J. Agric. Sci. Mansoura Univ., 27 (9): 6505 - 6522, 2002

EFFECT OF IRRIGATION WATER HAVING DIFFERENT EC AND SAR VALUES ON ONION PRODUCTIVITY UNDER SANDY SOIL CONDITIONS

Labeeb, G.
Soils Department, Faculty of Agriculture, Mansoura University

ABSTRACT

A *pot experiment was* performed at Soils Department, Faculty Of Agriculture Mansoura University during 2001 growing season to determine the effect of water salinity levels (0.4, 1.0, 2.0 and 3.0 dSm^{-1}). SAR levels (3.5, 7.0 and 14.0) and the simplest combination *between the levels of the previous* factors on elemental distribution, nutrients uptake and the productivity of onion plant.

The obtained results can be summarized in:

Under the experiment conditions, the correlation studies between irrigation water studied characters and bulbs fresh weight reveal that the reduction rate in bulbs fresh yield by increasing water salinity by one unite is dependent on SAR value and the adverse trend is true . At SAR of 14.0 ,increasing water salinity by 1 dSm^{-1} *decreased the yield of bulbs fresh* weight by 24.940 % . While at SAR of 3.5 the reduction rate under the same increase in water salinity was 19.550 % . At EC value of 0.4 dsm^{-1},raising SAR value one unite decreased the bulbs fresh weight by 2.071 % ,while at EC value of 3.0 dSm^{-1} *the reduction amounted to be* 4 240 % .

The obvious trend was also obtained as a result of the effect of water salinity and SAR on the dry weights of bulbs, culls and roots .

Raising irrigation water salinity and / or water SAR increased culls dry weight /bulbs dry weight ratio . Whenever, this ratio at the treatment of 0.4 dSm^{-1} and SAR of 3.5 *was increased* from 31.13 % to 62.02 % at the treatment of 3.0 dSm^{-1},and SAR of 14 .

Raising irrigation water salinity increased N, P, K and Na contents in onion plant parts . *Raising SAR of irrigation water increased* Na content up to the highest level of SAR (14). While phosphorous content was increased up to SAR levels of 7.0 then decreased after that.

Raising irrigation water salinity and / or SAR decreased *K/Na ratio.*

The relative nitrogen use efficiency was reduced from 100% to 56.96 as a result of water salinity increasing from 0.4 to 3 dSm^{-1}, while raising SAR from 3.5 to 14 decreased the relative nitrogen use efficiency from 100% to 54.03%.

Phosphorus uptake by onion plant in this study amounted to be from 12.48 to *19.95% of that N uptake.*

Increasing irrigation water salinity and /or water SAR reduced N,P and K uptake, So, altered the distribution pattern of each. While, sodium uptake was increased with *increasing water SAR , but decreased by increasing* water salinity, and the amount of sodium uptake by plant is very small compared to that of N, P and K , these reflect the highest onion ion uptake selectivity .

INTRODUCTION

Nowadays, in Egypt, onion *(Allium Cepa, L.)* is one of the most successful exportable vegetable crop grown in the new reclaimed desert soils. It is well known that such soils are characterized by small water retention capacity and in this case the application of drip or sprinkler irrigation system can alleviate this problem . But the irrigation water used in that areas is mostly derived from the shallow saline ground water aquifers or from Nile-drainage water mixture, which restricts highly the growth of plants . Abd EL-Salam and Osman (1965) found that the salinity of the ground water aquifers in both the Mediterranean costal area and western desert, ranges between 2-6 grams/liter with the domination of sodium. In unpublished data the irrigation water which is used in the Qalabshu and Zayan costal area in Dakahlia governorate has an EC value ranging between 3 and 5 dSm-1 and SAR value not less than 10 (G.Labeeb,2001).

Soil salinity stresses on onion plant were studied but Little information are known about the effect of water salinity levels and their salinity composition on onion yield, whenever Miyamoto in 1989 studied the effect of subirrigation with various saline solutions on emergence (seed emergence means the appearance of a cotyledon from the soil surface) and seedling *mortality of onion seeds planted* 15 mm deep in loamy sand soil . He revealed that a significant reduction in the final emergence counts occurred at 22.0 to 30.0 dSm^{-1} in the saturation extract . when subirrigation was done with a solution of 4.9 dSm^{-1} the soil surface salinity exceeded than the such levels in a matter of 6-10 days after seeding , which is the initial period of emergence .This reduction in emergence caused by hypocotyle mortality induced by cotyledon salt damage .

Yadav *et al.* (1998)studied the effect of soil salinity levels on growth and yield of 3 onion cultivars .They reveal that the growth and the bulbs yield of all cultivars were not affected adversely up to a soil salinity level of 4.0 dSm^{-1} and the highest soil salinity (16 dSm^{-1}) reduced the leaves dry weight and the bulbs yield by about 40-50 %as compared to the control (0.3 dSm^{-1}) .

Sharma *et al.* (2000) studied the adaptability of onion genotypes under alkalinity and salinity stresses of the soil. They found that a fifty percent *reduction in bulb yield was observed at pH 9.14 and ECe 3.93* dSm^{-1} compared to that of a non stresses treatment.

The high sodium percentage in soils also affects onion productivity, as a continuous decrease in dry matter production was found with rise in ESP,(Singh and Abrol, 1985).

A good understanding of the effect of irrigation water characters on crop productivity is must be demand. So that this study was carried out to shed some light on irrigation water characters (EC & SAR) on onion productivity.

MATERIALS AND METHODS

A pot experiment was conducted at the Soils Dept. of Mansoura Univ. in winter 2001, to determine the effect of irrigation water having different levels of salinities and SAR ratios on the productivity of onion .

Plastic pots without pores in the bottoms were filled with 7 kg of sandy soils of pH 7.4 , EC of paste extract 2.4 dSm^{-1} and total carbonate of 0.4% (soil properties were determined according to Jackson,1967) .

The pots of 18 cm diameter were arranged to form strip plot in a complete randomized block design with nine replicates .

Four levels of water salinity : control of EC 0.4 , 1.0,2.0 and 3.0 dSm-1 were used in this experiment . In addition three levels of sodium adsorption ratios : 3.5, 7.0 and 14.0 were also used to form 12 water treatments .

To explain how the experimental saline solutions were prepared , the following theoretical and mathematical treatments are concerned

According to Richards 1954 :

$$SAR = Na / \sqrt{\frac{Ca + Mg}{2}} \qquad (1)$$

The ions are calculated as meq L^{-1}

Now suppose that we attend to prepare one liter of saline water having SAR ratio of 14.0 and EC of 3.0 dSm^{-1}

by substitution

$$14 = \sqrt{2}.Na / \sqrt{Ca + Mg}$$

$$14 = 1.414.Na / \sqrt{Ca + Mg}$$

$$\frac{1.414}{14}.Na = \sqrt{Ca + Mg}$$

$$0.101 Na = \sqrt{Ca + Mg}$$

By squaring this equation we got

$\therefore$ 0.0102 Na^2 = Ca + Mg

Make the equation equal zero

$\therefore$ 0.0102 Na^2 – (Ca + Mg) = 0.0 ....(2) in a water having SAR = 14

As we previously supposed, the electrical conductivity of required solution is 3.0 dSm^{-1}.According to Richards(1954), multiplying the EC value in dSm^{-1} by 10 produces the amount of cations in meq L^{-1}.

Thus ,concentration of the solution =3.0 x 10 = 30.0 meq L^{-1} (3)

This means that the solution contains 30.0 meq of Na , Ca and Mg ions per liter .

$$\therefore \quad Na + (Ca+Mg) = 30 \text{ meq} \qquad (4)$$

Make the equation equal zero

$$Na + (Ca+Mg) - 30 = 0.0 \qquad (5)$$

Adding the equation 2 to the equation 5

$$0.0102\, Na^2 \quad - (Ca + Mg) \quad = 0.0 \qquad (2)$$

$$+ \qquad Na \;+(Ca + Mg \;- 30 = 0.0 \qquad (5)$$

$$0.0102\, Na^2 + Na \qquad - 30 = 0.0 \qquad (6)$$

Multipling by 1/ 0.0102 , we got

$$Na^2 + 98.039\, Na - 2941.17 = 0.0 \qquad (7)$$

By solving the equation algebricaly ,we got .

$$(Na - 24.08373)\,(Na + 122.12273) = 0.0 \qquad (8)$$

$\therefore$ Na – 24.08373 = 0.0 $\qquad$ $\therefore$ Na = 24.08373 meq

As obvious the other case of Na = – 122.12273 which is not acceptable.

REFERENCES

Abdel-Salam , M. A. and A. Z. Osman (1965). Interaction of saline water irrigation and phosphorus fertilization on crop production. J. of Soil Sci. UAR. , 5 (2) :75-88.

Asseed , M . and A .W. Warid (1977) . Response of onion plant to saline water irrigation . Libyan J. of Agriculture , 6 (2) :123-128 .

Bailey, J. S. (1992). Effect of gypsum on the uptake, assimilation and cycling of N^{15}-labeled ammonium and nitrate- N by perennial ryegrass. Plant and Soil, 143: 19-31.

Bernstein, L. (1975). Effects of salinity and sodicity on plant growth. Ann. Rew. Phytopathol., 13: 295-312.

Cottenie, A.; M. Verloo; L. Kiekens; G. Velghe and Camerlynck (1982). "Chemical analysis of plant and soil, lab. anal. & Agrochemistry", satate Univ. Gent, Belgium.

Fenn, L. B. and S. Feagley (1999). Review of beneficial uses of calcium and ammonium salts for stimulating plant growth and metabolite translocation. Communications in soil science and plant analysis, 30 (19/20): 2627-2641.

EL-Agrodi, M. W. M. and M. A. Abou EL- Soud (1988). Effect of irrigation regime and water salinity on rice plant under lysimeters condition II-concentration and uptake of N,P,K, and Na. J. Agric. Sci., Mansoura Univ., 13 (2): 950-958.

Gomez, K. A. and A. A. Gomez (1984). Statistical Procedure for Agriculture Research 2nd . Ed., John wiley and Sons.

Gupa, R. K. and I. P. Abral (1990). Salt affected soils: their reclamation and management for crop production. Adv. Soil Sci., 11: 223-288.

Hallmark, W. B.; L. P. Brown and G. L. Hawkins (1997). Use of calcium chloride to reduce the nitrogen requirements of sugarcan. Louisiana Agric., 40: 30-31.

Lea-Cox, J. D. and J. P. Syvertsen (1993). Salinity reduces water use and nitrate-N use efficiency of citrus. Annals of Botany, 72: 47-54.

Jackson, M. L. (1967). "Soil Chemical Analysis. Prentice" Hall of India, New Delhi.

Jones, J. B.; Benjamin woff, Jr. and H. A. Mills (1991)."Plant analysis". Hand Book. Micro-Macro, Publishing, Inc. U.S.A.

Mangal, J. L. and S. Lal (1988) .Salt tolerance behaviour of Kharif onion variety N-53 . Haryana J. of Horticulture Sci., 17 (1-2): 78-82 .

Miyamoto,S. (1989) .Salt effects on germination, emergence and seedling mortality of onion . Agronomy J. ,81 (2):202-207 .

Richards . L. A. (1954). " Diagnosis and improvement of saline and alkali soils " . Agriculture Hand Book No . 60 . United States Dept . of Agriculture .

Sharma,P. C. ; B. Mishra ; R. Singh ; Y. P. Singh and N. K. Tyagi (2000) . Adaptability of onion (*Allium cepa*) genotypes to alkali and salinity stresses . Indian J. of Agric. Sci., 70 (10) :674-678 .

J. Ae, N. and N. Hayashi (1983). Salt tolerance of parsley, welsh onion, radish and cabbage. Scientific reports of the faculty of Agriculture, Okayama University, 62: 25-30.

Singh, S. B. and I. P. Abrol (1985). Effect of exchangeable sodium percentage on growth, yield and chemical composition of onion and garlic. J. of Indian Soc. of Soil Sci., 33 (2):358-361.

Sonbol, H. A.; M. W. M. El-Agrodi and G. Labbeeb (2001). Effect of Nitrogen and gypsum on rice plant .II – rice yield and nutrients uptake. J. Agric. Sci. Mansoura Univ., 26 (4): 2465-2480.

Stino, K. R. ; M. Abdel-Aziz Abdel-Fattah; A. S. Abdel-salam ; W. A. Wand ; Ihsan A. El-Mofty and Mona M.Abdel-Gawwad (1972 a). Salinity effects on the growth of some onion varieties. Desert Inst. Bull. A. R. E . 22 (1) :167-174.

Stino, K. R. ; M. Abdel-Aziz Abdel-Fattah; A. S. Abdel-salam ; W. A. Warid ; Ihsan A. El-Mofty and Mona M.Abdel-Gawwad, (1972 b). Chemical constituents of the onion plant in relation to sodium chloride concentration and variety . I I – Calcium, Magnesium, Nitrogen and total Carbohydrates . Desert Inst. Bull. A R E , 22 (2) 379-392.

Stino, K. R. ; M. Abdel-Aziz Abdel-Fattah; A. S. Abdel-salam ; W. A. Ward ; Ihsan A. El-Mofty and Mona M.Abdel-Gawwad, (1972 c). Chemi constituents of the onion plant in relation to sodium chloride concentration and variety . I – Sodium, potassium and chloride . Desert Inst. Bull. A. R. E . 22 (1) :175-191 .

Sung, F. J. M. and W. S. Lo (1990). Growth responses to rice in amm ium based nutrient solution with variable calcium supply. Plant an Soil, 125: 239-244.

Yadav, S. S. ;Narendra Singh and B. R. Yadav (1998) . Effect of ifferent levels of soil salinity on growth and yield of onion (*Allium cepa* . Indian J. of Hort., 55 (3) :243-247 .

دة المطبوعـــة

ر ولاتذكر داخل النص كأرقام بل

Ali and Ah.

Ali et

مراجع فى نهاية البحث وفقا للنموذج التـــالى مـــع

Abo El-Goud, S.A.M.; M.M. El-Deeb and K.M. Abd

65

تصدر المجلة شهرياً

ث فى ٣ ثلاث صور مكتوبة على النظام الموضح عاليه مـــع تكـــاليف

م قدرها ٥٠,٤٠ جنيها

تكاليف النشر

بالنسبة للمشترك الخارجى: ١١ جنيه عن كل صفحة حتى عدد ١٢ صفحـــة ،

Labeeb, G.

... خواص مياه الرى وإنتاجية محصول البصل فى الأراضى الرملية

... جبيب
... الأراضى - كلية الزراعة - جامعة المنصورة

... تجربة أصص بقسم الأراضي بكلية الزراعة جامعة المنصورة خلال الموسم الشتوي
... اسة تأثير ملوحة ماء الري (٠,٤ ، ١ ، ٢ ، ٣ ملليموز /سم) وكذلك قيم ادمصاص
... ٧,٠ و ١٤,٠) والتفاعل بينهما علي المحصول وامتصاص وتوزيع العناصر
... الفوسفور والبوتاسيوم والصوديوم) بين أجزاء نبات البصل المختلفة
... عليها كما يلي:
... ة الارتباط بين خواص ماء الرى المدروسة أن النقص فى المحصول
... قف على قيمة (SAR) نسبة ادمصاص الصوديوم لهذه المياه فعند
... مقدار ١ ملليموز/سم أدت الى نقص فى المحصول يعادل
... هذه الزيادة فى الملوحة أدت إلى انخفاض فى المحصول
... قف إلى حد كبير على ملوحة هذا الماء فعند ملوحة
... دار الوحدة الى نقص فى المحصول قد ...
... الزيادة فى قيمة SAR إلى نقص قد ...
... نور نفس الاتجاه تحت نفس
... يما معا أدت الى زيادة نسبة
... ٠,٤ ملليموز/سم و ٣,٥
... لماء الري.
... سيوم والصوديوم
... يوم والصوديوم حتى
... تركيز الصوديوم ٧ ثم
... اص للصوديوم ... نسبة ادمصاص
... ملوحة أو قيمة نسبة ادمصاص ... ملوحة
... الى ٥٦,٩٦% وذلك بارتفاع ملوحة
... ١٠٠% الى ٥٤,٠٣% ... ك بارتفاع قيم
... يقل من ١٢,٤٨ الى ٠,٩٥ % من النيترو
... امتصاص الصوديوم كل على حدة أو كليهما معا
... وأدت الى تغيير فى ... توزيع كل منهما
... بوتاسيوم و ... بينما قل بزيا
... بزيادة قيمة نسبة ادمصاص ... الممتص م
... بواسطة نبات البصل قليلة جدا بالمقارنة ... علي
... وهذا يعكس الى درجة كبيرة ... البصل العالية

مجلة
جامعة المنصورة
للعلوم الزراعية

مجلد ٢٧ العدد (٩)

سبتمبر ٢٠٠٢

The pots of 18 cm diameter were arranged to form strip plot in a complete randomized block design with nine replicates .

Four levels of water salinity : control of EC 0.4 , 1.0,2.0 and 3.0 dSm-1 were used in this experiment . In addition three levels of sodium *adsorption ratios* : 3.5, 7.0 and 14.0 were also used to form 12 water treatments .

To explain how the experimental saline solutions were prepared , the following theoretical and mathematical treatments are concerned

According to Richards 1954 :

$$SAR = Na / \sqrt{\frac{Ca + Mg}{2}} \qquad (1)$$

The ions are calculated as meq L^{-1}

Now suppose that we attend to prepare one liter of saline water having SAR ratio of 14.0 and EC of 3.0 dSm^{-1}

by substitution

$$14 = \sqrt{2}.Na / \sqrt{Ca + Mg}$$

$$14 = 1.414.Na / \sqrt{Ca + Mg}$$

$$\frac{1.414}{14}.Na = \sqrt{Ca + Mg}$$

$$0.101Na = \sqrt{Ca + Mg}$$

By squaring this equation we got

$\therefore$ 0.0102 Na^2 = Ca + Mg

Make the equation equal zero

$\therefore$ 0.0102 Na^2 – (Ca + Mg) = *0.0 ....(2) in a water having* SAR = 14

As we previously supposed, the electrical conductivity of required solution is 3.0 dSm^{-1}.*According to Richards(1954), multiplying the EC value* in dSm^{-1} by 10 produces the amount of cations in meq L^{-1}.

Thus ,concentration of the solution =*3.0 x 10 = 30.0 meq* L^{-1} (3)

This means that the solution contains 30.0 meq of Na , Ca and Mg ions per liter .

$\therefore$ Na + (Ca+Mg) = 30 meq (4)

Make the equation equal zero

Na + (Ca+Mg) – 30 = 0.0 (5)

Adding the equation 2 to the equation 5

$$\begin{array}{lrcrl} & 0.0102\,Na^2 & -\,(Ca + Mg) & = 0.0 & (2) \\ + & Na & +(Ca + Mg & -30 = 0.0 & (5) \\ \hline & 0.0102\,Na^2 + Na & & -30 = 0.0 & (6) \end{array}$$

Multipling by 1/ 0.0102 , we got

Na^2 + 98.039 Na – 2941.17 = 0.0 (7)

By solving the equation algebricaly ,we got .

(Na – 24.08373) (Na + 122.12273) = 0.0 (8)

$\therefore$ Na – 24.08373 = 0.0 $\therefore$ Na = 24.08373 meq

As obvious the other case of Na = – 122.12273 which is not acceptable.

By substitution in equation 5 by the obtained value of Na :
24.08373 +(Ca + Mg) - 30.0 = 0.0
$\therefore$ (Ca + Mg) = 30.0 -24.08373 =5.91627 meq .

After the amount of (Ca + Mg) is obtained in meq ,it was divided between both cations by 3.94418 meq for Ca and 1.97209 meq for Mg (2:1).These values are converted to the proper amounts of chloride forms , which were found to be 1.409 g NaCl, 0.432 g $CaCl_2.6H_2O$ and 0.200 g $MgCl_2.6H_2O$ .The three salts were mixed and added gradually to a baker containing about 700 ml of distilled water . The solution was stirred , the EC was measured and the required distilled water was added to adjust the EC reading at 3.0 dSm^{-1} . Thus we have now a saline solution of 3.0 dSm^{-1} and an SAR of 14.0.

By proper diluting of this solution we obtained the less values of EC :0.4 ,1.0 and 2.0 dSm^{-1}, but having the same value of SAR of 14.0 .

The same procedure was done to obtain other solutions having less SAR ratios of 7.0 and 3.5 by substitutions in Richards equation and having different concentrations of salinity expressed in EC values of :3.0 , 2.0 ,1.0 and 0.4 dSm^{-1} ,respectively .

Thus, the obtained treatments were as follows:

No.	EC (dSm-1)	SAR values
1.	3	3.5
2.	3	7.0
3.	3	14
4.	2	3.5
5.	2	7.0
6.	2	14
7.	1	3.5
8.	1	7.0
9.	1	14
10.	0.4	3.5
11.	0.4	7.0
12.	0.4	14

At the beginning of January , the soil was moistened to reach the saturation point and 5 seedlings (60 days old) of onion, var. Giza 20 were transplanted . After 15 days the plants were thinned to two plants in each pot.

Soil water contents were adjusted to be at the field capacity (14%) every five days by weighing .

All fertilizer requirements were added to each pot as solutions . Fifty ml of a solution containing 7.5 g P L^{-1}, 0.112 g B L^{-1} , 0.303 g iron in ferrous form L^{-1} , 0.299 g Cu L^{-1}, 0.224 g Zn L^{-1} and Mn 0.224 g Zn L^{-1} was added 30 days after transplanting . Other 50 ml solution containing 48.5 g N L^{-1} in the Urea form and 30.25 g K L^{-1} in the K_2SO_4 form was added twice at 30 and 70 days after transplanting .

Green portion of the recently full expanded leaves were taken at the beginning of bulb formation for analysis . two months after transplanting , according to the recommendation of Jones *et al.* (1991) .

In 28 th April , when about 70-80% of the tops were bent over, the soils of the pots were turned over and put on a 2 mm sieve under slowly effulent of tap water until the roots become clean , and then separated and air dried. The plants were cured at room temperature for a month and the culls and the bulb yields were separated and weighed .

Roots , culls and bulbs were dried at 70 °C , weighed , ground and wet ashed . N,P,K and Sodium were determined in the wet ashed product as described by Cottinue et al. (1982)

Collected data were subjected to the statistical analysis, the technique of analysis variance (ANOVA) for strip plot in randomized complete block design (R.C.R) according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Data in Table 1 show that ,highly significant negative differences were produced in the dry weights of the tow recently full expanded leaves due to the application of the studied treatments . The weights of the leaves decreased from about 1.10 to 0.77 g when the electrical conductivities of the irrigation waters were increased from 0.4 to 3.0 dSm^{-1}. However the maximum reduction reached about 30.0% of the control weight .This reduction may be explained on the basis that the salinity decreases the length of the leaves through the decrease in the size of the tissue cells . In addition , The intercellular space may be reduced as a result of closer pac in king of the parenchymatous cells , and the cambial activities may be also inhibited due to salinity (Stino et al., 1972 a) .

Table (1): Effect of irrigation water qualities on the weight of leaves at the beginning of the bulb formation

W. salinity / SAR value	Water salinity levels (dsm^{-1}) 0.4	1.0	2.0	3.0	Means	L.S.D
	Two leaves dry weight (g)					
3.5	1.192	1.059	0.962	0.822	**1.009**	**
7.0	1.161	1.018	0.838	0.768	**0.946**	0.040
14	0.958	0.814	0.814	0.729	**0.829**	0.053
Means	**1.104**	**0.964**	**0.871**	**0.773**		
L.S.D	** 0.026	0.039				
Inter. L.S.D	**	0.080	0.107			

Similar trends were obtained with the treatments of the SAR ratios , but the reduction in the weights of leaves was lesser than that of the electrical conductivities, as the maximum reduction reached 17.84 % when the SAR ratio was increased from 3.5 to 14.0.

Concerning the interaction , the highest weight of the leaves ,however ,was obtained with the SAR ratios of 3.5 and EC of 0.4 dSm^{-1}.

The means of the bulb fresh weights as affected by the electrical conductivities and SAR ratios of the irrigation waters are shown in Table 2 .

The data revealed that the means of the bulbs fresh weights decreased from about 87.49 g / pot to 35.16 g pot^{-1} when the EC of the irrigation water was increased from 0.4 to 3.0 dSm^{-1}. The statistical analysis proved that the differences between the means were highly significant . The obtained results are in agreement with that of Mangal and Lal, (1988), (they found that, the fresh weight of bulbs was reduced almost 6-fold under 10.0 mmhos/cm of soil paste extract compared with control,0.73 mmhos/cm.

Table (2): Effect of irrigation water qualities on bulbs yield fresh weight

W salinity / SAR value	Water salinity levels (dsm^{-1})				Means	L.S.D
	0.4	1.0	2.0	3.0		
Bulb fresh weight (g pot^{-1})						
3.5	93.489	75.057	60.844	45.079	**68.617**	**
7.0	90.689	67.717	41.600	35.369	**58.844**	0.429
14	78.278	47.589	36.456	25.033	**46.839**	0.570
Means	**87.485**	**63.454**	**46.300**	**35.160**		
L.S.D	** 0.640 0.970					
Inter. L.S.D **	0.857 1.140					

The correlation between bulbs fresh weight per pot and the irrigation water studied characters which are used in this study could be described by this linear equation

Bulbs yield = 105.358 -19.212 EC (dSm^{-1})-2.023 SAR value

From the equation , we can calculate the bulbs fresh weight which will be produced if we known the EC and SAR values of irrigation water.

We can also calculate the EC value of the irrigation water , at which the sandy soils can not produce any yield of bulbs at known SAR value and pointed out the SAR effect on these value ,this could be obtained by substituting the value of yield by 0.0 and SAR for ex. by 3.5 .

0.0 =105.358-19.212 EC (dsm^{-1})-2.023 X 3.0

0.0 =105.358-19.212 EC (dsm^{-1})-7.081

0.0=98.277-19.212 EC (dsm^{-1})

98.277 =19.212 EC (dsm^{-1})

hence that EC (dsm^{-1}) at SAR of 3.0 = 98.277 / 19.212 = 5.115 dsm-1 .

The EC value which led to 0.0 bulb yield at SAR of 14.0 will be reduced to a large extent ,

0.0=105.358-19.212 EC (dsm^{-1}) -2.023 X 14.0

0.0=105.358-19.212 EC (dsm^{-1}) – 28.322

0.0 = 77.036 - 19.212 EC

hence that EC at SAR of 14.0 = 77.036 / 19.212 = 4.010 dsm^{-1}

The reduction in the bulbs fresh yield due to salinity may be attributed to the reduction of the photosynthetic capacity, so that the translocation of the photosynthetic products is reduced to a large extent.

Also we can calculate the SAR value of the irrigation water , at which the sandy soils can not produce any yield of bulbs and pointed out the EC value effect on this value .

From the above mentioned, the reduction rate in bulbs fresh yield by increasing water salinity by one unite is dependent on SAR value . At SAR of

14.0 ,increasing water salinity by unite led to decrease the yield of bulbs fresh weight by 100 / 4.010 = 24.940 % .While at SAR of 3.5 the reduction rate under the same increase in water salinity is 100 / 5.115 = 19.550 %

By the previous way at EC value of 0.4 dsm^{-1},raising SAR value one unite led to decrease the bulbs fresh weight by 2.071 % ,while at EC value of 3.0 dSm^{-1} the reduction amounted to be 4.240 % .These results are in coincide with those of Asseed and Warid, (1977), they found that, a continuous irrigation with water containing 1500 ppm NaCl reduced bulbs weight more than did irrigation with 1500 ppm $NaCl+CaCl_2$.

Bulbs fresh weight was decreased from 93.489 g pot^{-1} at 0.4 dsm^{-1} and 3.5 SAR to 25.033 g pot^{-1} at 3.0 dsm^{-1} and 14.0 SAR (by equal 73.22% reduction)

The data of Table 3 revealed that increasing either salinity of irrigation water and/or SAR value led to significant decreases in bulbs , culls and roots dry weights which is similar to the trends of the bulbs fresh weight.

The relationship between the dry matter of onion plant parts and the irrigation water studied characters were described by the following equations

Bulbs dry matter = 15.970 - 2.947 EC dSm^{-1} – 0.32 SAR
Culls dry weight = 4.547 - 0.615 EC dSm^{-1} – 0.053 SAR
Roots dry weight = 2.428 - 0.402 EC dSm^{-1} –0.036 SAR

From the previous equations ,at SAR of 3.5 increasing water salinity by one unite led to decrease bulbs , culls and roots dry weight by about 19.845 ,14.104 and 17.464 % ,respectively .Corresponding values were increased to 25.648 ,16.166 and 20.894 % at SAR of 14.0 . These results are in agreement with that of Managal *et al.* (1988) ,and Leo-Cox and Syvertsen (1993) they found that, salinity reduces fibrous root dry weight relatively more than shoot dry weight.

Table (3): Effect of irrigation water qualities on the plant parts dry weight

W salinity / SAR value	Water salinity levels (dsm^{-1}) 0.4	1.0	2.0	3.0	Means	L.S.D
			Bulb dry weight (g pot^{-1})			
3.5	14 018	11.304	9.124	6.612	**10.265**	**
7 0	13.606	10.133	6.162	5.164	**8.766**	0.060
14	11 742	6.995	5.356	3.499	**6.898**	0 114
Means	**13.122**	**9.477**	**6.881**	**5.092**		
L.S.D		** 0.105 0 158				
Inter L.S.D ** 0.120 0.159						
			Culls dry weight (g pot^{-1})			
3 5	4.390	3.551	3.247	2.517	**3.426**	**
7 0	3.913	3 409	2 766	2.377	**3.116**	0.043
14	3.694	3 157	2.347	2 170	**2.842**	0.058
Means	**3.999**	**3.372**	**2.787**	**2.355**		
L.S D		** 0.039 0.059				
Inter L S.D ** 0 087 0 115						
			Root dry weight (g pot^{-1})			
3 4	2.268	1 853	1.445	1.177	**1.686**	**
7 0	2 089	1 665	1.264	0.932	**1.493**	0.025
14	1 779	1 413	1.208	0 770	**1.293**	0.033
Means	**2.045**	**1.650**	**1.306**	**0.960**		
L.S.D		** 0.031 0.046				
Inter. L.S.D ** 0.050 0.066						

The equation also reveal that the increase in SAR of the irrigation water by one led to decrease the bulbs ,culls and roots dry weights by about 2.164 ,1.232 and 1.588 % , respectively , at water salinity level of 0.4 dSm^{-1} . whenever, the salinity of the irrigation water increased from 0.4 to 3.0 dSm^{-1} these values were increased to 4.488 ,1.962 and 2.946 % ,respectively . These results are confirmed by that of Fenn and Feagley, (1999) they found a significant root and bulb growth increases from increasing Ca^{2+}: NH_4^+ ratios in the growth media (field and greenhouse experiments). Whenever Ca^{2+} shortage led to decrease the plant CO_2 fixation capacity, as found by Sung and Lo,(1990) .

The results indicated that, the highest reduction occurred by water salinity and /or sodium adsorption ratio was in bulbs dry weight and the lowest in culls dry weight, then culls dry weight /bulb dry weight value increased by increasing salinity and/or sodium adsorption ratio of the irrigation water as shown in Table 4.

Table (4): Effect of irrigation water qualities on culls dry weight/bulbs dry weight %

W. salinity / SAR value	Water salinity levels (dsm^{-1})				Means
	0.4	1.0	2.0	3.0	
3.5	31.13	31.41	35.59	38.07	**34.05**
7.0	28.76	33.64	44.89	46.03	**38.33**
14	32.48	45.13	43.82	62.02	**45.86**
Means	**30.79**	**36.73**	**41.43**	**47.04**	

Data illustrated in Tables 5 and 6 show the effects of water salinity levels ,water SAR levels and their interactions on N concentration and uptake by onion plant parts.

Data in Table 5 reveal that, increasing water salinity from 0.4 to 3.0 dsm^{-1} led to increasing nitrogen concentration by 38.19 % in bulbs, 26.43% in culls and 10.12% in roots. Similar results were obtained by Stino *et al.* (1972 b) they found that the concentration of total nitrogen in bulbs was increased with increasing the nutrient solution salinity . This increase resulting from a continuous nitrogen absorption with a decrease in onion growth (Table 3).

Increasing SAR ratios from 3.5 to 14.0 led to a decrease in nitrogen concentration with 23.62 ,15.83 ,and 7.78%in bulbs ,culls and roots, respectively .This may be attributed to the poisonous effects of sodium ions on the cells .The highest nitrogen concentration was obtained with the highest and the lowest levels of water salinity and SAR ratios respectively , and the reverse trend is true.

Data also reveal that, nitrogen concentrations in bulbs are two times higher than those of culls or roots.

As shown in Table 6, irrigation water salinity decreases the relative N use efficiency from 100% at 0.4 dsm^{-1} to 81.48%, 66.12 and 56.96% at 1.0, 2.0 and 3.0 dsm^{-1}, respectively. Similar results were found by Lea-Cox and Syvertsen, (1999) . They revealed that , the nitrogen use efficiency was reduced in Citrus with increasing salinity level .

The irrigation water salinity not only does affects nitrogen uptake but also does affects nitrogen distribution among the plant parts .The N uptake by bulbs, culls and roots was 80.72, 12.48 and 6.80% from the total respectively, at 0.4 dsm^{-1} of irrigation water .These value are changed to 77.62,16.21 and 6.17 % for the same parts at EC value of 3.0 dsm^{-1}.

Table (5): Effect of irrigation water qualities on N % in onion plant parts

W. salinity / SAR value	Water salinity levels (dsm^{-1}) 0.4	1.0	2.0	3.0	Means	L.S.D
			N% in bulbs			
3.5	1.984	2.071	2 232	2.638	**2.231**	**
7.0	1 624	1.887	2.063	2.424	**2.000**	0.026
14	1.475	1.579	1.801	1.960	**1.704**	0.035
Means	**1.694**	**1.846**	**2.032**	**2.341**		
L.S.D		** 0.036	0.055			
Inter. L.S.D **	0.053	0.070				
			N% in culls			
3.5	0.973	1.020	1.083	1 145	**1.055**	**
7.0	0.867	0.956	1.013	1.089	**0.981**	0.005
14	0.738	0.883	0.907	1.023	**0.888**	0.007
Means	**0.859**	**0.953**	**1.001**	**1.086**		
L.S.D		** 0.004	0.005			
Inter. L.S.D **	0.010	0.014				
			N% in roots			
3.5	0.965	0.971	1.026	1.046	**1.002**	NS.
7.0	0.920	0.934	0.984	1.014	**0.963**	
14	0.873	0.875	0.969	0.977	**0.924**	
Means	**0.919**	**0.927**	**0.993**	**1.012**		
L.S.D		*	0.063			
Inter. L.S.D		NS.				

The data of table 6 show clearly that nitrogen uptake by the economic *part of the plant was decreased to the account* of the other parts when increasing water salinity .These results are in agreement with those of Sonbol *et al.* (2001) as they found that, soil salinity reduced the nitrogen migration from rice shoots to grains .

The nitrogen uptake was also decreased from about 275.058 mg N pot^{-1} to 148.609 mg pot^{-1} by increasing sodium adsorption ratio from 3.5 to 14.0 , this reduction not only is due to the reduction in the yield components (Table 3) , but also due to the nitrogen concentration reduction in plant parts (Table 5).

The reducing effect of the highest SAR on N concentration and uptake, may be ascribed to Ca deficiency effects as reported by Bernstein, (1985)and Gupa and Abrol, (1990). They reported that, the SAR level of 15.8 could cause Ca^{2+} deficiencies for safflower and various pea and bean species. Calcium deficiency reduces NH_4^+ absorption rate as found by Bailey, *(1992), who suggested that, at least a 67% faster absorption rate due to the* presence of added Ca^{2+} as compared to NH_4^+ without Ca^{2+}. These results are confirmed by that of Hallmark *et al.* ,(1997) they found that sugarcane which fertilized with a Ca^{2+}-urea fertilizer (molar ratio of urea /$CaCl_2$ of 1.8) increased sugar yield 31% over 4-year period ,and they concluded that much less *total N was needed for maximum sugar production if Ca^{2+} was added* with urea.

Table (6):Effect of irrigation water qualities on N uptake by onion plant

W. salinity / SAR value	Water salinity levels (dsm^{-1})				Means	L.S.D
	0.4	*0.1*	*0.2*	*3.0*		
N uptake by bulbs (mg pot^{-1})						
3.5	282.874	234.106	203.648	174.425	**222.574**	**
7.0	229.289	191.210	127.122	125.175	**166.117**	**8.990**
14	178.190	110.451	96.462	68.580	**112.172**	**11.927**
Means	**224.091**	**178.589**	**142.411**	**122.727**		
L.S.D		** 8.592	13.017			
Inter. L.S.D **	17.981	23.915				
N uptake by culls (mg pot^{-1})						
3.5	42.715	36.220	35.165	28.820	**35.730**	**
7.0	33.926	32.590	28.020	25.886	**30.106**	0.502
14	27.262	27 876	21.287	22.199	**24.656**	0.668
Means	**34.634**	**32.299**	**28.157**	**25.635**		
L.S.D		** 0.527	0.798			
Inter L.S.D **	1.005	1.337				
N uptake by roots (mg pot^{-1})						
3.5	21.886	17 993	14.826	12.311	**16.754**	**
7.0	19.219	15 738	12.438	9.450	**14.211**	0.258
14	15.531	12.364	11.706	7.523	**11.781**	0.343
Means	**18.879**	**15.365**	**12.990**	**9.761**		
L S D		** 0.289	0.438			
Inter L.S.D **	0.516	0.687				
Total N uptake by onion plant (mg pot^{-1})						
3 4	342.718	288.319	253.639	215.556	**275.058**	**
7.0	274.106	239.538	167.580	160.511	**210.434**	5.766
14	215.988	150.691	129.455	98.302	**148.609**	7.669
Means	**277.609**	**226.183**	**183.558**	**158.123**		
L.S.D		** 7.524	11.399			
Inter. L.S.D **	11.532	15.338				

Data also reveal that, the relative nitrogen use efficiency decreased from 100% at SAR 3.5 to about 76.51 % , at SAR 7.0 and to 54.03% at SAR 14.0 .However the highest nitrogen uptake was achieved at the treatment of 0.4dsm^{-1} and SAR 3.5 (342.718 mg pot^{-1}) and the lowest with the treatment of 3.0 dsm^{-1} and SAR 14.0 (28.68 % of the highest one).

Data in Table 7 show that, the proportion of phosphorous concentrations in onion plant parts about 3.98 : 2.78 : 1.0 for bulbs ,roots and culls, respectively. It appears that plant tended to accumulate phosphorus in bulbs and roots to face the deleterious effect of Na resulting from increasing SAR from 3.5 to 7.0 . Raising the SAR from 7.0 to 14.0 caused the plant potential for phosphorus accumulation to fail to face the hazardous effect .

The differences in phosphorus concentrations between the SAR treatments are highly significant in all plant parts .

Data also reveal that, phosphorus concentrations in bulbs and roots high significantly increased with increasing water salinity levels from 0.4 to 3.0 dsm^{-1}.

Table (7): Effect of irrigation water qualities on P % in onion plant parts

W. salinity / SAR value	Water salinity levels (dsm^{-1}) 0.4	1.0	2.0	3.0	Means	L.S.D
			P% in bulbs			
3.5	0.250	0.283	0.318	0.372	**0.306**	**
7.0	0.284	0.307	0.389	0.428	**0.352**	0.012
14	0.252	0.288	0.391	0.432	**0.341**	0.015
Means	**0.262**	**0.293**	**0.366**	**0.411**		
L.S.D		** 0.015	0.023			
Inter. L.S.D **	0.024	0.031				
			P% in culls			
3.5	0.082	0.085	0.088	0.090	**0.086**	**
7.0	0.084	0.085	0.085	0.089	**0.086**	0.002
14	0.084	0.082	0.082	0.079	**0.082**	0.003
Means	**0.083**	**0.084**	**0.085**	**0.086**		
L.S.D			Ns			
Inter. L.S.D **	0.004	0.006				
			P% In roots			
3.5	0.182	0.225	0.221	0.240	**0.217**	**
7.0	0.248	0.260	0.258	0.246	**0.253**	0.004
14	0.211	0.240	0.245	0.236	**0.239**	0.005
Means	**0.214**	**0.242**	**0.241**	**0.241**		
L.S.D		** 0.007	0.011			
Inter. L.S.D **	0.008	0.011				

Data of Table 8 show that, total phosphorus uptake (100 %) is divided to 77.10% to 83.30 in bulbs , 9.90 %to 12.90 % in roots and from 7.45 to 9.35 % in culls .

The reduction in phosphors uptake compared to that of 0.4 dsm^{-1} (control) is about 17.92%, 28.38% and 41.00% at salinities of 1.0, 2.0 and 3.0 dsm^{-1}.

Raising SAR from 3.5 to 7.0 did not reduce the phosphorus uptake to a large extent (about 3.49 %) , but raising SAR from 3.5 to 14.0 caused 27.24% reduction. Phosphorus uptake by onion plant in this study ranged between about 12.48 to 19.95% compared to N uptake.

The data revealed that both highest salinity and SAR levels of 3.0 dsm^{-1} and 14 produced the least uptake of Phosphorus . The reduction was about 57.14% compared with control .

Table (8): Effect of irrigation water qualities on P uptake by onion plant

W. salinity / SAR value	Water salinity levels (dsm^{-1}) 0.4	1.0	2.0	3.0	Means	L.S.D
	P uptake by bulbs (mg pot^{-1})					
3.5	35.045	31.990	29.014	24.597	**30.162**	**
7.0	38.641	31.108	23.970	22.102	**28.955**	0.906
14	29.590	20.146	20.942	14.801	**21.370**	1.205
Means	**34.425**	**27.748**	**24.624**	**20.500**		
L.S.D	** 1.446 2.190					
Inter. L.S.D **	1.812 2.409					
	P uptake by culls (mg pot^{-1})					
3.5	3.600	3.018	2.857	2.265	**2.935**	**
7.0	3.287	2.898	2.351	2.116	**2.663**	0.0009
14	3.103	2.589	1.925	1.714	**2.333**	0.0011
Means	**3.330**	**2.835**	**2.378**	**2.032**		
L.S.D	** 0.0004 0.0005					
Inter. L.S.D **	0.0014 0.0019					
	P uptake by roots (mg pot^{-1})					
3.5	4.128	4.169	3.193	2.825	**3.579**	**
7.0	5.181	4.381	3.261	2.293	**3.779**	0.096
14	3.754	3.391	2.960	1.817	**2.981**	0.127
Means	**4.354**	**3.980**	**3.138**	**2.312**		
L.S.D	** 0.226 0.342					
Inter. L.S.D **	0.191 0.254					
	Total P uptake by onion plant (mg pot^{-1})					
3.4	42.773	39.177	35.064	29.687	**36.676**	**
7.0	47.109	38.387	29.582	26.511	**35.397**	1.055
14	36.447	26.126	25.827	18.332	**26.684**	1.404
Means	**42.110**	**34.563**	**30.158**	**24.843**		
L.S.D	** 1.158 1.754					
Inter. L.S.D **	2.111 2.807					

Data in Table 9 show the potassium concentrates in onion plant parts. The whole mean of the element concentration in roots and culls represent 45.63 % and 64.59 % of its concentration in bulbs . It appears from the data that raising water SAR significantly decreases potassium concentration in plant parts . with the exception of the culls , raising water salinity up to the highest level used in the experiment significantly increases potassium concentration in onion plant parts, , while the increase in culls was up to 2.0 dSm^{-1}.

The treatment of the highest levels of water salinity and SAR reduces potassium concentration in culls than that of the lowest levels of EC and the same level of SAR, this may be due to intensive element migration from culls to the bulbs at the ripening time.

Table (9): Effect of irrigation water qualities on K % in onion plant parts

W. salinity / SAR value	Water salinity levels (dsm^{-1}) 0.4	1.0	2.0	3.0	Means	L.S.D
K% in bulbs						
3.5	1.799	2.090	2.200	2.414	**2.126**	**
7.0	1.527	1.768	2.136	2.146	**1.894**	0.065
14	1.288	1.673	1.716	1.780	**1.614**	0.086
Means	**1.538**	**1.844**	**2.017**	**2.113**		
L.S.D		** 0.059	0.089			
Inter. L.S.D ** 0.129 0.172						
K% in culls						
3.5	1.252	1.276	1.428	1.430	**1.347**	**
7.0	1.185	1.247	1.263	1.251	**1.237**	0.007
14	1.042	1.129	1.056	0.996	**1.056**	0.009
Means	**1.160**	**1.217**	**1.249**	**1.226**		
L.S.D		** 0.010	0.016			
Inter. L.S.D **0.014 0.018						
K% in roots						
3.5	0.892	0.903	0.999	0.990	**0.946**	**
7.0	0.805	0.848	0.860	0.915	**0.857**	0.008
14	0.753	0.742	0.788	0.793	**0.769**	0.011
Means	**0.817**	**0.831**	**0.882**	**0.899**		
L.S.D		** 0.009	0.014			
Inter. L.S. **0.017 0.022						

The data in Table 10 show that, potassium uptake was significantly decreased with increasing sodium adsorption ratio. This reduction (46.78 %reduction by increasing SAR from 3.5 to 14.0) can be attributed to the antagonism between Na and potassium which was reflected in potassium concentration depletion in plant parts and to the reduction in dry matter formation .

Salinity decreases also potassium uptake (44.31 % reduction by increasing water salinity from 0.4 to 3.0 dSm^{-1}) due to growth suppression and the decrease in the dry matter formation as shown in Tabel 3 . These results are in a coincide with that of Shimose and Hayashi, (1983).

The combined effect between salinity and SAR treatment caused a decrease in potassium uptake of about 72.85% at water salinity and SAR of 3.0 and 14 compared the control treatment (0.4dSm^{-1} and 3.5 SAR) . It is worthy to note that potassium distribution pattern is similar to that of nitrogen.

In Table 11 data clearly show that, raising SAR and /or water salinity increases sodium concentration in onion plant part , and the highest concentration was found in roots. These results are in agreement with those of EL-Agrodi and Abou EL-Soud (1988) in their studies on rice plant . They found that increasing water salinity level from 0.4 to 7.0 dSm^{-1} increased the concentration of N. P, K and Na in grains .

Table (10): Effect of irrigation water quality on K uptake by onion plant

W. salinity / SAR value	Water salinity levels (dsm^{-1}) 0.4	1.0	2.0	3.0	Means	L.S.D
		K uptake by bulbs ($mg\ pot^{-1}$)				
3.5	252.184	236 254	200 728	159.614	212.195	**
7.0	207.764	179.151	131.620	110.819	157 339	2.340
14	151.237	117.026	91.909	62.282	105.614	3.113
Means	**203.728**	**177.477**	**141.419**	**110.905**		
L.S.D		** 2.121	3.213			
Inter. L.S.D ** 4.680 6.225						
		K uptake by culls ($mg\ pot^{-1}$)				
3.5	54.963	45.311	46.367	35.993	45.659	**
7.0	46.369	42.510	34.935	29.736	38.388	0.590
14	38.491	35.643	24 784	21.613	30.133	0.785
Means	**46.608**	**41.155**	**35.362**	**29.114**		
L.S.D		** 0.789	1.195			
Inter. L.S.D ** 1.180 1.569						
		K uptake by roots ($mg\ pot^{-1}$)				
3.5	20 231	16.733	14.436	11.652	15 763	**
7.0	16.816	14.289	10.870	8.528	12.626	0.264
14	13.396	10.484	9.519	6.106	9.876	0.351
Means	**16.814**	**13.835**	**11.608**	**8.762**		
L.S.D		** 0.221	0.335			
Inter. L.S.D ** 0.527 0.701						
		Total K uptake by onion plant ($mg\ pot^{-1}$)				
3.4	327.378	298.298	261.531	207.259	273.617	**
7.0	270.949	235.950	177.425	149.083	208.352	3.888
14	203.124	163.153	126.212	90.001	145.623	5.171
Means	**267.150**	**232.467**	**188.389**	**148.781**		
L.S.D		** 5.104	7.732			
Inter. L.S.D ** 7.775 10.341						

Table (11): Effect of irrigation water qualities on Na % in onion plant parts

W. salinity / SAR value	Water salinity levels (dsm^{-1}) 0.4	1.0	2.0	3 0	Means	L.S.D
		Na% in bulbs				
3.5	0.065	0.100	0.121	0 141	0.107	**
7.0	0.096	0.122	0.149	0.166	0.133	0.005
14	0.169	0.191	0.239	0.201	0.200	0.007
Means	**0.110**	**0.138**	**0.170**	**0.169**		
L.S.D		** 0.006	0.009			
Inter. L.S.D ** 0.010 0.014						
		Na% in culls				
3.5	0.098	0.099	0.110	0.121	0.107	**
7.0	0.108	0 114	0.123	0.134	0.120	0.003
14	0.126	0.127	0.133	0.145	0.133	0.005
Means	**0.111**	**0.113**	**0.122**	**0.133**		
L.S.D		** 0.004	0.005			
Inter. L.S.D ns						
		Na% in roots				
3.5	0.123	0.149	0.170	0.185	0.157	**
7.0	0.181	0.182	0.198	0.205	0.192	0.002
14	0.197	0.201	0.207	0 218	0.206	0.003
Means	**0.167**	**0.177**	**0.192**	**0.203**		
L.S.D		** 0.002	0.004			
Inter. L.S.D ** 0.005 0.006						

Regarding to the concentrations of K/Na value as shown from Tables 9 and 11, it was decreased with raising SAR and/or water salinity, it was decreased from 27.677 at the treatment of 0.4 dsm^{-1} and 3.5 SAR to 8.856 at 3.0 dsm^{-1} and 14 SAR in bulbs, this reduction was from 12.776 to 6.869 in culls and from 7.252 to 3.638 in roots. These results are confirmed by that of Stino *et al.* (1972 c). They pointed out that sodium content was increased in leaves and bulbs of onion plant, whereas, Potassium decreased with increasing NaCl in nutrient solution.

As shown from Table 12, the total sodium uptake by onion plant was reduced by increasing water salinity because the reduction rate in yield was more pronounced than Na content increases in onion plant parts as a result of increasing water salinity.

In general ,Sodium uptake by onion plant is very small compared to the N, P, and K uptake, these reflect to a large extent the highest onion ion uptake selectivity.

Table (12): Effect of irrigation water qualities on Na uptake by onion plant

W. salinity / SAR value	Water salinity levels (dsm^{-1}) 0.4	1.0	2.0	3.0	Means	L.S.D
	Na uptake by bulbs (mg pot^{-1})					
3.5	9.112	11.304	11.040	9.323	**10.195**	**
7.0	13.062	12.362	9.181	8.572	**10.794**	0.311
14	19.844	13.360	12.801	7.033	**13.260**	0.413
Means	**14.006**	**12.342**	**11.007**	**8.309**		
L.S.D		** 0.482	0.730			
Inter. L.S.D **	0.621	0.827				
	Na uptake by culls (mg pot^{-1}					
3.5	3.907	3.515	3.572	3.046	**3.510**	**
7.0	4.226	3.886	3.402	3.185	**3.675**	0.083
14	4.654	4.009	3.122	3.147	**3.733**	0.110
Means	**4.262**	**3.803**	**3.365**	**3.126**		
L.S.D		** 0.051	0.077			
Inter. L.S.D **	0.166	0.221				
	Na uptake by roots (mg pot^{-1})					
3.5	2.790	2.761	2.457	2.177	**2.546**	**
7.0	3.781	3.067	2.503	1.911	**2.816**	0.061
14	3.505	2.840	2.501	1.679	**2.631**	0.081
Means	**3.359**	**2.889**	**2.481**	**1.922**		
L.S.D		** 0.056	0.086			
Inter. L.S.D **	0.122	0.163				
	Total Na uptake by onion plant (mg pot^{-1})					
3.4	15.809	17.580	17.069	14.546	**16.251**	**
7.0	21.069	19.315	15.086	13.668	**17.285**	0.313
14	28.003	20.209	18.424	11.859	**19.624**	0.417
Means	**21.627**	**19.035**	**16.860**	**13.358**		
L.S.D		** 0.427	0.647			
Inter. L.S.D **	0.627	0.834				

REFERENCES

Abdel-Salam , M. A. and A. Z. Osman (1965). Interaction of saline water irrigation and phosphorus fertilization on crop production. J. of Soil Sci. UAR. , 5 (2) :75-88.

Asseed , M . and A .W. Warid (1977) . Response of onion plant to saline water irrigation . Libyan J. of Agriculture , 6 (2) :123-128 .

Bailey, J. S. (1992). Effect of gypsum on the uptake, assimilation and cycling of N^{15}-labeled ammonium and nitrate- N by perennial ryegrass. Plant and Soil, 143: 19-31.

Bernstein, L. (1975). Effects of salinity and sodicity on plant growth. Ann. Rew. Phytopathol., 13: 295-312.

Cottenie, A.; M. Verloo; L. Kiekens; G. Velghe and Camerlynck (1982). "Chemical analysis of plant and soil, lab. anal. & Agrochemistry", satate Univ. Gent, Belgium.

Fenn, L. B. and S. Feagley (1999). Review of beneficial uses of calcium and ammonium salts for stimulating plant growth and metabolite translocation. Communications in soil science and plant analysis, 30 (19/20): 2627-2641.

EL-Agrodi, M. W. M. and M. A. Abou EL- Soud (1988). Effect of irrigation regime and water salinity on rice plant under lysimeters condition II- concentration and uptake of N,P,K, and Na. J Agric. Sci., Mansoura Univ., 13 (2): 950-958.

Gomez, K. A. and A. A. Gomez (1984). Statistical Procedure for Agriculture Research 2nd . Ed., John wiley and Sons.

Gupa, R. K. and I. P. Abral (1990). Salt affected soils: their reclamation and management for crop production. Adv. Soil Sci., 11: 223-288.

Hallmark, W. B.; L. P. Brown and G. L. Hawkins (1997). Use of calcium chloride to reduce the nitrogen requirements of sugarcan. Louisiana Agric., 40: 30-31.

Lea-Cox, J. D. and J. P. Syvertsen (1993). Salinity reduces water use and nitrate-N use efficiency of citrus. Annals of Botany, 72: 47-54.

Jackson, M. L. (1967). "Soil Chemical Analysis. Prentice". Hall of India, New Delhi.

Jones, J. B.; Benjamin woff, Jr. and H. A. Mills (1991)."Plant analysis". Hand Book. Micro-Macro, Publishing, Inc. U.S.A.

Mangal, J. L. and S. Lal (1988) .Salt tolerance behaviour of Kharif onion variety N-53 . Haryana J. of Horticulture Sci., 17 (1-2): 78-82 .

Miyamoto,S. (1989) .Salt effects on germination, emergence and seedling mortality of onion . Agronomy J. ,81 (2):202-207 .

Richards , L. A. (1954). " Diagnosis and improvement of saline and alkali soils " . Agriculture Hand Book No . 60 . United States Dept . of Agriculture .

Sharma,P. C. ; B. Mishra ; R. Singh ; Y. P. Singh and N. K. Tyagi (2000) . Adaptability of onion (*Allium cepa*) genotypes to alkali and salinity stresses . Indian J. of Agric. Sci., 70 (10) :674-678 .

Shimose, N. and N. Hayashi (1983). Salt tolerance of parsley, welsh onion, radish and cabbage. Scientific reports of the faculty of Agriculture, Okayama University, 62: 25-30.

Singh ,S. B. and I. P. Abrol (1985). Effect of exchangeable sodium percentage on growth, yield and chemical composition of onion and garlic . J. of Indian Soc. of Soil Sci., 33 (2):358-361.

Sonbol, H. A.; M. W. M .El-Agrodi and G. Labbeeb (2001). Effect of Nitrogen and gypsum on rice plant .II – rice yield and nutrients uptake. J. Agric. Sci. Mansoura Univ., 26 (4): 2465-2480 .

Stino, K. R. ; M. Abdel-Aziz Abdel-Fattah; A. S. Abdel-salam ; W. A. Warid ; Ihsan A. El-Mofty and Mona M.Abdel-Gawwad (1972 a). Salinity effects on the growth of some onion varieties. Desert Inst. Bull. A. R. E . 22 (1) :167-174.

Stino, K. R. ; M. Abdel-Aziz Abdel-Fattah; A. S. Abdel-salam ; W. A. Warid ; Ihsan A. El-Mofty and Mona M.Abdel-Gawwad, (1972 b). Chemical constituents of the onion plant in relation to sodium chloride concentration and variety . I I – Calcium, Magnesium, Nitrogen and total Carbohydrates . Desert Inst. Bull. A R E , 22 (2) :379-392.

Stino, K. R. ; M. Abdel-Aziz Abdel-Fattah; A. S. Abdel-salam ; W. A. Warid ; Ihsan A. El-Mofty and Mona M.Abdel-Gawwad, (1972 c). Chemical constituents of the onion plant in relation to sodium chloride concentration and variety . I – Sodium, potassium and chloride . Desert Inst. Bull. A. R. E , 22 (1) :175-191 .

Sung, F. J. M. and W. S. Lo (1990). Growth responses to rice in ammonium based nutrient solution with variable calcium supply. Plant and Soil, 125: 239-244.

Yadav ,S. S. ;Narendra Singh and B. R. Yadav (1998) . Effect of different levels of soil salinity on growth and yield of onion (*Allium cepa*) . Indian J. of Hort., 55 (3) :243-247

العلاقة بين خواص مياه الرى وإنتاجية محصول البصل فى الأراضى الرملية

جمعة لبيب
قسم الأراضى - كلية الزراعة - جامعة المنصورة

أقيمت تجربة أصص بقسم الأراضي بكلية الزراعة جامعة المنصورة خلال الموسم الشتوي لعام ٢٠٠١ لدراسة تأثير ملوحة ماء الري (٠,٤، ١، ٢، ٣ ملليموز /سم) وكذلك قيم ادمصاص الصوديوم (٣,٥ و ٧,٠ و ١٤,٠) والتفاعل بينهما علي المحصول وامتصاص وتوزيع العناصر الغذائية (النيتروجين والفوسفور والبوتاسيوم والصوديوم) بين أجزاء نبات البصل المختلفة ملخص النتائج المتحصل عليها كما يلي:

أوضحت نتائج دراسة الارتباط بين خواص ماء الرى المدروسة أن النقص فى المحصول نتيجة زيادة ملوحة ماء الرى تتوقف على قيمة (SAR) نسبة ادمصاص الصوديوم لهذه المياه فعند SAR ١٤ زيادة ملوحة ماء الرى بمقدار ١ ملليموز/سم أدت الى نقص فى المحصول يعادل ٢٤,٩٤ % ولكن عند قيمة SAR ٣,٥ هذه الزيادة فى الملوحة أدت إلى انخفاض فى المحصول قيمته ١٩,٥٥ % فقط.

كذلك فإن تأثير قيمة SAR لماء الرى يتوقف إلى حد كبير على ملوحة هذا الماء فعند ملوحة ماء رى ٠,٤ ملليموز/سم أدى رفع قيمة SAR بمقدار الوحدة الى نقص فى المحصول قدره ٢,٠٧١% وعند ملوحة قدرها ٣ ملليموز/سم أدت هذه الزيادة فى قيمة SAR إلى نقص قدره ٤,٢٤%

سلك تأثر كل من الوزن الجاف للأبصال والعروش والجذور نفس الاتجاه تحت نفس المعاملات.

زيادة ملوحة ماء الرى أو قيمة نسبة ادمصاص الصوديوم أو كليهما معا أدت إلى زيادة نسبة العروش/الأبصال. حيث زادت هذه القيمة من ٣١,١٣% عند ملوحة قدرها ٠,٤ ملليموز/سم و ٣,٥ SAR لماء الري إلى ٦٢,٠٢% عند ملوحة قدرها ٣ ملليموز/سم و SAR ١٤ لماء الري.

بزيادة ملوحة ماء الرى زاد تركيز كل من النيتروجين والفوسفور والبوتاسيوم والصوديوم في أجزاء نبات البصل المختلفة وبزيادة قيمة نسبة ادمصاص الصوديوم زاد تركيز الصوديوم حتى أقصى قيمة (١٤) تحت الاختبار أما الفوسفور فزاد حتى قيمة نسبة ادمصاص للصوديوم ٧ ثم نقص بعد ذلك.

نسبة البوتاسيوم/الصوديوم تقل بدرجة كبيرة سواء بزيادة الملوحة أو قيمة نسبة ادمصاص الصوديوم كل على حدة أو كليهما معا.

الكفاءة النسبية لاستخدام النيتروجين قلت من ١٠٠% الى ٥٦,٩٦% وذلك بارتفاع ملوحة ماء الرى من ٠,٤ الى ٣ ملليموز/سم وكذلك قلت من ١٠٠% الى ٥٤,٠٣% وذلك بارتفاع قيمة نسبة ادمصاص الصوديوم للماء من ٣,٥ الى ١٤ .

الفوسفور الممتص بواسطة نبات البصل يمثل من ١٢,٤٨ إلى ١٩,٩٥% من النيتروجين الممتص

زيادة ملوحة ماء الرى وقيمة نسبة ادمصاص الصوديوم كل على حدة أو كليهما معا قللت امتصاص النيتروجين والفوسفور والبوتاسيوم وأدت إلى تغيير فى نسب توزيع كل منهما بين أجزاء النبات المختلفة.

الصوديوم الممتص زاد بزيادة قيمة نسبة ادمصاص الصوديوم بينما قل بزيادة الملوحة. وكمية الصوديوم الممتص بواسطة نبات البصل قليلة جدا بالمقارنة بالممتص من النيتروجين والفوسفور والبوتاسيوم وهذا يعكس الى درجة كبيرة قدرة البصل العالية على الامتصاص الاختياري للأيونات.