J. Agric. Sci. Mansoura Univ., 27(8): 5539 - 5548, 2002

RESPONSE OF LETTUCE TO SOME GROWTH REGULATORS AND BIOFERTELIZERS UNDER SALINE CONDATIONS

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ABSTRACT

Two field experiments were performed in Ras Suder to investigate the effect of GA3 at concentrations of 50 , 100 and 150 mg./ L, IAA at conc. of 25 , 50 and 75 mg./ L and Uniconazole at conc. of 5 , 10 and 15 mg./ L. Also to study the effect of biofertelizers (Azotobacters and Azospirilla) in addition to control treatment on growth , yield , K and Na content of Balady and Ice Berg cultivars of lettuce. Seedlings were dipped in treatments before transplanting.

Obtained results revealed that Ice Berg cultivar surpassed than Balady cultivar in number of leaves and minerals composition . While Balady cultivar enhanced than Ice Berg in plant height, the percentage of humidity , plant weight and the yield of lettuce per feddan.

The application of IAA or uniconazole treatments at low concentrations or Azotobacter on lettuce plants show significantly the highest no. of leaves per plant , plant weight as well as yield of lettuce per feddan.

While the highest plants produced with GA_3 treatment with concentration of 150 mg./ L. On the other hand uniconazole or Azotobacter treatments show the high percent of humidity in lettuce .

Na content decreased with increasing GA_3 and uniconazole concentrations, also the low concentration of IAA or biofertilizer treatments decreased Na content in lettuce. . The content of K in lettuce plants increased with increasing GA3 and uniconazole concentrations, while K increased in plants with low concentration of IAA. Also biofertilizers application increased K content in lettuce plants.

Keywords: Lettuce – Saline conditions – growth regulators – Biofertilizers.

INTRODUCTION

Lettuce is one of the most important leafy crops for consumption as salad crops . Increase lettuce production could be achieved by growing crop in newly reclaimed areas and improve yield and quality by some cultural treatments .

GA_3 enhanced elongation of plant cell , and with increasing concentrations increased plant height of lettuce (Ahmed , 1992 and Suttle *et al.*, 1992) . Spray seedlings with GA_3 at 20 mg./L. increased production of lettuce and head weight. (Myczkowski *et al.*, 1991 and Sokolowska , 1994) . Also Myczkowski *et al.*(1991) showed that GA_3 application to lettuce increased K content in plant leaves .

IAA increase size of plant cells , rate of enlargement of cells and rate of differentiation (Aharoni, 1989) . In the same line IAA application at different concentrations caused promotion of lettuce growth, Ahmed (1992). As regard IAA increased production of auxin derivatives, including asparagine and L-alanine, Martens and Frankenberger (1993) .

Uniconazole application increased plant FW, total yield of plant when sprayed with concentration 25 ppm (EL- Sayed *et al*, 1991). Hamada *et. al.*(1990) and Imam (1995) found that application of uniconazole on some vegetable plants (tomata, V faba and cucumber) decreased plant height , No of leaves and leaf area . Potassium content in shoot of plants increased with application (5-07) , Imam and Bekheta (1995).

Bio-fertilizers application (Azotobacter and Azospirillium) had a good effect on growth , yield , quality and marketing of vegetables (Pandy and Kumar, 1989 and Barakart and Gabr , 1998) . As regard Subbiah (1994) indicated that application of bio- fertilizers had significant effects on nutrients uptake (NPK) .

The aim of this investigation to study the response of lettuce plants to some growth regulators and Bioferilizers and there effects on growth , yield and K and Na content in lettuce under saline conditions of Ras Sudr.

MATERIALS AND METHODS

Two field experiments were carried out at Ras Sudr . Experimental Station of the Desert Research Center. South Sinai Governorate, at the two growing seasons 1996 / 1997 and 1997 /1998 , to investigate the effect of some growth regulators and biofertlizers treatments on growth , yield and minerals composition of Balady and Ice Berg cultivars of lettuce (Lactuca sativa Var. Longifolia), under saline soil and water conditions of Ras Sudr. The experiment was irrigated from well its salinity was 4000 ppm.

Twenty four treatments , which were the combination of the two lettuce cultivars and twelve treatments, were applied in a split plot design with three replicates . cultivars were distributed at main plots , while growth regulators and biofertilizers were distributed randomly in the sub- plots .

The area of experimental unit was 10.5 m^2 (3.5 lengh x 3 width) and consisted of 5 rows , each row 60 cm apart . Treatments included seedlings dipped in GA_3 at concentrations , 50 , 100 and 150 mg / L., IAA at concentrations of 25 , 50 and 75 mg / L., Uniconazol at concentrations 5,10 and 15 mg/L. Also Azotobacter and Azospirilla biofertilizers used in addition to control treatment. Seedlings were dipped in treatments for an hour before transplanting .

Seeding were on October 20th for the two seasons, forty five days after sowing , healthy seedlings were set at both sides of ridges , and the space between seedlings was 20 cm. All treatments were fertilized with calcium super phosphate (15.5 % P_2O_5) at 300 kg. /fed. added once, 30 days before trans planting, while potassum sulphat (48% K_2O) at rate of 150 Kg./fed .and ammonium sulphate (20.5 % N) at rate of 300 Kg./fed. were divided into two equal parts , applied 3 and 6 weeks after transplanting as side dressing . The normal cultural practices of crop growing were followed .

Studied characters were estimated 9 weeks after transplanting as : Number of leaves per plant, plant hieght, humidity percenage / leaves , plant weight and yield was determined as ton /fed. as well as K and Na content in

lettuce leaves were determined by method described by Brown and Lilliland (1964).

All data were subjected to the statistical analysis according to Thomas and Hills (1975) .

Chemical analysis of the irrigation water was determined by methods of Richards (1954) in Table (A) . While physical and chemical analysis of the experimental area of soil were estimated by methods of Piper (1950) and Jackson (1962) respectively in Table (B).

Table (A) : Chemical analysis of irrigation water.

PH	EC dsm^{-1}	Anions (meq/L)				Cations (meq/L)			
		$CO_3^=$	HCO_3^-	$SO_4^=$	Cl^-	Ca^{++}	Mg^{++}	Na^+	K^+
7.8	6.56	-	2.74	20.82	43.84	20.25	13.85	34.78	0.25

Table (B) : Physical and chemical analysis of soil.

Physical properties

(%) of particles size distribution (mm)						
$CaCO_3$ %	Coarse Sand	Fine Sand	Total Sand	Silt	Clay	Class Texture
56.99	0.5 – 1.0	0.10 – 0.25	0.1 – 1.0	0.002 – 0.05		Loam sand
	53.7	27.6	81.3	7.9	10.8	

Chemical analysis

PH	EC Dsm-1	Organic Matter (%)	Saturation soluble extract								N mg/ 100g	Gypsum (%)	Zn Ppm
			Anion (meq /L)				Cation (meq /L)						
			$CO_3^=$	HCO_3^-	$SO_4^=$	Cl^-	Ca^{++}	Mg^{++}	Na^+	K^+			
8.1	4.12	0.62	-	0.7	12.0	27.9	22.3	2.31	13.5	0.61	1.84	0.15	2.17

RESULT AND DISCUSSION

Growth characteristic :

Data of leaves number , plant height , percentage of humidity as well as fresh weight of lettuce plant are presented in Table (1 and 2) .

It can concluded that Ice Berg cv. Plants were significantly higher in leaves number than those of Balady cv. Plants . On the other hand plants of Balady cultivar in plant increased significantly than those of Ice Berg cultivar in plant height, humidity percentage of leaves as well as plant weight. These results are true in both growing seasons.

Pronounced plants received IAA and uniconazole treatments , also plants received biofertilizers showed significant increase in No. of leaves/plant than control treatment, while the highest plants obtained with GA_3 treatments and plant height increased with increasing GA_3 concentrations up to 150 mg/L., also the low concentration of IAA and biofertilizers treatments increased plant height of lettuce .

Concerning, interaction treatments cleared that Ice Berg cultivar treated with IAA at 25 mg/L. or uniconazole at 5 mg./L. and biofertilizer treatments gave the highest No. of /plant than other treatments, the same cultivar with

GA_3 treatment at concentration 150 mg./L gave the tallest plants when compared with other treatments under study .

As regard, data in Table (2) show that, plants received uniconazole at concentration 5 mg./L. contained the highest percentage of humidity than other treatments . Also the same treatment in Balady cultivar enhanced than other interaction treatments in humidity percentage of leaves .

Results revealed that , plant weight of lettuce increased significantly in plants treated with IAA at cone. 50 or 75 mg./L and uniconazole at conc. 5 or 10 mg./L as well as biofertilizers treatments especially Azotobacter when compared with control treatment. As regard Balady cultivar plants treated with IAA at conc. 75 mg./L gave the highest plant wieght than other treatments .

Present results are in agreement with those of Ahmed (1992) and Suttle *et al.* (1992) who reported that , with increasing concentration of GA_3 increase plant height . Also Myczkowski *et al.* (1991) and Sokolowska (1994) showed that application of GA_3 to lettuce improved head weight and increased seed yield . This may be due to that GA_3 effect is similar to red light which promotes the synthesis of gibberellin as it overcomes photodormancy of seeds . Also GA_3 may be increased metabolism of plant hormones and induced cell elongation and expansion (Hammer *et al.* 1995) .

Obtained results show that 25 or 50 mg./L IAA application stimulate vegetative growth . These results agree with Aharoni (1989) who concluded that IAA retarded chlorophyll loss in lettuce . Also Ahmed (1992) and Hammer *et al.* (1995) cleared that , the inhibition of growth of lettuce hypocotyls due to presence of endogenous IAA. While Martens and Frankenberger (1993) found that IAA increased production of auxin derivatives .

The uniconozale application show the same trend of IAA treatments . Obtained results show that, low concentration of uniconozole enhance vegetative growth of lettuce . These results are in the same line with those obtained by EL-Sayed *et al.* (1989) who reported that, low concentration of uniconazole (25 ppm) increased growth of pea plants . The effect of uniconazole on plant growth under saline conditions may be due to that uniconazole induce low temperature tolerance and increase activities of antioxidants including glutathione , peroxidase and catalase which induce stress tolerance and protect cell membranes from oxidative stress damage (Senaratana *et al.*, 1988 and Upadhyaya *et al.*, 1989). Also Macky *et al.*, (1990) reported that application of (S-07) at 10 mg./L increase the resistance of stomatal in plant leaves . Many investigators mentioned that with increasing rate of uniconazole to seedlings of vegetables increase the inhibition of plant growth (Hamada *et al.*, 1990 and Imam, 1995) .

Concerning , the results present in Table (1 and 2) show that plants received biofertilizers enhanced in No. of leaves/plant, plant height and plant weight than control treatment in both growing seasons , also Azotobacter surpassed than Azospirilla treatment in their effect on plant growth. No. of leaves per plant increased with Azotobacter application in Ice Berg cultivar, while plant height enhanced with Azotobacter than Azospirilla treatment in Balady cultivar.

Table (1) : Effect of some growth regulators and biofertilizers treatments on No. of leaves per plant and height (cm) of Balady and Ice Berg Lettuce cultivars.

Charact. Season / Cult.Treat.	No. of leaves / plant						Plant height (cm)					
	1996-1997			1997-1998			1996-1997			1997-1998		
	B.	Ice B.	X	B.	Ice B.	X	B.	Ice B.	X	B.	Ice B.	X
GA (50mg./L)	32.3	28.0	31.2	33.0	30.3	31.7	34.5	32.7	33.6	33.6	32.3	33.0
GA (100mg./L)	36.0	31.3	33.7	37.0	44.5	40.8	38.0	35.3	36.7	39.7	46.0	42.9
GA (150 mg./L)	27.0	35.3	31.2	37.0	40.7	38.9	48.3	59.0	53.7	47.0	51.0	49.0
IAA (25 mg./L)	54.0	66.3	60.2	61.7	60.3	61.0	32.5	32.0	32.3	33.0	28.0	30.5
IAA (50 mg./L)	54.0	41.3	47.7	55.7	59.0	57.4	33.0	32.7	32.9	30.0	27.7	28.9
IAA (75 mg./L)	49.3	31.0	40.2	43.3	59.3	51.3	31.8	25.3	28.6	31.7	20.7	26.2
S-07 (5 mg./L)	54.0	80.0	67.0	54.7	78.0	66.4	27.5	22.3	24.9	32.3	25.3	28.8
S-07 (10 mg./L)	53.3	64.3	58.8	42.3	83.0	62.6	30.5	19.7	25.1	30.7	20.3	25.5
S-07 (15 mg./L)	48.7	59.0	53.9	37.3	62.0	49.7	24.3	21.0	22.7	24.3	24.3	24.3
Azot.	52.0	60.0	56.0	45.7	61.0	53.4	40.0	26.3	33.2	36.0	26.3	31.2
Azosp.	55.7	47.0	51.4	45.7	45.0	45.4	36.0	25.3	30.7	33.7	26.3	30.0
Cont.	33.0	41.0	37.0	40.0	39.0	39.5	30.0	22.3	26.2	30.0	21.0	25.5
Mean	45.8	48.7		44.5	55.2		33.8	29.5		33.5	29.1	
LSD at 0.05 for :- Cult	2.91			5.26			2.01			2.00		
Treat	6.06			8.43			2.61			4.02		
C.xT.	8.59			11.94			3.69			5.69		

Table (2) : Effect of some growth regulators and biofertilizers treatments on humidity percentage in leaves and plant weight (gm) of Balady and Ice Berg Lettuce cultivars.

Charact. Season / Cult.Treat.	Humidity % in leaves						Plant weight (gm)					
	1996-1997			1997-1998			1996-1997			1997-1998		
	B.	Ice B.	X	B.	Ice B.	X	B.	Ice B.	X	B.	Ice B.	X
GA (50mg./L)	83.3	64.0	73.7	79.4	69.6	74.5	820	160	240	255	160	208
GA (100mg./L)	86.3	74.4	80.4	87.0	79.0	83.0	380	190	285	373	235	305
GA (150 mg./L)	82.7	81.3	82.0	86.3	78.1	82.2	280	165	223	270	180	225
IAA (25 mg./L)	84.7	84.2	84.5	87.1	84.7	85.9	310	220	265	415	400	408
IAA (50 mg./L)	86.0	84.8	85.4	86.2	83.8	85.0	435	413	424	355	485	420
IAA (75 mg./L)	85.7	73.3	79.0	89.5	80.9	85.2	360	242	301	325	245	285
S-07 (5 mg./L)	88.6	85.4	87.0	90.7	85.5	88.1	416	330	373	445	400	423
S-07 (10 mg./L)	87.8	87.6	87.7	86.7	86.9	86.8	415	320	368	375	520	448
S-07 (15 mg./L)	83.3	82.8	83.1	84.3	84.1	84.2	316	295	306	276	265	271
Azot.	87.4	85.0	86.2	88.0	87.0	87.5	370	335	353	385	285	335
Azosp.	85.2	85.1	85.2	83.7	81.4	82.6	265	230	248	365	265	315
Cont.	89.2	85.8	87.5	89.0	85.4	87.2	125	100	113	165	95	130
Mean	85.9	80.9		86.5	82.2		333	250		334	295	
LSD at 0.05 for :- Cult	3.46			NS			23.12			31.87		
Treat	5.17			2.51			39.59			50.70		
C.xT.	7.33			3.56			NS			NS		

These results agree with those obtained by Abd-El- Fatah (1998) who applied biofertilizers to artichoke in reclaimed calcareous soil enhanced plant growth .

Barakart and Gabr (1998) showed that tomato seedling growth wasgreatly improved by inoculation of biofertilizer (Azotobacter and Azospirillum). The beneficial effects of applying Azotobacter and Azospirillum are related to their N- fixing proficiency and with their ability to produce antibacterial and antifungal compounds , growth regulators and siderophones (Pandey and Kumar , 1989).

Total yield:-

Data presented at Table (3) show that , yield of Balady cv. was higher than those of Ice Berg cv. the differences between yield of two culivars were significant in both growing seasons . Concerning 75 mg/L IAA or 10 mg/L uniconazole application gave the highest lettuce yield than other concentrations of growth regulators . Also biofertilizers treatments increased yield significantly when compared with control treatment, also yield obtained from seedlings treated with Azotobazcter enhanced than plants treated with Azospirilla .

On the other hand GA_3 had insignificant effect on total yield of lettuce, while Sokolwska (1994) found that GA_3 application increased yield of lettuce. Obtained results on the effect of IAA on total yield of lettuce in the same line of those recorded by Ahmed (1992) and Martens and Frankenberger (1993), they reported that IAA application increased production of lettuce. Also application of uniconazole at 25 ppm gave the highest total yield of *phaseolus vulgaris* (El-Sayed *et al.*,1989) and with increasing concentration of uniconazole reduce total yield of Vicia faba (Imam, 1995). The effect of IAA may be due to increase production of auxin derivatives (Martens and Frankenberger 1993) also Aharoni (1989) reported that IAA retarded chlorophyll loss and increase production of ethylene induced in the treated leaf discs.

As regard, the effect of uniconazole application on the production of lettuce may by due to uniconazole induce low temperature tolerance was accompanied by increasing leaves or activities of various antioxidants which reduce stress related to oxidative damage of cell membranes (Upadhaya *et al.*,1989). Therefore uniconazole has a good effect on saline conditions may be due to its effect in decreasing water loss from seedlings (Yamazaki and Koshioka, 1992). The high concentration of uniconazole reduce leaf enlargement , stem elongation and plant transpiration, also delayed flowering, but increase chlorophyll concentration as a result of increase level of endogenous cytokinins (Thomas and Singh, 1996).

Biofertilizer application had a positive effect on production of lettuce and these results are in the same trend with those obtained by Barakart and Gabr (1998) on tomato . the superiority of biofertilizers appears to be as a result of the active of some biological substances which help indirectly in greater absorption of nutrients from soil solution, Azospirilla were reported to produce IAA, Lactic acid, GA_3 and cytokinine like substances (Vlassak and Reynders, 1980).

Table (3) : Effect of some growth regulators and biofertilizers treatments on total yield (ton/fed.) of Balady and Ice Berg Lettuce cultivars.

Charact. / Season / Cult. Treat.	Total yield (ton /fed .)					
	1996-1997			1997-1998		
	B.	Ice B.	X	B.	Ice B.	X
GA (50mg./L)	6.47	5.77	6.12	8.90	6.87	7.89
GA (100mg./L)	11.23	7.00	9.12	11.27	8.10	9.69
GA (150 mg./L)	7.93	7.90	7.92	9.17	7.37	8.27
IAA (25 mg./L)	9.30	8.57	8.94	12.27	9.47	10.87
IAA (50 mg./L)	11.67	12.35	12.01	9.87	14.53	12.20
IAA (75 mg./L)	14.95	8.43	11.69	10.70	6.70	8.70
S-07 (5 mg./L)	12.10	9.77	10.94	13.33	12.00	12.67
S-07 (10 mg./L)	12.30	9.82	11.06	11.33	15.80	13.57
S-07 (15 mg./L)	6.50	9.50	8.00	7.93	7.80	7.87
Azot.	13.92	13.30	13.61	11.86	9.38	10.62
Azosp.	11.00	8.70	9.85	10.84	8.33	9.59
Cont.	9.40	6.90	8.15	9.30	7.38	8.44
Mean	1.056	9.00		10.56	9.49	
LSD at 0.05 for :- Cult	**1.251**			**0.650**		
Treat	**1.605**			**1.485**		
C.xT.	**3.660**			**2.104**		

The positive effect of Azotobacter and Azospirilla on lettuce yield may be due to their effect in N-fixing proficiency and their ability to produce antibacterial and antifungal compounds, growth regulators and siderophores (Pandey and Kumar, 1989). The beneficial of biofertilizers on plant development can be attributed not only to N2-fixation process, but also to the production of growth promoting substances and successful competition against antagonists of plant growth (Gowily *et al.*, 1993).

Also biofertilizers appears to be a result of the highest microbial counts recorded and produce biological active substances and the increases in the population of microorganisms. A status that improve the soil condition particularly temperature, aeration and moisture retention which favour the production of plants (EL-Kased *et al.*,1996).

The interaction between cultivars and treatments , showed that Balady cultivar treated with IAA at conc. 75 mg/L. or uniconazole at conc. 10 mg/L or biofertilizers treatments especially Azotobacter gave the highest values of yield than other treatments in both growing seasons.

Na and K contents:-

Leaves contents of sodium and potassium percentage are shown in Table (4) . There were no significant differences between Balady and Ice Berg cultivars in Na and K content in leaves . On the other hand it can be observed that sodium content decreased with increasing concentrations of GA3 and (S-07) , also Azotobacter and Azospirilla treatments decreased sodium content in lettuce leaves than control treatment . The trend of potassium content in lettuce leaves affected by treatments under study show opposite trend than sodium content. Potassium content increased with increasing concentrations of GA_3 and uniconazole application , in addition to Azotobacter and Azospirilla treatments when compared with control treatment. These results agree with those obtained by Myczkowski *et al.*, (1991) who reported that GA_3 spray reduced nitrite leaf content and increased K content in lettuce leaves . Also Imam and Bekheta (1995) mentioned that uniconazole treatment increased

the shoot K content when compared with control . Also Subbiah (1994) showed that application of biofertilizers had significant effects on nutrients uptake (NPK) .

Table (4) : Effect of some growth regulators and biofertilizers treatments on Na (%) and K (%) content in leaves of Balady and Ice Berg Lettuce cultivars.

Charact.	Na(%)						K%					
Season	1996-1997			1997-1998			1996-1997			1997-1998		
Cult. / Treat.	B.	Ice B.	X	B.	Ice B.	X	B.	Ice B.	X	B.	Ice B.	X
GA (50mg./L)	0.85	0.78	0.82	0.90	0.86	0.88	2.7	2.4	2.6	2.6	2.4	2.5
GA (100mg./L)	0.72	0.66	0.69	0.81	0.79	0.80	2.6	2.6	2.6	2.6	2.7	2.7
GA (150 mg./L)	0.68	0.58	0.63	0.70	0.66	0.68	2.8	2.9	2.9	2.8	2.7	2.8
IAA (25 mg./L)	0.66	0.67	0.67	0.70	0.69	0.70	3.1	3.3	3.2	2.9	3.0	3.0
IAA (50 mg./L)	0.96	1.00	0.98	0.86	0.96	0.91	2.7	2.9	2.8	2.6	2.7	2.7
IAA (75 mg./L)	0.98	1.08	1.03	0.90	1.00	0.95	2.7	2.7	2.7	2.4	2.5	2.5
S-07 (5 mg./L)	1.00	0.92	0.96	0.90	0.92	0.91	3.0	3.2	3.1	2.9	2.7	2.8
S-07 (10 mg./L)	0.87	0.81	0.84	0.79	0.84	0.82	3.2	3.3	3.3	3.3	3.0	3.2
S-07 (15 mg./L)	0.70	0.79	0.75	0.64	0.70	0.67	3.5	3.6	3.6	3.4	3.3	3.4
Azot.	0.90	0.92	0.91	0.81	0.80	0.81	2.7	2.8	2.7	2.8	3.0	2.9
Azosp.	0.71	0.80	0.76	0.68	0.74	0.71	3.0	3.3	3.2	3.0	3.2	3.1
Cont.	1.50	1.69	1.60	1.39	1.56	1.48	2.3	2.6	2.5	2.4	2.6	2.5
Mean	0.88	0.89		0.84	0.88		2.9	3.0		2.8	2.8	
LSD at 0.05 for :- Cult	**NS**			**NS**				**NS**			**NS**	
Treat	**0.15**			**0.30**				**0.29**			**0.25**	
C. x T.	**NS**			**0.02**				**NS**			**NS**	

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إستجابة الخس لبعض منظمات النمو و التسميد الحيوى تحت الظروف الملحية

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مركز بحوث الصحراء

تم إقامة التجربة بمحطة بحوث راس سدر بجنوب سيناء تحت الظروف الملحية ، لدراسة تأثير الجبريلك أسد بتركيز ٥٠ ، ١٠٠ ، ١٥٠مجم /لتر ، تأثير إندول أستيك أسد بتركيز ٢٥ ، ٥٠ ،٧٥ مجم/لتر وأيضا تأثير اليونى كونازول بتركيز ٥، ١٠، ١٥ مجم /لتر . كما تم دراسة تأثير التسميد الحيوى (الأزوتوباكتر ، الأيزوسبيريلا) بالإضافة لمعاملة المقارنة على صفات النمو ، الإنتاج ، محتوى البوتاسيوم والصوديوم لصنفى الخس (البلدى ، الأيس برج) . و قد تم غمس الشتلات فى المعاملات قبل زراعتها فى الأرض المستديمة .

وقد أوضحت النتائج المتحصل عليها :-

١- تفوق الصنف أيس برج على الصنف البلدى فى عدد الورق و محتوى العناصر بينما تفوق الصنف البلدى على الصنف الآخر و بالنسبة لطول النبات ونسبة الرطوبة ، ووزن النبات وأيضا إنتاج المحصول للفدان .

٢- وجد أن استخدام الأندول أسيتك أسد ، اليونى كونازول بالتركيزات المنخفضة وأيضا استخدام الأزوتوباكتر حقق زيادة معنوية عن باقى المعاملات بالنسبة لعدد الورق للنبات ، وزن النبات بالإضافة لأنتاج المحصول للفدان .

٣- كما وجد أن استخدام الجبريلك أسد بالتركيز المرتفع أدى للحصول على أطول نباتات معنويا بالمقارنة بباقى المعاملات

٤- كما لوحظ أن استخدام اليونى كونازول أو الأزوتوباكتر أعطى أعلا نسبة رطوبة فى الخس تحت الظروف الملحية .

٥- قل محتوى الصوديوم فى الأوراق مع زيادة تركيز حمض الجبرلين واستخدام اليونى كونازول والتركيز المنخفض من الأندول أستيك أسد وأيضا استخدام الأسمدة الحيوية ، أما بالنسبة لمحتوى البوتاسيوم فقد زاد فى النبات مع إستخدام التركيزات المنخفضة من الأندول أسيتك أسد واليونى كونازول والتركيز المرتفع من الجبريلك أسد وأيضا معاملات الأسمدة الحيوية مما يوضح زيادة قدرة النبات على تحمل الملوحة.