savithri, 2015**). These materials improve water status of plant, improve root growth, and thus enable plant to resist water shortage.

Marco *et al.* (2001) chitosan is commercially prepared as a waste byproduct from the shells of shrimp, crab, and lobster, and as such, its use as an anti-transpirant in crop production seems economically feasible. In view of the increasing demand for limited resource water, the possibility to reduce crop transpiration, particularly in irrigated agriculture, would be advantageous. Foliar application of chitosan reduces transpiration of plants through partial or full closure of stomata. Reduction in yield and biomass from chitosan-induced closure of stomata were not statistically significant.

Osmotic root hydraulic conductance, transpiration rate, leaf osmotic potential and relative water content, and root and leaf abscisic acid contents were also analysed. Abscisic acid and inhibitor of stomatal opening when applied as foliar sprays. Thus, correlations were sought between the factors (*e.g.* decrease of transpiration rate, leaf dehydration and abscisic acid) that regulate root hydraulic conductance and aquaporin expression during drought (**Klein *et al.*, 2004**).

The objectives of this study to evaluate foliar application of some anti-respiration and hydro-gel on production of peanut plant under sandy soil conditions and to increase water use efficiency and taking a full advantage of available water.

2. Materials and Methods

A field experiment was conducted on a newly reclaimed sand textured soil under drip irrigation system at Ismailia Agricultural Research Station located between Latitude 30° 35' 30" N, Longitude 32° 14' 50" E and elevation 3 meters from the sea level, and cultivated with peanut plants as (*Arachishypogaea*, Giza 5) a summer crop during the agricultural growing season of 2016 and 2017. Some hydrophysical, chemical and fertility status of the studied sand soil are illustrated in Table (1).

The fixed plots, was an area of 10.5 m^2 ($3.0\times3.5m^2$) for each one, with three replicates, arranged into a split–split plot design, with three replicate, as follows:

Irrigation water requirement for peanut plant is 1125 m^3 $acre^{-1}$. Three irrigation water regimes were at 100 and 75% from water requirement (1125 and 884 m^3 $acre^{-1}$) as main plots. Two type of anti-respiration were use as sub plots with three concentrations as sub-sub plots of abscisic acid at rate of 0.0, 5.0 and 10.0 g $l^{-1}$and chitosan at rate of 0.0, 15.0 and 20.0 g l^{-1} Hydrogel was applied to soil three rates 0.0, 2.0 and 3.0 %.

All plots received nitrogen fertilizer at the rate of 40 kg $acre^{-1}$ nitrogen as ammonium sulphate (20.6 % N), added in two equal doses (one and two months after planting). Phosphorus was added at the rate of 35 kg $acre^{-1}$ (as single superphosphate, 12.5% P_2O_5), while K was added at a rate of 40 kg $acre^{-1}$ K_2O as potassium sulphate (48% K_2O) during the preparation of soil cultivation.

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

Soil characteristics		Value		Soil characteristics		Value
Particle size distribution%:				Soluble cations (soil paste $mmole_cL^{-1}$):		
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 $mmole_cL^{-1}$):		
pH (1:2.5 soil water suspension)		7.69		CO_3^{2-}		0.00
$CaCO_3$ %		1.33		HCO_3^-		1.40
Organic carbon %		0.21		Cl^-		0.71
ECe (dS/m, 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 h^{-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

Some physical, chemical and fertility properties of the investigated soil (bulk density, moisture constants and nutrients retained) at maximum vegetative growth stage (90 days after sowing) were determined according to the standard methods as described by **Piper, (1950); Richards (1954); Jackson (1973)** and **Page *et al.* (1982)**. Available N, P and K were extracted by 1% K_2SO_4, 0.5 M solution sodium bicarbonate and 1 N ammonium acetate respectively, and were determined according to **Jackson (1973)**. 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 its attributes (seed and Foliage yield, weight of 100 seed, seed oil, oleic acid, iodine value and nutrient contents of N, P, K, Fe, Mn and Zn were determined.

For each plot, the chosen samples of both seeds and foliage taken at harvest were dried; ground and wet digested using H_2SO_4+$HClO_4$acid mixture. In the digested products, N was determined with a micro-Kjeldahl **(Chapman and Pratt, 1961)**. Phosphorus was determined colour metrically, according to **Watanab and Olsen (1965)**. Potassium was determined using a Flamephoto meter, according to **Jackson (1973)**. Iron, manganese and zinc were determined using an Atomic Absorption Spectrophotometer. Oil content for peanut seeds was determined according to **Bligh and Dyer (1959)**. Oleic acid determined according to **AOCS (1989)** and iodine value were calculated using the equation given by **Chowdhury *et al.* (2015)**. All collected data were statistically analyzed according to **Gomez and Gomez (1984)**.

3, Results and Discussions

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**).

I. Effect water regime with hydro gel with different Anti-respiration

a) Plant height

Data given in Table 2 showed the highest value of plant height of peanut plants as affected by applied the irrigation water at high rate 100% (1125 $m^3 acre^{-1}$) at both anti-respirations under study. In generally, data obtained indicated that the applied chitozan was gave best values of plant height than Absassic acid as foliar application. This may be due to anti-transpirants will lower the surface tension of water, which increases the efficiency of water penetration but reduces the build-up of water droplets on the plant (**Lolicato, 2011**).

Table 2: Effect water regime with hydro gel soil application with different Anti-respiration types on plant height (cm) of peanut plants grown in sandy soil

Hydro-gel % (H)	Anti-respiration types (A)						
	Control	Chitozan mg l^{-1}			Absassic acid		
		5	10	Mean	15	20	Mean
	100% water application (R)						
0	56.90	80.75	70.96	69.53	68.55	64.87	63.44
2	58.00	81.55	73.53	71.02	69.35	65.43	64.26
3	50.33	75.28	69.45	65.02	67.48	63.21	60.34
Mean	55.07	79.19	71.31	68.52	68.46	64.50	62.68
	75% from water application						
0	53.90	76.04	68.98	66.30	65.42	62.66	60.66
2	56.00	77.76	70.43	68.06	69.11	64.86	63.32
3	50.03	72.73	67.23	63.33	63.48	61.43	58.31
Mean	53.31	75.51	68.88	65.90	66.00	62.98	60.76
Grand mean	54.19	77.35	70.09	67.21	67.23	63.74	61.72
LSD at 0.05	H 0.25	R 0.14	A 0.33	H*R 1.24	H*A 0.35	R*A 0.11	H*R*A 0.10

Regard to interaction between treatments data in Table (2) illustrated that higher effect on peanut plant height was showed to applied the irrigation water at high rate 100% (1152 $m^3 acre^{-1}$) accompanied with spray chitosan at low rate of 5 mg l^{-1} and applied soil 2% hydro-gel.

b) Dry matter of foliage

Data in Table 3 showed that the similar trend was obtained for dry matter content of peanut foliage as previously mentioned in fresh weight of foliage. Dry matter content at the irrigation water of 100% (1125 $m^3 acre^{-1}$) was more pronounced than that obtained at water regime 75% (884 $m^3 acre^{-1}$). **Vorasoot *et al.* (2003)** dry matter production, pod yield, seed yield, number of seed per plant and seed size of all peanut cultivars significantly decreased under water stress regimes. Photosynthesis reduced by water stress due to reduced stomata conductance and reductions in leaf area. As moisture stress increases, stomata start closing as a mechanism to reduce transpiration. Consequently, the entry of carbon dioxide is also reduced (**Reddy *et al.*, 2003**). Data also indicated that chitosan foliar spray was more favorable than abcissic acid as anti-respiration materials.

Table 3: Effect water regime with hydro gel soil application with different Anti-respiration types on fresh weight for foliage (kg $acre^{-1}$) of peanut plant grown in sandy soil

Hydro gel % (H)	Anti-respiration types (A)						
	Control	Chitozan mg l^{-1}			Absassic acid		
		5	10	Mean	15	20	Mean
	100% water application (R)						
0	1516.8	2956.8	2789.7	2421.1	2705.3	2446.5	2222.8
2	1654.1	2966.9	2886.5	2502.5	2764.8	2527.6	2315.5
3	1456.9	2899.5	2775.5	2377.3	2627.6	2539.9	2208.1
Mean	1542.6	2941.0	2817.2	2433.6	2699.2	2504.7	2248.8
	75% from water application						
0	1511.4	2380.2	2156.8	2016.1	2100.7	2027.6	1879.9
2	1585.6	2396.3	2215.7	2065.8	2134.8	2116.9	1945.7
3	1499.5	2245.8	2011.6	1918.9	2076.9	1996.4	1857.6
Mean	1532.1	2340.7	2128.0	2000.3	2104.1	2046.9	1894.4
LSD at 0.05	H 102.0	R 112.0	A 91.2	H*R 65.8	H*A 57.6	R*A 157.6	H*R*A 142.0

While application rate of 5 mg l^{-1} chitosan was, also more effect on dry matter content of peanut plants than that obtained at high rate of 20 mg l^{-1}abcissic acid at both rates of irrigation water applied and at both rate of hydro-gel applied.

II. Effect water regime with hydro-gel with different Anti-respiration on yield

a) Weight of 100 seeds

Clear from the values in Table 4 that the weight of 100 seeds showed significant increase with application of both 100% and 75% irrigation water. Concerning the effect of water irrigation applied to peanut plants accompanied with chitosan anti-respiration as compared with control. The highest increment of weight of 100 peanut seeds was occurred with chitozan at rate of 5 mg l^{-1} followed by chitosan at rate of 10 mg l^{-1} both companied with applied 100% irrigation water (1125 $m^3 acre^{-1}$). Same trend was observed with 75% irrigation water (884 $m^3 acre^{-1}$) but with different values. **Junya *et al.* (2012)** indicated that drought during the vegetative phase has small effect on growth and yield of peanut and 24% of yield reduction was reported when peanut was subjected to drought during the end of growing season (**Boontang *et al.*, 2010**).

Regard to hydro-gel as super absorbent water polymers. Data clearly showed that applied low rate at 2% more effect than those obtained from using high rate of 3% and control. The addition of hydrogel at the rate of 2 gkg^{-1} increased the water holding capacity of coarse sand from 171 to 402% (**Johnson 1984a**).

Data recorded in Table 4 showed that the application of two anti-respiration (chitosan and abcissic acid) combined with 100 and 75% irrigation water at 2% application rate of hydro-gel resulted in a significant increases in weight of 100 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**).

b) Peanut seeds yield

Data presented in Table 5 revealed that reducing irrigation eater requirements for 75% and the application chitosan or abcissic 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% applied hydro-gel combined with abcissic acid at rate of 25 mg l^{-1} gave the lowest yield compared with the other treatments used.

Table 4: Effect water regime with hydro gel soil application with different Anti-respiration types on weight for 100 seeds (g) and yield (kg $acre^{-1}$) of peanut plants grown in sandy soil

Hydro gel % (H)	Anti-respiration types (A)						
	Control	Chitozan mg l^{-1}			Absassic acid		
		5	10	Mean	15	20	Mean
	Weight 100 seeds						
	100% water application (R)						
0	53.00	95.36	92.11	80.17	85.36	72.49	70.28
2	56.76	100.21	94.63	83.87	88.70	75.36	73.60
3	51.90	90.41	90.00	77.44	80.19	70.10	67.39
Mean	53.88	95.32	92.24	80.48	84.75	72.65	70.42
	75% from water application						
0	54.98	68.90	65.15	62.67	66.69	63.93	61.87
2	55.11	70.32	67.35	64.59	67.32	64.22	62.21
3	50.98	67.13	64.00	60.70	65.98	62.33	59.76
Mean	53.69	68.78	65.5	62.65	66.66	63.49	61.28
LSD at 0.05	H 0.12	R 0.10	A 0.05	H*R 0.01	H*A 0.07	R*A 0.06	H*R*A 0.02
	Seed yield						
	100% water application (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 application						
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 12.3	R 10.7	A 6.2	H*R 7.8	H*A 2.3	R*A 4.4	H*R*A 25.3

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-respiration. The application of hydrogels may be is an important practice to assist plant growth by increased water retention by sandy soils and its availability to plants 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 Walas, 1986a**).

Data in Table 5 showed that effect of the interaction between 100% water requirement and chitosan ate rate of 5 mg l^{-1} accompanied with 2% soil application of hydro-gel. The inter action was significant and more pronounced on peanut yield. This result may be explained by that Hydrogels 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**).

III. Effect water regime with hydro-gel with different Anti-respiration types on yield quality and quality

1. Peanut seed oil quantity

a) Seed oil content

With respect to peanut seed oil content seed data showed in Table 4 that the 100% applied irrigation water at amount 1125 $m^3 acre^{-1}$ was high oil content than water regime 75% at amount of water 884 $m^3 acre^{-1}$ that means water regime was reduce the oil content of peanut seed. The decrease in seed oil contents of oil seed crops under water stress is a common phenomenon (**Ali *et al.,* 2009**). Seed oil content of peanut seed was found to decrease under drought stress (**Dwivedi *et al.,* 1996**).

Regard to type of anti-respiration, data obtained indicated that chitosan and abcessic acid at all applied rates used increased oil content compared to control treatments. While chitosan foliar spray at rate of 5 mg l^{-1} and abcissic acid at rate of 15 mg $acre^{-1}$ were more favorable effect on oil contents of peanut seeds. **El-Nagar *et al.* (2012**) on pea green yield found that spraying the plants with chitosan at a rate of 1% increased vegetable growth and yield and its component.

Concerning to hydro-gel rates, Table 4 indicated that oil seeds content was of high value at rate 2% soil application than other rates used without or at 3% application one.

Table 4: Effect water regime with hydro gel soil application with different Anti-respiration types on seed oil (%) of peanut plants grown in sandy soil

Hydro gel % (H)	Anti-respiration types (A)						
	Control	Chitozan mg l^{-1}			Absassic acid		
		5	10	Mean	15	20	Mean
	100% water application (R)						
0	20.00	30.12	29.70	26.60	28.22	27.40	25.20
2	20.15	30.43	30.03	26.87	28.36	27.52	25.34
3	19.01	25.14	24.95	23.03	21.35	20.55	20.30
Mean	19.72	28.56	28.22	25.50	25.97	25.16	23.62
	75% from water application						
0	19.01	29.15	28.30	25.48	27.22	26.44	24.22
2	19.54	29.27	29.00	25.93	28.43	27.87	25.28
3	18.56	27.76	22.43	22.91	21.00	20.75	20.13
Mean	19.03	28.72	26.57	24.78	25.55	25.02	23.20
LSD at 0.05	H 0.22	R 0.14	A 0.90	H*R 0.12	H*A 0.21	R*A 0.11	H*R*A 0.15

However, the highest value of irrigation water, 1125 m^3 $acre^{-1}$, was associated with the combined effect of 100% irrigation quantity and 5mg l^{-1} of chitosan as anti-respiration under 2% hydro-gel soil application increase oil seed content than other treatments under study. Chitosan is an anti-transpirant compound that has proved to be effective in many crops (**Karimi *et al*., 2012**) and was used to protect plants against oxidative stress (**Guan *et al.,* 2009**) and to stimulate plant growth (**Farouk *et al.,* 2008 and 2011**).

2. Peanut seed oil quality

a) Oleic acid of peanut seed oil

In this study, data in Table 5 showed a huge variation between the peanut irrigated with 100% and 75% water requirements was observed for oleic acid content. **Andersen and Gorbet (2002)** reported that oleic acid content in peanut genotypes varied from 21 to 85%. Peanut oil composition is influenced by several groups of factors including environmental factors, genetic factors and interaction between environmental and genetic factors (**Chaiyadee *et al.,* 2013**). These findings supported by **Chowdhury *et al.* (2015)**.

These results in Table 5 showed that the oleic acid content of peanut varieties was affected by the quantity of irrigation water at the growing seasons. It might be the reason of the higher mean oleic acid percentage of peanut responses. **Gulluoglu *et al.* (2016)** found that higher temperature during the last 4 weeks before harvest resulted in higher oleic acid and lower linoleic acid content. Several factors affect the fatty acid content in peanut oil, including soil nutrient, moisture availability, growing conditions and maturity (**Chaiyadee *et al.,* 2013**).

In the present study, it was observed that, the oleic acid content among peanut plants sprayed with 5 and 15 mg l^{-1} chitosan and absassic acid, respectively was insignificant effect and higher response.

On the other hand, data showed that soil application of hydro-gel as usually at rate of 2% was more effect in oleic oil content of peanut oil and all parameters previously under study.

Finally, from previously data obtained in Table 5, the application 100% irrigation water combined with different rate of chitosan 5 and 10 mg l^{-1} and 2% soil applied of hydro-gel was more effective in crude protein of peanut seed than 75% water regime applied with hydro-gel at rate of 3% and control one with sprayed anti-respiration at 25 mg l^{-1}absassic acid.

Table 5: Effect water regime with hydro gel soil application with different Anti-respiration types on oleic acid and Iodine value of peanut oil

Hydro gel % (H)	Anti-respiration types (A)						
	Control	Chitozan mg l^{-1} 5	10	Mean	Absassic acid 15	20	Mean
	oleicacid (%)						
	100% water application (R)						
0	44.9	79.3	74.6	66.266	77.9	67.2	62.50
2	48.5	80.9	75.9	68.43	79.3	75.5	64.93
3	35.7	75.2	70.4	60.43	75.3	64.1	56.93
Mean	43.03	78.46	73.63	65.04	73.3	68.03	61.45
	75% from water application						
0	34.1	75.3	67.3	58.90	56.3	54.3	48.23
2	36.0	75.9	70.4	60.76	71.7	69.1	58.93
3	32.5	68.7	66.4	55.86	55.1	46.8	44.8
Mean	34.20	73.3	68.03	58.51	61.03	56.73	61.03
LSD at 0.05	H 0.02	R 0.10	A 0.03	H*R 0.09	H*A 0.07	R*A 0.4	H*R*A 0.10
	Iodine value (mg 100kg^{-1})						
	100% water application (R)						
0	72.60	49.32	55.80	59.24	60.36	63.62	65.52
2	73.90	52.35	58.35	61.53	62.62	65.96	67.49
3	73.71	50.39	60.51	61.53	65.09	68.39	69.06
Mean	73.40	50.68	58.22	60.77	62.69	65.99	67.36
	75% from water application						
0	73.60	68.23	69.45	70.42	69.80	70.49	71.29
2	76.71	70.60	71.23	72.84	71.60	72.00	73.43
3	75.90	69.35	70.35	71.86	70.35	71.60	72.61
Mean	75.40	69.393	70.34	71.71	70.58	71.36	72.45
LSD at 0.05	H 0.04	R 0.10	A 0.21	H*R 0.09	H*A 0.07	R*A 0.01	H*R*A 0.03

a) Iodine value of peanut seed oil

Iodine value is used to measure unsaturation or the average number of double bonds in fats and oils. Decrease in iodine value shows decrease in the number of double bonds and it indicates oxidation of the oil (**Josphine *et al.*, 2016**).

Data in Table 5 showed that the iodine value of peanut oil was affected by all treatments under study. The application of 100% irrigation water requirement was more pronounced in such iodine value and with highly significant than 75% water requirement.

Regard to anti-respiration types used, data obtained indicated that at rate of chitosan 5 mg l^{-1} and 10 mg l^{-1}abcassic acid was more responses on iodine value of peanut oil under study.

On the other hand, the hydro-gel used as soil application also was more favorable effect at rate of 2% than other rates used.

Finally, the iodine value of peanut oil obtained was more affected by water regime with anti-respiration foliar spray as chitosan and soil application of hydro-gel both at low rate.

Finally, from the above mentioned could be noticed that the oleic and Iodine value were different during the growing seasons due to the variation of different factors and the lowest iodine value were reported from the applied anti-respiration type to other and application of hydrogel at different water requirement. This was due to lower oleic acid percentage obtained.

IV. Water use efficiency (WUE)

Data in Table 6 show the water use efficiency for peanut plants grown under drip irrigation system and irrigation water regain with different foliar of application anti-respiration and rate accompanied with soil application rate of hydro-gel. Data showed that the effect of irrigation treatments on water use efficiency (WUE) as peanut yield m^3 of irrigation water. Irrigation treatment under 100% gave the highest WUE than 75%. This can be attributed to the integration of root distribution between the different root depths in the root zone.

Regard to ante-respiration type and rates, data obtained indicated that the chitosan at rate of 5 mg l^{-1}

followed by abcissic acid at rate of 15 mg l^{-1} was higher in WUE than other treatment used. This finding may be due to during water stress plants generally close their stomata with resultant reduced water loss, decreased photosynthesis and an overall apparent increase in water use efficiency (**Barbour *et al.*, 2000**). **Farooq *et al.* (2009)** noticed that during drought stress reduces leaf size, stem extension and root proliferation, disturbs plant water relations and reduces water-use efficiency. During water stress plants generally close their stomata with resultant reduced water loss, decreased photosynthesis and an overall apparent increase in water use efficiency (moles of carbon fixed per mole of water transpired).

Table 6: Effect water regime with hydro gel soil application with different Anti-respiration types on water use efficiency (kg $acre^{-1}$) of peanut plants grown in sandy soil

Hydro gel % (H)	**Anti-respiration types (A)**						
	Control	**Chitozan** mg l^{-1}			**Absassic acid**		
		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

Data obtained in Table 6 also indicated that use hydro-gel at 2% was more effect on WUE compared with 3% and without application this due to the addition of hydrogel at the rate of 2 % increased the water holding capacity of coarse sand from 171 to 402% (**Johnson 1984a**). 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**).

Conclusions

From above mentioned could be conclude that the application irrigation water at 100% (1125 $m^3 acre^{-1}$) accompanied with anti-respiration chitosan or abcissic acid both of each at low rates and companied with 2% hydro-gel were more effect than that obtained in term of water use efficiency is sandy soil condition grown with peanut plants.

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