J. King Saud Univ., Vol. 14, Agric. Sci. (1), pp. 23-32. Riyadh (1422/2002)

Growth and Yield of Onion (*Allium cepa* L.) Cultivars under Different Levels of Irrigation Water Salinity

A.R. Al-Harbi, H. H. Hegazi, A.A. Alsadon and F. El-Adgham
Plant Production Department, College of Agriculture
King Saud University, Riyadh, Saudi Arabia

(Received 23/10/1420; accepted for publication 19/6/1421)

Abstract. Seeds of ten onion (*Allium cepa* L.) cultivars; Dorado, Contessa, Texas Grano 502, UND Grand PRR, Giza 6, Creol Red, Texas Early Grano, Yellow Spanish, Long Day Ring Master and El-Hassawy; were grown in two greenhouse experiments at the Agricultural Research and Experiment Station, King Saud University. The experiments were conducted during 1997 and 1998 growing seasons to study the effect of irrigation water salinity on onion cultivars. In the second season (1998) Giza 6 cultivar was excluded due to its poor seed germination. The seeds were sown in 30 cm plastic pots filled with 10 kg of sandy soil. The seedlings received equal amounts of a balanced liquid fertilizer and five levels of irrigation water salinity with electrical conductivity (Ec) of 0.5 (Control), 2, 4, 6 and 8 mS cm^{-1}. The control was irrigated using tap water and the higher levels of salinity were achieved by adding mixtures of NaCl and $CaCl_2$ with a fixed level of sodium absorption ratio (SAR) (5). The vegetative growth components and bulb yield were measured in the tested cultivars. Salinity retarded onion vegetative growth. At the highest salinity level bulb fresh weight was reduced by 72.8 and 81.5% while bulb diameter was reduced by 50.2 and 51% in the first and second experiments, respectively. Contessa, Texas Grano 502 and Dorado gave the highest bulb yield in both seasons. No interactive effect between cultivars and salinity levels was observed on the growth and yield.

Introduction

Salinity is a major yield-limiting factor of crop growth and yield in one third of irrigated lands of the arid and semi-arid region [1]. Salinity is often defined as the presence of an access concentration of soluble salt in the root media, sufficient to supress plant growth [2]. Salts stress influences both osmotic pressure of the soil solution due to high concentration of salts and anion balance in the plant cell [3].

Erdei and Kuiper [4] found that under saline condition, growth of salt sensitive and salt tolerant species were reduced according to the ecological features of these species. Shanon [5] has found also a wide range of variability in salt tolerance between a number of agronomic species. Growth and yield of onion were affected when the irrigation water salinity exceeded 3 mS cm^{-1} [6]. Other investigators reported that high levels of salinity reduced onion vegetative growth, yield and quality [7-8].

Plant growth reduction under high levels of salinity might be attributed to the reduction of the leaf area, which was considerd as the major cause of growth reduction as a result of reducing the photosynthetic area [9]. Poljakoff [10] indicated that the osmotic effect, resulting from soil salinity may cause disturbance in water balance of the plant, including a reduction of turgor and an inhibition of growth as well as a stomatal closure and a reduction of photosynthesis.

Many factors may affect plant tolerance to high salinity including species and growth stage along with other environmental factors. Onion is one of the most popular vegetables in many countries and has a very important nutritional value. Onion production in Saudi Arabia was increased from 42618 tons in 1994 to 239122 tons in 1995 [11]. Such a dramatic increase happened after decreasing the wheat prodcution area, which in some areas was replaced by vegetable crops such as potato and onion.

Most of the agricultural crops, grown in Saudi Arabia, require successive irrigation for high yield and quality. Increase of area under irrigation led to the depletion of high quality water and increased irrigation water salinity. Riyadh region is the main onion production area. The quality of the irrigation water in this region was classified as a meduim saline to a very saline water [12]. The dominant cations in the irrigation water are sodium (Na) and calcium (Ca) [13]. Recently, Falatah *et al* [14] analyzed more than 400 samples of irrigation ground water, collected from eight intensive agricultural regions in Saudi Arabia. They found that Na is the dominant cation (60%), followed by Ca (38%); while, chloride (Cl) is the dominant anion (60%), followed by sulpher (S) (30%).

The purpose of this study was to examine the effects of irrigation water salinity on the growth and yield of ten onion cultivars.

Materials and Methods

Two greenhouse experiments were conducted at the Agricultural Research and Experiment Station, College of Agriculture, King Saud University during the 1996/1997 and 1997/1998 growing seasons. Seeds of ten onion cultivars in the first season and nine cultivars in the second season were directely sown in a 30 cm plastic pots, filled with 10 kg sandy soil. The soil texture was 90% sand, 4% silt and 6% clay and it was sterlized with "Rizolex" fungicide. The pots were placed into a greenhouse and the mean air temperature was approximatly 23° during the day and 18° C during the night.

Ten onion cultivars, that were available in the local market, were used: Dorado, Contessa, Texas Grano 502, UND Grand, Giza 6, Creole Red., Texas Early Grano, Yellow Spanich, Long Master and local cultivar El-Hassawy were used in the first season. Giza 6 cultivar was excluded in the second season due to its poor germination. The plants were received five levels of irrigation water salinity as follow: Control (tap water, Ec= 0.5 mS cm^{-1}), 2, 4, 6, and 8 mS cm^{-1}. The higher levels of salinity were achieved by adding the required amounts of NaCl and $CaCl_2$ to the tap water with a constant level of sodium absorption ratio (SAR). The experiments were laid out in a split plot system in a randomized complete blocks design with five replicates. Salinity levels represented the main plots and the cultivars were assigned to the sub-plots.

The seeds were sown on the 3rd of November in both seasons. The seedlings were thinned out to 10 seedlings per pot. The seedlings were irrigated using tap water and salinity treatments were imposed at the first true leaf stage. The plants received equal amounts of a balanced foliar fertilizer twice a week and irrigated, whenever it was necessary, with equal amounts of tap or saline water, adjusted at the beginning of the experiment.

The vegetative growth was assised three times during the experiment. Two plants were harvested from each pot on the 15th of February, 1st of April and 14th of March. The vegetative growth was determined as: plant height, leaf number, shoot fresh and dry weight. The final harvest was carried out at the suitable harvesting time of each cultivar. The yield components including bulb fresh and dry weight percentage, and bulb diameter were determined.

Data were analyzed using SAS program and treatment means were compared using LSD (5% level) according to Gomez and Gomez (15, pp 188-207).

Results and Discussion

Different growth stages of onion, starting from seed emergence upto flowering, can be affeceted when the irrigation water salinity exceeded 3 mS cm^{-1} [6]. Results presented in Table (1a,b,c) showed the effects of salinity treatments on the onion vegetative growth at different stages. The measurements of plant height, leaf number and shoot fresh and dry weight were taken after 104, 149 and 192 days from planting. Generally, the onion vegetative growth features decreased significantly with increasing irrigation water salinity. This was very clear in both the first and second samples that were taken after 104 and 149 days from planting. In the third sample (after 192 days), a part of the plant shoot started getting dry, which affected the results of some vegetative growth features.

Table 1. Effects of salinity on vegetative growth of onion, in the first and second seasons of 1997 and 1998

Salinity level ($mS\ cm^{-1}$)	Plant height (cm)	Leaf number (l/p)	Shoot fresh weight (g/p)	Shoot dry weight (g/p)
a. First sample:		First season (1997)		
Control	42.39 a	5.13 a	9.85 a	4.93 ab
2	37.40 b	4.63 b	7.11 b	5.03 a
4	31.15 c	4.23 c	5.60 b	4.27 b
6	28.22 d	4.00 c	5.32 b	4.13 b
8	28.99 cd	3.93 c	4.76 b	4.18 b
		Second season (1998)		
Control	45.12 a	6.30 a	28.59 a	9.93 a
2	40.13 b	5.70 b	24.75 ab	7.36 a
4	37.70 bc	5.60 bc	21.15 bc	7.05 a
6	35.40 cd	5.30 bc	18.22 c	6.66 a
8	33.09 d	5.20 c	17.11 c	6.07 a
b. Second sample:				
		First season (1997)		
Control	62.97 a	7.50 a	40.62 a	11.75 ab
2	59.67 a	7.40 a	38.05 a	12.44 a
4	52.06 b	6.67 b	23.26 b	10.73 b
6	35.40 c	5.43 c	10.06 c	08.87 c
8	36.53 c	5.30 c	11.20 c	09.55 c
		Second season (1998)		
Control	57.19 a	8.11 a	58.97 a	17.54 b
2	48.77abc	7.48 ab	68.99 a	20.75 ab
4	45.88 bc	7.19 ab	45.04 a	22.65 ab
6	40.94 c	6.74 b	33.39 a	21.26 ab
8	54.87 ab	7.74 ab	50.83 a	25.65 a
c. Third sample:				
		First season (1997)		
Control	54.04 a	5.93 a	35.89 a	09.70 a
2	48.75 ab	6.23 a	26.59 ab	07.98 ab
4	42.39 bc	5.73 ab	19.23 bc	07.64 ab
6	35.06 c	4.73 b	11.54 c	06.51 b
8	34.26 c	4.63 b	11.24 c	07.49 ab
		Second season (1998)		
Control	43.33 a	6.89 a	35.14 a	09.62 a
2	49.34 a	7.33 a	45.53 a	10.17 a
4	51.45 a	7.89 a	36.60 a	10.72 a
6	40.92 a	7.04 a	32.13 a	09.10 a
8	49.57 a	7.44 a	36.00 a	10.05 a

* Means within the same column and having similar letters are not significantly different, using the least significant difference test (LSD) at 0.05 level.

In the first sample, plant height, leaf number, and shoot fresh and dry weight were significnatly decreased as a result of high salinity in both growing seasons, except the shoot dry weight in the second season, where the differences did not reach the used significant level. The same general trend was observed in the second sample, while the results were inconsistant in the third sample especially in the second growing season.

The interaction effect between onion cultivars and salinity levels in respect to vegetative growth appeared insignificant, indicating that salinity reduced vegetative growth uniformally in all cultivars. The decline in the onion vegetative growth because of salinity is consistant with the results reported in similar experiments by various authors [16-18].

Vegetative growth reduction could be attributed to the osmotic and a nutritional effect of salinity, which interfered with the cell membrane permabilty [19] and reduced the translocation of, assimilates [20]. Salinity also decreases the diffusion pressure gradient between the medium and the plant, which affected the water availibility in the plant [21]. Munns *et al* [22] reported that some salts such as sodium and chloride, might interfere with the metabolism in the leaves or with plant uptake and transport of essential nutrient ions.

Bulb yield and quality were significantly reduced with increasing irrigation water salinity in both growing seasons (Table 2). The results showed significant reductions in the bulb fresh weight. The percentages of reduction, compared to control, were 8.3, 40.0, 61.4 and 72.8, in the first season, and 40.8, 56.1, 63.7 and 81.5, in the second season, when the salinity levels were increased to 2, 4, 6, and 8 mS cm^{-1}, respectively. Similar trends were observed for the bulb diameter and the bulb dry matter percentage. Bulb diameter decreased by 50.2% and 51.0%, compared to the control when the salinity level was increased to 8 mS cm^{-1}, in the first and second seasons respectively. The reductions of bulb dry weight percentage were 60.0 and 53.1% in the first and second seasons respectively. Several other investigators reported reductions in the onion yield components such as bulb weight and diameter with increasing salinity [4, 23]. Such reductions could be attributed to the reductions happened for plant vegetative growth and photosynthetic area.

Table 2. Effects of salinity on yield and quality of onion bulb, in the first and second seasons of 1997 and 1998

Salinity level (mS cm^{-1})	Bulb fresh weight (g/p)	Bulb diameter (cm)	Bulb dry matter (%)
	First season (1997)		
Control	12.81 a	2.59 a	15.38 a
2	11.75 a	2.32 a	12.11 b
4	07.68 b	1.83 b	09.70 bc
6	04.95 bc	1.37 c	06.71 cd
8	03.49 c	1.29 c	06.15 d
	Second season (1998)		
Control	39.30 a	3.63 a	34.47 a
2	23.25 b	2.92 bc	24.16 b
4	17.24 bc	2.30 bc	19.68 b
6	14.26 bc	1.91 c	19.50 b
8	07.27 c	1.77 c	16.15 b

* Means within the same column and having similar letters are not significantly different, using the least significant difference test (LSD) at 0.05 level.

Vegetative growth features of the different onion cultivars are presented in Table (3a,b,c). In the first sample, the cultivar El-Hassawy, Texas Grano 502, Long Master and Contessa had significantly higher vegetative growth in both seasons than those of the other six cultivars. In the second sampling date, El-Hassawy had significantly the highest plant height in both seasons. Leaf number was highest for Dorado in the first season and for El-Hassawy, in the second season. Shoot fresh weight reflected the highest value for El-Hassawy, in the first season, and for Texas Grano 502, in the second season, but the difference was not significant compared to El-Hassawy. Shoot dry weight was slightly higher for El-Hassawy, but the difference did not reach the used significant level. In the second season, the shoot dry weight was significantly the lowest for Long Master and insignificant differences were observed among the other cultivars.

Table 3. Vegetative growth of different onion cultivars in the first and second seasons

Cultivar	Plant height (cm)	Leaf number (l/P)	Shoot fresh weight (g/p)	Shoot dry weight (g/p)
a. First sample:				
		First season (1997)		
Dorado	31.60 cde	4.47 bcd	4.99 c	4.24 bc
Contessa	38.48 a	4.93 ab	8.42 a	4.90 a
Texas Grano 502	37.48 a	4.73 abc	8.74 a	4.97 a
UND Grand	35.37 abc	4.20 cd	6.48 ab	4.66 ab
Giza 6	26.83 f	3.60 e	3.96 c	3.96 c
Creole Red	31.23 de	4.47 bcd	5.72 bc	4.33 bc
Texas Early Grano	32.78 bcd	3.93 de	5.95 bc	4.22 bc
Yellow Spanish	27.89 ef	3.93 de	4.07 c	4.03 c
Long Master	35.94 ab	5.07 a	8.44 a	4.66 ab
El-Hassawy	38.71 a	4.53 abc	8.52 a	4.92 a
		Second season (1998)		
Dorado	39.46 ab	5.87 abc	22.34 bc	6.92 b
Contessa	41.71 a	6.00 ab	23.25 bc	6.86 b
Texas Grano 502	43.08 a	6.00 ab	23.95 abc	7.23 ab
UND Grand	38.78 ab	5.53 bcd	21.81 bc	6.57 b
Creole Red	31.82 c	5.13 de	15.81 d	6.30 b
Texas Early Grano	33.11 cde	5.20 de	17.89 cd	6.36 b
Yellow Spanish	30.99 de	4.67 de	18.26 cd	6.63 b
Long Day Master	44.73 a	6.33 a	29.97 a	8.50 ab
El-Hassawy	40.91 ab	6.00 ab	24.88 ab	11.37 a
b. Second sample:				
		First season (1997)		
Dorado	48.93 bc	7.20 a	28.73 ab	10.23 a
Contessa	48.25 c	7.47 abc	24.82 abc	9.77 a
Texas Grano 502	53.45 ab	6.33 bcd	25.17 abc	10.83 a
UND Grand	55.03 a	6.33 cd	24.34 abc	11.09 a

Table 3. Contd.

Cultivar	Plant height (cm)	Leaf number (l/P)	Shoot fresh weight (g/p)	Shoot dry weight (g/p)
Giza 6	45.17 c	5.67 d	18.67 c	10.91 a
Creole Red	44.67 c	6.60 ab	19.62 c	10.74 a
Texas Early Grano	48.81 bc	5.80 cd	24.97 abc	10.60 a
Yellow Spanish	45.92 c	6.60 ab	20.47 bc	10.91 a
Long Master	47.62 c	6.87 ab	23.97 ab	10.45 a
El-Hassawy	55.41 a	6.73 ab	32.62 a	11.86 a
		Second season (1998)		
Dorado	49.37 abc	7.33 ab	41.00 b	21.32 ab
Contessa	47.01 bc	7.40 ab	46.68 ab	19.54 ab
Texas Grano 502	45.70 c	6.73 b	84.23 a	19.99 ab
UND Grand	54.22 ab	7.53 ab	60.57 ab	19.82 ab
Creole Red	49.71 abc	7.33 ab	45.83 ab	25.60 a
Texas Early Grano	49.01 abc	8.13 a	51.51 ab	22.90 ab
Yellow Spanish	50.67 abc	7.47 ab	44.37 sb	22.64 a
Long Master	44.42 c	6.87 b	41.56 b	18.52 b
El-Hassawy	55.67 a	8.27 a	47.17 ab	23.77 ab
c. Third sample:				
		First season (1997)		
Dorado	38.97 bc	5.47 d	16.93 d	7.78 ab
Contessa	44.00 b	5.33 b	22.96 abc	7.78 ab
Texas Grano 502	44.68 b	5.20 b	24.93 ab	8.17 ab
UND Grand	42.45 bc	5.07 b	23.23 abc	7.66 b
Giza 6	42.63 bc	5.27 b	17.50 cd	7.88 cd
Creole Red	41.04 bc	5.80 b	20.75 abcd	7.69 b
Texas Early Grano	42.27 bc	5.20 b	19.39 bcd	7.46 b
Yellow Spanish	37.56 c	5.20 b	16.18 d	7.82 ab
Long Master	44.33 b	5.73 b	20.97 abcd	7.72 b
El-Hassawy	51.17 a	6.27 a	26.14 a	8.70 a
		Second season (1998)		
Dorado	52.22 a	7.67 a	36.87 ab	10.38 abc
Contessa	51.78 a	7.73 a	44.46 a	10.42 abc
Texas Grano 502	48.74 ab	6.93 ab	34.37 ab	9.64 abc
UND Grand	44.10 bc	6.88 ab	32.16 ab	9.06 bc
Creole Red	38.18 c	6.00 b	28.84 b	8.90 c
Texas Early Grano	46.66 ab	8.07 a	42.15 a	10.93 a
Yellow Spanish	47.65 ab	7.53 a	38.06 ab	10.72 ab
Long Master	43.65 bc	7.13 ab	36.94 ab	9.40 abc
El-Hassawy	49.30 ab	7.93 a	39.41 ab	9.98 abc

* Means within the same column and having similar letters are not significantly different, using the least significant difference test (LSD) at 0.05 level.

In the third sampling date, plant height and leaf number reflected significantly highest values for El-Hassawy cultivar. Almost a general trend was observed similar to that of the second season. Shoot fresh and dry weights were the highest for El-Hassawy, in the first season, and for Texas Early Grano and Contessa, in the second season, but the differences were not significant as compared to El-Hassawy.

Yield components of the different cultivars are presented in Table 4. In the first season, Contessa had the significantly highest bulb fresh weight, diameter and dry matter percentage. The three yield components were significantly the lowest for Yellow Spanish and Texas Early Grano. Almost, the same general trend was observed in the second season, except that the bulb fresh weight reflected the highest value for Texas Grano 502, but the difference was insignificant as compared to Contessa. Several authers reported pronounced reductions in onion growth and yield under saline conditions and these reductions depend on the ecological features of grown cultivars [4]. No significant interactions were observed between cultivars and salinity treatments. The response to salinity was different from one cultivar to another regardless of the salinity level.

Table 4. Bulb yield and quality of onion cultivars, in the first and second growing seasons of 1997 and 1998

Cultivar	Bulb fresh weight (g/p)	Rank	Bulb diameter (cm)	Rank	Bulb dry matter (%)	Rank
	First season (1997)					
Dorado	10.12 bc	3	2.27 ab	2	12.21 ab	3
Contessa	14.19 a	1	2.63 a	1	14.14 a	1
Texas Grano 502	10.80 b	2	2.23 b	3	12.23 ab	2
UND Grand	07.49 cd	5	2.03 bc	4	8.65 bcd	7
Giza 6	07.16 cd	8	1.97 bc	5	9.60 bcd	6
Creole Red	8.10 bc	4	1.84 cd	6	8.59 bcd	8
Texas Early Grano	4.27 d	10	1.32 e	9	6.83 cd	9
Yellow Spanish	4.83 d	9	1.32 e	9	6.27 d	10
Long Master	7.22 cd	7	1.49 de	8	11.08 ab	4
El-Hassawy	7.48 cd	6	1.68 de	7	10.48 abc	5
	Second season (1998)					
Dorado	22.12 abcd	4	2.57 bcd	4	24.70 a	6
Contessa	23.84 abc	3	3.26 ab	2	22.70 a	5
Texas Grano 502	29.67 a	1	3.75 a	1	25.18 a	2
UND Grand	25.83 ab	2	2.88 bc	3	24.83 a	3
Creole Red	19.65 bcd	6	2.54 bcd	5	24.83 a	4
Texas Early Grano	15.39 cde	8	2.10 d	8	21.05 a	8
Yellow Spanish	09.67 e	9	1.00 e	9	13.30 b	9
Long Master	15.93 cde	7	2.32 cd	6	22.10 a	7
El-Hassawy	20.30 bcd	5	2.15 cd	7	26.26 a	1

* Means within the same column and having similar letters are not significantly different, using the least significant difference test (LSD) at 0.05 level.

References

[1] Epstein, E., Norlyn, J.D., Rush, D.W., Kingsbury, R.W., Kelley, D.B., Cunningham, G.A. and Wrond, A.F. "Saline Culture of Crops: A Genetic Approach". *Science,* Washington D.C., 210 (1980), 399-404.

[2] Mass, E.V. and Nieman, R.H. "Physiology of Plant Tolerance to Salinity". In: *Crop tolerance to Sub-optimal Land Condition.* Jung, G.A. (Ed.). Chapter 13. *Amer. Soc. Agron.* Spec. Publ., 32 (1978), 277- 282.

[3] Munns, R. and Termaat, A. "Whole Plant Response to Salinity". *Aust. J.Plant Physio,* 13 (1986), 143-160.

[4] Erdie, L and Kuiper, P.J.C. "The Effect of Salinity on Growth, Cation Content, Na+ uptake and Translocation in Salt-sensitive and Salt Tolerant Plantago Species". *Physiol. Plant.* 47 (1979), 95-99.

[5] Shanon, M.C. "In Quest of Rapid Screening Techniques for Plant Salt Tolerance". *HortScienc.* 5 (1979), 587-589.

[6] Gupta, I.C.and Yadav, J.S.P. "Crop Tolerance to Saline Irrigation Water". *J. Indian Soci. Soil Scie.*, 3 (1986), 379-386.

[7] Malach, Y.D., Pasternak, D., Mendlinger, S., Borovic, I., Salam, N.E. and Malach, D. "Irrigation with Brackish Water under Desert Conditions". VIII. Further Studies on Onion (*Allium cepa* L.) Production with Brackish Water. *Agricultural Water Management*, 6 (1989), 201-215.

[8] Al-Islali, N.y. and Al-Bahrany, A.M. "Growth and Organic Solutes Accumulation in Two Onion Cultivars (*Allium cepa* L.) Stressed with Sodium Chloride". *Alex. Jour. Agric. Res.*, 39. No. 3 (1994), 597-610.

[9] Papp, J.C., Ball, M.C. and Terry, N."Acomperative Study of NaCl Salinity on Respiration, Photosynthesis and Leaf Extension Growth in *Beta vulgaris* L. (Sugar Beet)". *Plant Cell and Environment*, 6 (1983) 675-677.

[10] Poljakoff-Mayber, A. "Biochemical and Physiological Responses of Higher Plants to Salinity Stress". In: *Bio. Saline Research.* San Prieto. (Ed), pp 245-270. New York: Plenum Press, NY., 1982.

[11] Ministry of Agriculture and Water. *Agricultural Statistical Year Book.* Riyadh: Saudi Arabia, 1998.

[12] Al-Omran, A.M. "Evaluation of Some Irrigation Water in Central Region of Saudi Arabia". *J. Coll. Agric. King Saud Univ.*, 9 (1987), 363-369.

[13] Garawi, M.S. and Alhendi, H.A. "Spectroscopic Study of Metallic Constituents in some Undergroud Water in Al-Kassem Area (Saudi Arabia)". *Arab Gulf J. Scient. Res.*, 11 (1993), 47-56.

[14] Falatah, A.M., Al-Omran, A.M., Nadeem, M.S. and Mursi, M.M. "Chemical Composition of Irrigation Ground Water used in Some Agricultural Region of Saudi Arabia". *Emirates J. for Agric. Sci.*, 11 (1999).

[15] Gomez, K.A. and Gomez, A.A. *Statistical procedure for Agricultural Research.* 2nd ed., New York: John Wiley and Sons, 1983.

[16] Stino, K.R. Abdul-Fattah, A.M., Abdel-Salam A. and Abdel Gawad, M.M.. "Salinity Effects on the Growth of Some Onion Varieties". *Bull-Dirasat- Inst*: 22, No.1 (1972), 167-174.

[17] Wannamaker, M.J. and Pike, L.M. "Onion Response to Various Salinity Levels". *J. Amer. Soc. Hort. Sci.*, 112, No.1 (1987), 49-52.

[18] Mangal, J.L., Singh, R.K. and Yadav, A.C. "Selections for Increased Salinity in Onion Seed Crops and Effect on Other Characters". *Vegetable Science,* 18, No. 2 (1991), 140-145.

[19] Richard, L.A. and Wadleigh, C.H.. "Soil, Water and Plant Growth". 73-251. New York: Acadimic Press, Inc., 1952.

[20] Plaut, Z. and Reinhold, L."The Effect of Stress on c14 Sucrose Transport in Bean Plants". *Aus. J. Biol. Sci.*, 18 (1965), 1143-11155.

[21] Bernsteim, N. and Ayers, A.D. "Salt Tolerance of Five Varieties of Onion". *Proc. Amer. Soc. Hort. Sci.*, 62 (1965), 367-370.

[22] Munns, R. and Termaat, A. "Whole Plant Response to Salinity". *Aust. J. Plant Physiol.*, 13 (1986), 143-160.

[23] Sonneveld, C. "The Salt Tolerance of Greenhouse Crops". *Nether. J. Agric. Sci.*, 36 (1988), 63-73.

نمو وإنتاجية بعض أصناف البصل تحت مستويات مختلفة من ملوحة مياه الري

عبدالعزيز الحربي ، حجازي حسن حجازي ، عبدالله السعدون ،و فتحي الأدغم

قسم الإنتاج النباتي، كلية الزراعة، جامعة الملك سعود

(قدم للنشر في ٢٣/١٠/ ١٤٢٠ وقبل للنشر في ١٩/٦/ ١٤٢١ هـ)

ملخص البحث. زرعت بذور عشرة أصناف من البصل (*Allium cepa* L.) وهي: دورادو ، وكونتيسا، وتكساس جرانو ٥٠٢، ويو ن د جراند ب ر ر، وجيزة ٦، وكيريول ردو، تكساس إيرلي جرانو، ويلو سبانش، ولونغ ماستر، والحساوي، خلال موسمي زراعة في البيوت المحمية في محطة الأبحاث والتجارب الزراعية التابعة لكلية الزراعة جامعة الملك سعود. في الموسم الثاني (١٩٩٨م) تم استبعاد الصنف جيزة ٦ وذلك لضعف إنبات بذوره. زرعت البذور في قصاري قطرها ٣٠ سم مملوءة بـ ١٠ كجم من التربة الرملية. كان التوصيل الكهربائي لمياه الري المستخدمة كالتالي: ٠,٥ (الشاهد) و ٢ و٤ و٦ و٨ ملليموز/سم. تم ري المعاملة الضابطة بالماء العادي، أما المعاملات الملحية فقد تم ريها بماء تم تحضيره بإضافة الكميات المطلوبة من ملح كلوريد الصوديوم وكلوريد الكالسيوم مع المحافظة على معدل ثابت من نسبة ادمصاص الصوديوم (٥) في جميع المعاملات. تم تقدير صفات المجموع الخضري والمحصول للأصناف المستخدمة. أظهرت النتائج انخفاضاً معنوياً في النمو الخضري لجميع الأصناف بزيادة نسبة الأملاح في مياه الرى. انخفض محصول أصناف البصل بنسبة ٧٢,٨٪ في الموسم الأول و ٨١,٥٪ في الموسم الثاني عند زيادة ملوحة مياه الري إلى ٨ ملليموز/سم في الموسم الأول والثاني. كما انخفضت أقطار أصناف البصل ٥٠,٢٪ و ٥١٪ عند نفس المستوى من الملوحة في الموسمين. أعطت الأصناف كونتيسا و تكساس جرانو ٥٠٢ و دورادو أعلى محصول في الموسمين. كما لم تظهر النتائج تداخلاً في التأثير بين الأصناف وملوحة مياه الري، سواء على المجموع الخضري أو المحصول في الموسمين.