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SOME FACTORS AFFECTING *Nicotiana glauca* GRAHAM GROWTH AND ACTIVE INGREDIENTS:
I. EFFECT OF DIFFERENT SALINE WATER IRRIGATION AND COMPOST LEVELS

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ABSTRACT

This study was carried out at El-Sheikh Zewaied Research Station, Desert Research Centre at North Sinai Governorate during the two seasons of 2003/ 2004 and 2004/ 2005 to study the effect of different levels of compost (0, 4, 8 and 12 m^3/ fad.), saline water irrigation (600, 1500 and 3000 ppm) and their interaction on growth, active ingredients and chemical constituents of tree tobacco (*Nicotiana glauca*) plants. Results indicated that the maximum yield of active ingredients (total alkaloids, anabasine and rutin) and the highest values of growth characters (plant height, number of branches, dry weight of plant and dry weight of leaves/ plant) and plant minerals content (N, P, K, Zn, Mn and Fe) could be obtained when plants were irrigated with saline water at 1500 ppm with the addition of 12 m^3/fad compost during soil preparation.

INTRODUCTION

Nicotiana glauca Graham, also called wild tobacco or tree tobacco, is a fast growing shrub or small tree, native to South America, belongs to the family *Solanaceae* (Mizrachi *et al.*, 2000). It is widely spread as a wild shrub all over Arabian countries such as Egypt, Libya and Jordan and is known locally by the Arabic name Massas (Tokholm, 1956). Studies demonstrated that *N. glauca* is highly toxic to humans (Mizrachi *et al.*, 2000) and animals (Panter *et al.*, 2000). The plant contains the alkaloid anabasine which is the isomer of nicotine. This substance is responsible for the clinical toxicology of this plant. The plant has been used medicinally (Watt and Breyer-Brandwijk, 1962) and in ethnoveterinary medicine (Gueye, 1997). Warmed leaves are applied to the head to relieve headache, on the throat to relieve pain, and put in shoes for painful feet (Van Wyk, 2000) and an infusion of the leaves has been used as a steam bath in the treatment of rheumatism (Moerman, 1998). It is also used to treat burns and inflammatory diseases (Morel *et al.*, 1998). *Nicotiana glauca* also contained rutin which considered the main polyphenolic acid in this plant. The rutin is called vitamin D which has an important effect in resolving arteriosclerosis and in restoring the capillary function of assimilation (Clans, 1967).

Salinity is currently one of the most severe abiotic factors limiting agricultural production. The high rates of population growth and global warming are expected to further exacerbate the threat of salinity, especially in areas with a semi-arid climate as in the Mediterranean region. In areas such as that of the Mediterranean, it would be desirable to irrigate with saline water or to blend saline with high quality water, as well as to grow selected salt-tolerant crops (Flowers *et al.*, 2005). The main problem enface using saline water in irrigation that salinity affects plant performance through the development of osmotic stress and disruption of ion homeostasis, which in turn cause metabolic dysfunctions (Paranychianakisa and Chartzoulakis, 2005). Moreover, salinity can cause imbalance in the uptake of mineral nutrients as well as phytotoxicity for excessive accumulation of Na^+ and Cl^- in the tissues (Hu and Schmidhalter, 2005). To best of our knowledge there are no previous studies concerning the effect of saline water irrigation on *N. glauca* growth and active ingredients concentrations.

Compost can be used to improve soil structure, to increase soil organic matter, to provide some plant nutrients and to enhance plant growth. Additionally, compost can remediate soils contaminated with toxic organic compounds (Amine-Khodja *et al.*, 2006).

The main objectives of this study were to investigate: (i) the opportunity of using saline water irrigation to irrigate *Nicotiana glauca*; (ii) to investigate the effect of using different rates of compost and (iii) to determine the combined effect of using different levels of saline water irrigation and compost on growth, active ingredients and chemical constituents of tree tobacco.

MATERIALS AND METHODS

This study was carried out during two successive seasons of 2003/ 2004 and 2004/ 2005 at the Experimental Station of Desert Research Center at El-Sheikh Zewaied, North Sinai Governorate.

Seeds of *Nicotiana glauca* Graham were sown in the nursery bed on 1st of August during both seasons. Meanwhile, Seedlings were transplanted in the experimental area on 15th of September (2003 and 2004). The mechanical and chemical properties of experimental farm soil are shown in Table (A), and the analysis of compost is shown in Table (B). This experiment included 12 treatments which were the combination of three saline water irrigation levels [control (tap water, 600ppm), 1500 and 3000 ppm], and four rates of compost (0, 4, 8 and 12 m^3/ fad.). The layout of this experiment was split plot system in a completely randomized design with three replicates, where saline water irrigation treatments randomly arranged in main plots while the rates of compost were randomly assigned in sub plots. The experimental area (plot) was 25 m^2 and contained 25 plants. The distance between rows and plants within row was one meter. The irrigation system of the experiment was drip irrigation. The chemical analysis of irrigation water was tabulated in Table (C). All plants were irrigated with 8 L/ plant/ week. Different rates of compost were added during soil preparation before planting the seedlings. All plants have been received similar chemical fertilization at the rate of 300 Kg/ fad ammonium nitrate, 250 Kg/ fad superphosphate and 100 Kg/ fad potassium sulphate. Plants received normal agricultural practices whenever they needed.

Recorded Data:

Five plants were randomly chosen from every plot on 15[th] February in both seasons, the following data were recorded:

Plant growth characters:

1. Plant height (cm),
2. Number of branches per plant.
3. Dry weight of plant and leaves per plant (g).

Active ingrédients

1. Total alkaloids percentage in leaves was determined according to methods of Saitoh *et al*. (1985). Total alkaloids content per plant was determined by multiplying the percentage of total alkaloids by the dry weight of leaves per plant.
2. Anabasine percentage in leaves was determined according to the method of Troje *et al*. (1997) and anabasine content per plant was calculated by multiplying the percentage of anabasine by the dry weight of leaves per plant.
3. Rutin percentage in leaves was estimated according the methods of Kreft *et al*. (2002) and then the rutin content per plant was calculated by multiplying the percentage of rutin by the dry weight of leaves per plant.

Table A: Physical and chemical analysis of experimental farm soil in North Sinai Research Station

Mechanical analysis	Value	Chemical analysis					
		Soluble anions (mEg/L)	Value	Soluble Cations (mEg/L)	Value	Available (mg/L)	Value
Fine sand %	31.96	CO_3	-	Ca	4.08	N	9.13
Coarse sand %	56.16	Cl	1.30	Mg	0.82	P	2.71
Silt %	7.40	SO_4	4.74	Na	4.50	K	0.15
Clay %	2.25	pH	8.30	K	0.25	$CaCo_3$	2.30
Soil texture	Sandy						
E.C Mmhos/ cm	0.93						

Table B: Chemical analysis of compost in North Sinai Research Station

Parameters	2003/2004	2004/2005	Parameters	2003/2004	2004/2005
rganic matter %	61.30	58.21	Potassium %	1.20	1.28
rganic carbon %	32.55	33.76	Iron ppm	248.10	141.50
Total nitrogen %	1.48	1.56	Zinc ppm	149.20	27.60
C/N ratio	24.02	21.64	Copper ppm	23.30	27.60
Phosphorus %	0.81	0.86	Manganese ppm	114.90	120.10

Table C: Chemical analysis of the used irrigation water in North Sinai Research Station

pH	Total salts concentration (ppm)	Soluble anions (mEg/L)				Total	Soluble cations (mEg/L)				Total
		$H_2CO_3^-$	Cl^-	$(SO_4)^{--}$	CO_3^-		Ca^{++}	Mg^+	Na^+	K^+	
7.8	3000	358.2	1059	625	0.00	1863	88.88	76.08	880.0	12.0	1057

Chemical constituents:

1. Total carbohydrate percentage was determined in leaves according to the method of Herbert *et al*. (1971).

2. Macro elements (N, P and K) and microelements (Zn, Mn and Fe) percentages were estimated in leaves according to the method of Chapman and Pratt (1961).
3. Sodium and calcium percentages were determined in leaves according to the method of Jackson (1962).
4. Magnesium percentage was determined in the leaves according to the method of Cheng and Bray (1951).
5. Chloride percentage was determined in leaves according to the method of Jackson and Brown (1955).

The recoded data were statistically analyzed, and the means were compared using least significant difference (LSD) test at 5% level according to Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

Plant growth characters

Effect of salinity

Data in Tables 1 and 2 show that all growth characters i.e., plant high, number of branches per plant, dry weight of plant and leaves per plant significantly increased with increasing water irrigation salinity up to 1500 ppm, while increasing this level to 3000 ppm resulted in significant decreases in these parameters compared with control and 1500 ppm treatments. These results hold true in both seasons. These results are in harmony with these obtained by Khalil (2002) on rosemary and Hussein and Haggag (2003) on *Asclepias curassavica* plants.

The increment in plant growth which achieved with low salinity level (1500 ppm) might be due to the fact that saline irrigation water, containing appreciable amounts of soluble salts, is conducive to increase plant growth (Hussain *et al.*, 1997). This may be attributed to the minerals of salts component in saline water which supply the plant with nutritional material rather than it suppressed the growth. On the other hand, the depressive effect of high saline water concentration (3000 ppm) on plant growth might be due to the effect of salinity on arrest plant growth because osmotic stress mechanisms restrain water availability at the soil level (Bartels and Sunkar, 2005). Moreover, salinity can cause imbalance in the uptake of mineral nutrients as well as phytotoxicity for excessive accumulation of $Na+$ and $Cl-$ in the tissues (Hu and Schmidhalter, 2005).

Effect of compost:

As clear in Tables 1 and 2 all plant growth parameters (plant height, number of branches per plant and dry weight of leaves and plant) have been significantly increased by application of compost. Increasing of compost rate resulted in gradually significant increase in all growth parameters during both seasons. These results are in accordance with those obtained by Shalaby *et al.* (2005) on pepper and Abd El-Ghany (2007) on oregano plants.

This effect might be attributed to the fact that compost had some macro and micro nutrients, which enhance plant growth (Amine-Khodja *et al.*, 2006). Also compost may be contains many species of living organisms which release phytohormones such as GA_3, IAA and CYT which stimulate plant growth, nutrient absorption and photosynthesis process and reflected on plant dry matter accumulation.

Table 1: Effect of different saline water irrigation levels, compost rates and their interactions on plant height and number of branches per plant of *Nicotiana glauca* at 2003/ 2004 and 2004/ 2005 seasons.

Salinity concentration (ppm) (B)	Compost rates m³/fad (A)									
	Control	4	8	12	Mean(A	Control	4	8	12	Mean (A
	2003 / 2004					2004 / 2005				
	Plant height (cm)									
Control	140	167	183	190	170.00	155	175	190	205	181.25
1500	170	185	210	220	196.25	193	210	215	245	215.83
3000	120	130	155	161	141.50	135	149	151	158	148.25
Mean (B)	143.33	160.5	182.78	190.33		161.10	178.0	185.3	202.67	
L.S.D. at 0.5% for	A=4.91		B= 5.30		AB=10.60	A= 6.14		B= 8.25		AB=16.50
	Number of branches per plant									
Control	19.00	22.00	26.00	27.67	23.67	17.00	20.33	21.33	24.00	20.67
1500	23.33	25.33	30.33	36.67	28.91	21.00	24.00	28.00	32.67	26.42
3000	16.19	19.00	21.00	25.00	20.30	15.00	17.00	18.00	21.00	17.75
Mean (B)	19.51	22.11	25.78	29.79		17.67	20.44	22.44	25.89	
L.S.D. at 0.5% for	A= 0.55		B=0.46		AB=0.93	A=0.71		B= 0.76		AB= 1.52

Table 2: Effect of different saline water irrigation levels, compost rates and their interactions on dry weight of plant and leaves per plant (g) of *Nicotiana glauca* at 2003/ 2004 and 2004/ 2005 seasons.

Salinity concentration (ppm) (B)	Compost rates m³/fad (A)									
	Control	4	8	12	Mean(A	Control	4	8	12	Mean(A
	2003 / 2004					2004 / 2005				
	Dry weight									
Control	249.00	259.67	278.33	301.67	272.17	254.67	276.00	299.00	312.33	285.50
1500	287.00	321.00	253.33	373.00	333.58	292.00	332.00	376.00	391.33	347.83
3000	215.33	240.00	262.33	274.00	247.92	236.00	259.00	268.00	280.33	260.83
Mean (B)	250.44	273.55	298.00	316.22		260.89	289.00	314.33	328.00	
L.S.D. at 0.5% for	A=3.12		B= 2.51		AB=5.02	A= 4.95		B= 6.91		AB=13.82
	Dry weight of leaves per plant									
Control	90.00	94.67	107.33	118.67	102.67	82.00	97.00	110.00	118.00	101.75
1500	109.33	134.00	161.33	174.00	144.67	111.00	136.00	169.00	177.00	148.25
3000	74.33	87.33	104.67	107.33	93.42	75.00	92.00	95.00	101.33	90.83
Mean (B)	91.22	105.33	124.44	133.33		89.33	108.33	124.67	132.11	
L.S.D. at 0.5% for	A= 1.49		B=1.88		AB=3.76	A=6.82		B= 0.71		AB= 1.43

Effect of interaction:

As for the interaction of both factors under study, data in Tables 1 and 2 show that, irrigating plants with medium level of saline water (1500 ppm) combined with the highest compost level (12 m^3/fad.) recorded the highest significant increase in all recorded vegetative growth parameters during both seasons. On the other hand, the lowest values of growth parameters were recorded when plants were irrigated with the highest level of saline water (3000 ppm) without addition of compost. These results were in the same manner in both seasons of experiment and are in harmony with those obtained by Khalil (2002) on rosemary and El-Koony *et al.* (2004) on roselle since they found that, the application of compost to cultivated land significantly hindered the harmful effect of irrigation with saline water.

Active ingredients (total alkaloids, anabasine and rutin content):

Effect of salinity:

Concerning the effect of salinity on total alkaloids percentage in leaves and content per plant, data in Table 3 reveal that the highest level of saline water irrigation (3000 ppm) had a significant decrease compared with control, while the concentration of 1500 ppm recorded significant increase compared with control treatment. These increments were 54.73% and 58.95% in the first and second seasons, respectively over the control.

Table 3: Effect of different saline water irrigation levels, compost rates and their interactions on total alkaloids percentage in leaves and content (mg) per *Nicotiana glauca* plant at 2003/ 2004 and 2004/ 2005 seasons.

Salinity concentration (ppm) (B)	Compost rates m^3/fad (A)									
	Control	4	8	12	Mean (A)	Control	4	8	12	Mean (A)
	2003 / 2004					2004 / 2005				
	Total alkaloids percentage									
Control	0.59	0.61	0.64	0.65	0.62	0.58	0.63	0.65	0.67	0.63
1500	0.63	0.67	0.72	0.74	0.69	0.62	0.68	0.71	0.73	0.69
3000	0.51	0.53	0.56	0.57	0.54	0.51	0.54	0.55	0.57	0.54
Mean (B)	0.58	0.60	0.64	0.65		0.57	0.62	0.64	0.66	
L.S.D. at 0.5% for	A=0.18 B= 0.06 AB=0.12					A= 0.01 B=0.04 AB=0.09				
	Total alkaloids per plant (mg)									
Control	531.00	577.48	686.91	771.35	641.68	116.00	611.10	715.00	790.60	558.17
1500	688.87	897.80	1161.57	1287.60	1008.96	688.20	924.80	1199.90	1292.10	1026.25
3000	379.08	462.84	586.15	611.78	509.87	382.50	496.80	522.50	577.58	494.84
Mean (B)	532.98	645.92	645.92	890.24		437.79	677.56	812.46	886.76	
L.S.D. at 0.5% for	A= 18.92 B=20.18 AB=40.36					A=24.23 B= 32.92 AB= 65.84				

Data in Table 4 show that, the maximum anabasine percentage in leaves and content per plant have been recorded when plants were irrigated with saline water at 1500 ppm, while the minimum percentage was recorded with the treatment of 3000 ppm. This was obvious in both seasons.

Data in Table (5) indicate that the rutin percentage in leaves and content per plant has been decreased when plants were irrigated with saline water at 3000 ppm compared with control. On the other hand, the maximum values were recorded when plants irrigated with saline water at 1500 ppm. These results hold true during both seasons.

The enhancing effect of moderate salinity stress on alkaloid production which recorded in this study has been previously reported by Jaleel *et al.* (2008) on *Catharanthus roseus*. This may be attributed to the fact that as a response to plant stress, the enzymes of biosynthetic pathways rather than primary metabolism are induced, resulting in an accumulation of secondary metabolites such as alkaloids (Moreno *et al.*, 1995). On the other hand, the reduction in total alkaloids percentage and content under high saline water level may be attributed to that salinity arrest plant growth because osmotic stress mechanisms restrain water availability at the soil level (Bartels and Sunkar, 2005). Moreover, salinity can cause imbalance in the uptake of mineral nutrients as well as phytotoxicity for excessive accumulation of $Na+$ and $Cl-$ in the tissues (Hu and Schmidhalter, 2005).

Effect of compost:

The data recorded in Table (3) show that the percentage of total alkaloids and content per plant in leaves were significantly enhanced when plants were fertilized with compost during both seasons. These values were increased with increasing the rate of compost.

Application of compost at the highest rate (12 m^3/fad) gave the highest significant anabasine percentage and content per plant compared to untreated plants or other compost treatments (Table 4).

Table 4: Effect of different saline water irrigation levels, compost rates and their interactions on anabasine percentage in leaves and content (mg) per plant of *Nicotiana glauca* at 2003/ 2004 and 2004/ 2005 seasons.

Salinity concentration (ppm) (B)	Compost rates m^3/fad (A)									
	Control	4	8	12	Mean(A	Control	4	8	12	Mean(A
	2003 / 2004					2004 / 2005				
	Anabasine percentage									
Control	0.29	0.31	0.34	0.36	0.33	0.28	0.29	0.31	0.32	0.30
1500	0.33	0.37	0.38	0.39	0.37	0.33	0.35	0.36	0.39	0.36
3000	0.24	0.25	0.24	0.28	0.25	0.21	0.23	0.24	0.26	0.24
Mean (B)	0.29	0.31	0.32	0.34		0.27	0.29	0.30	0.32	
L.S.D. at 0.5% for	A=0.01 B= 0.01 AB=0.01					A= 0.03 B=0.04 AB=0.04				
	Anabasine content per plant (mg)									
Control	261.00	293.47	364.92	427.21	336.65	229.60	281.30	341.00	377.60	307.37
1500	360.78	495.80	613.05	678.60	537.05	366.30	476.00	601.73	690.30	533.58
3000	178.39	218.32	251.20	300.52	237.10	157.50	216.00	228.00	263.45	216.23
Mean (B)	264.53	326.52	398.20	453.32		251.13	324.43	390.24	443.7	
L.S.D. at 0.5% for	A= 24.77 B=19.48 AB=38.96					A=23.14 B= 20.13 AB= 40.2				

The data reported in Table (5) indicate that addition of compost to the soil resulted in significant increase in rutin percentage and content per plant. Increasing of compost level resulted in gradually increase in rutin percentage and content per plant. The highest values of rutin percentage (2.40 and 3.92%) and content per plant (3.20 and 3.43 g) were recorded with the highest compost rate (12 m^3/fad) during both seasons, respectively. In this regard, Stratton *et al.* (1995) results confirmed the benefits of compost application as a source of nutrients, particularly providing plants with sufficient nitrogen. It is well known that nitrogen represent the central atom in alkaloid molecule. The composted product offers both a source of organic matter and plant essential nutrient contents. The increment in plant nutrient contents reflects on carbohydrate synthesis which is the precursor of glycosides such as rutin.

Effect of interaction:

Concerning the interaction effect between different saline water irrigation levels and compost on alkaloids, anabasine and rutin percentages, it was found that the highest percentage values of alkaloids (0.74 and 0.69%), anabasine (0.39 and 0.39%) and rutin (2.40 and 2.74%) have been recorded when the moderate saline water irrigation level (1500 ppm) combined with the highest rate of compost (12 m^3/fad) during both seasons, respectively. Similar trend was recorded with alkaloids, anabasine and rutin contents during both seasons (Tables 3, 4 and 5).

Table 5 Effect of different saline water irrigation levels, compost rates and their interactions on rutin percentage in leaves and content (mg) per plant of *Nicotiana glauca* at 2003/ 2004 and 2004/ 2005 seasons.

Salinity concentration (ppm) (B)	Compost rates m^3/fad (A)									
	Control	4	8	12	Mean(A)	Control	4	8	12	Mean(A)
	2003 / 2004					2004 / 2005				
	Rutin									
Control	2.10	2.30	2.50	2.70	2.40	2.42	2.61	2.65	2.69	2.59
1500	2.50	2.60	2.30	2.40	2.45	2.58	2.69	2.71	2.74	2.68
3000	1.80	1.90	1.90	2.10	1.93	1.91	2.12	2.29	2.32	2.16
Mean (B)	2.13	2.27	2.23	2.40		2.30	2.47	2.55	3.92	
L.S.D. at 0.5% for	A=0.31 B= 0.07 AB=0.14					A= 0.08 B=0.07 AB=0.13				
	Rutin content									
Control	0	2.17	2.68	3.20	2.48	1.98	2.53	2.91	3.17	2.64
1500	2.73	3.48	3.71	4.17	3.52	2.86	3.65	4.57	4.84	3.98
3000	1.33	1.65	1.98	2.25	1.80	1.43	1.95	2.17	2.35	1.97
Mean (B)	1.98	2.43	2.79	3.20		2.09	2.71	3.21	3.45	
L.S.D. at 0.5% for	A= 0.04 B=0.05 AB=0.10					A=0.08 B= 0.09 AB= 0.19				

Chemical Constituents

Minerals concentrations:

Effect of salinity:

Data in Tables 6 and 7 shows that as the saline water irrigation level increased up to 1500 ppm the concentrations of N, P, K, Zn, Mn and Fe increased in the leaves. Similar results were reported by Khalil (2002) on rosemary. In the same time, increasing this level to 3000 ppm resulted in significant decrease in these concentrations compared with other treatments (600 and 1500 ppm) during both seasons. This depressive effect of high saline water irrigation level may be attributed not only to the osmotic inhibition of water absorption and ions toxicity but also to the disturbance of nutrient balances under such conditions. Furthermore, salinity condition may cause a general reduction in the enzymatic activity and photosynthesis processes in plant (Khalil *et al.*, 1976).

On the other hand, it was clear that Na, Ca, Mg and Cl concentrations have been gradually increased with increasing saline water irrigation level throughout the range examined during both seasons (Tables 8 and 9). This may be attributed to the gradually increase in concentrations of these minerals with increasing saline water irrigation level. The same conclusions were obtained by El-Feky (2004) on *Erythrina indica* and *Tecoma stans* plants.

Effect of compost:

Tables (6, 7, 8 and 9) show that nitrogen, phosphorus, potassium, zinc, manganese, iron, sodium, calcium, magnesium and chloride concentrations in the leaves were significantly increased as the compost rate increased. The highest concentrations of these minerals were obtained with the highest rate of compost ($12m^3$/fad). This result hold true during both seasons. The previous results are in agreement with those obtained by Shalaby *et al.* (2007) on pepper and Abd El Ghany (2007) on oregano plants. These increments in minerals percentages in plant leaves might be due to the compost microorganisms which have the ability to supply the growing plant with fixed elements and release phytohormones which could stimulate the growth and consequently increase the nutrient elements in plant tissue. In addition compost may play a favorable role in increasing nutrients availability in most soils, through the processes of chelating biochemical processes and production several organic acids during decomposition of organic manure.

Table 6: Effect of different saline water irrigation levels, compost rates and their interactions on nitrogen, phosphorus and potassium percentages in leaves of *Nicotiana glauca* plant at 2003/ 2004 and 2004/ 2005 seasons.

Salinity concentration (ppm) (B)	Compost rates m^3/fad (A)									
	Control	4	8	12	Mean(A)	Control	4	8	12	Mean(A)
	2003 / 2004					2004 / 2005				
	Nitrogen									
Control	2.60	2.90	3.10	3.20	2.95	2.70	2.90	3.10	3.20	2.98
1500	2.70	2.90	3.30	3.40	3.08	2.80	3.10	3.40	3.60	3.23
3000	2.17	2.30	2.70	2.80	2.49	1.90	2.30	2.40	2.60	2.30
Mean (B)	2.49	2.70	3.03	3.12		2.47	2.77	2.97	3.13	
L.S.D. at 0.5% for	A=0.05 B= 0.03 AB=0.06					A= 0.04 B=0.04 AB=0.09				
	Phosphorus									
Control	0.38	0.43	0.47	0.49	0.44	0.37	0.38	0.43	0.46	0.41
1500	0.43	0.51	0.56	0.57	0.52	0.39	0.45	0.52	0.55	0.48
3000	0.34	0.36	0.41	0.42	0.38	0.31	0.33	0.35	0.36	0.34
Mean (B)	0.38	0.43	0.48	0.49		0.36	0.39	0.43	0.46	
L.S.D. at 0.5% for	A= 0.00 B=0.00 AB=0.01					A=0.00 B= 0.00 AB= 0.00				
	Potassium									
Control	2.20	2.40	2.80	2.90	2.58	2.30	2.50	2.70	3.10	2.65
1500	2.60	3.10	3.30	3.60	3.15	2.80	3.20	3.40	3.70	3.28
3000	1.70	1.90	2.10	2.20	1.98	1.80	1.90	2.10	2.30	2.03
Mean (B)	2.17	2.47	2.73	2.90		2.30	2.53	2.73	3.03	
L.S.D. at 0.5% for	A= 0.03 B=0.03 AB=0.06					A=0.04 B= 0.08 AB= 0.17				

Effect of interaction:

Regarding the interaction effect between different saline water irrigation levels and compost rates on N, P, K Zn, Mn and Fe concentrations in plant leaves, data shown in Tables (6 and 7) clear that the treatment of 1500 ppm saline water irrigation combined with 12m^3/fed of compost gave the highest concentrations of these minerals in the first season (3.4%, 0.57%, 3.6%, 74 ppm, 62 ppm and 175 ppm) and second season (3.6%, 0.55%, 3.7%, 83 ppm, 69 ppm and 181 ppm), respectively. These results are in accordance with these found by Khalil (2002) on rosemary and El-Koony *et al.* (2004) on roselle.

Table 7: Effect of different saline water irrigation levels, compost rates and their interactions on zinc, manganese and iron concentrations (ppm) in leaves of *Nicotiana glauca* plant at 2003/ 2004 and 2004/ 2005 seasons.

Salinity concentration (ppm) (B)	Compost rates m^3/fad (A)									
	Control	4	8	12	Mean(A	Control	4	8	12	Mean(A
	2003 / 2004					2004 / 2005				
	Zinc									
Control	52	57	64	69	60.5	58	66	72	77	68.25
1500	63	71	73	74	70.25	74	78	81	83	79.00
3000	48	51	53	59	52.75	55	59	64	68	61.50
Mean (B)	54.33	59.67	63.33	67.33		56.1	67.67	72.33	76	
L.S.D. at 0.5% for	A=3.18 B= 4.62 AB=9.24					A= 9.21 B=7.31 AB=14.62				
	Manganese									
Control	46	48	52	58	51	49	54	57	62	55.50
1500	50	56	59	62	56.75	58	64	67	69	64.50
3000	42	45	47	49	45.75	44	47	48	55	48.50
Mean (B)	46	49.66	52.66	56.33		50.33	55	57.33	63	
L.S.D. at 0.5% for	A= 2.98 B=2.18 AB=4.36					A=4.09 B= 3.98 AB= 7.96				
	Iron									
Control	152	156	160	162	157.5	157	161	164	166	162
1500	167	169	172	175	170.7	171	174	178	181	176
3000	148	151	154	156	1152.2	152	154	158	160	156
Mean (B)	155.67	158.6	162	164.3		160	163	166.6	189	
L.S.D. at 0.5% for	A= 6.43 B=7.11 AB=14.22					A=8.24 B= 10.31 AB= 20.62				

On the contrary, the highest concentrations of Na (58 and 62%), Ca (2.4 and 2.43%), Mg (0.87 and 0.82%) and Cl (2.31 and 2.49%) in plant leaves have been recorded with the treatment of 3000 ppm saline water irrigation combined with 12 m^3/fad compost during both seasons, respectively.

Table 8: Effect of different saline water irrigation levels, compost rates and their interactions on sodium, calcium and magnesium percentages in leaves of *Nicotiana glauca* plant at 2003/ 2004 and 2004/ 2005 seasons.

Salinity concentration (ppm) (B)	Compost rates m^3/fad (A)									
	Control	4	8	12	Mean(A)	Control	4	8	12	Mean(A)
	2003 / 2004					2004 / 2005				
	Sodium									
Control	0.32	0.44	0.49	0.51	0.44	0.29	0.37	0.39	0.47	0.38
1500	0.42	0.53	0.55	0.56	0.52	0.41	0.49	0.54	0.57	0.50
3000	0.43	0.55	0.56	0.58	0.54	0.56	0.59	0.61	0.62	0.59
Mean (B)	0.39	0.51	0.53	0.55		0.42	0.48	0.51	0.55	
L.S.D. at 0.5% for	A=0.01	B= 0.01		AB=0.03		A= 0.01	B=0.02		AB=0.04	
	Calcium									
Control	0.90	1.40	1.50	2.00	1.45	1.11	1.39	1.62	1.83	1.49
1500	1.20	1.70	1.90	2.00	1.70	1.34	1.71	1.88	2.11	1.76
3000	1.90	1.90	2.10	2.40	2.08	1.91	2.14	2.21	2.43	2.17
Mean (B)	1.33	1.67	1.83	2.13		1.45	1.75	1.90	2.12	
L.S.D. at 0.5% for	A= 0.05	B=0.04		AB=0.09		A=0.08	B= 0.01		AB= 0.02	
	Magnesium									
Control	0.34	0.41	0.46	0.51	0.43	0.31	0.39	0.45	0.56	0.42
1500	0.45	0.58	0.66	0.71	0.60	0.43	0.52	0.59	0.69	0.56
3000	0.69	0.75	0.81	0.87	0.78	0.63	0.71	0.75	0.82	0.73
Mean (B)	0.49	0.58	0.64	0.70		0.46	0.54	0.60	0.68	
L.S.D. at 0.5% for	A= 0.10	B=0.05		AB=0.11		A=0.08	B= 0.02		AB= 0.04	

Total carbohydrate percentage:

Effect of salinity:

It appears from the data presented in Table (9) that increasing the saline water irrigation level from 600 ppm to 1500 ppm resulted in significant increase in total carbohydrate percentage in leaves, while increasing this level to 3000 ppm resulted in significant decrease in this percentage compared with other saline water irrigation treatments (600 and 1500 ppm) during both seasons. These results are in harmony with those reported by El-Feky (2004) on *Ertherina indicia* and *Tecoma stans* and Rezkalla (2006) on *Conocarpus erectus* plant.

Effect of compost:

Total carbohydrate percentage in leaves has been gradually increased with increasing applied compost rate (Table 9). The highest carbohydrate percentage (17.86 and 17.53%) was recorded with the highest compost rate (12 m^3/fad) during both seasons, respectively. These findings are in agreement with those obtained by Abd El-Salam (2007) on borage.

Effect of interaction:

As shown in Table (9) the maximum total carbohydrate percentages in leaves (18.6 and 18.3%) were recorded when the highest rate of compost (12 m^3/fad) combined with moderate level of saline water irrigation (1500 ppm) during both seasons, respectively. On the other hand the highest concentration of salinity (3000 ppm) without addition of compost recorded the lowest percentages (15.9 and 15.4%) during both seasons, respectively.

Table 9 Effect of different saline water irrigation levels, compost rates and their interactions on chloride and total carbohydrates percentages in leaves of *Nicotiana glauca* plant at 2003/ 2004 and 2004/ 2005 seasons.

Salinity concentration (ppm) (B)	Compost rates m^3/fad (A)									
	Control	4	8	12	Mean(A	Control	4	8	12	Mean(A
	2003 / 2004					2004 / 2005				
	Chloride									
Control	1.23	1.36	1.62	1.73	1.49	1.42	1.69	1.76	1.85	1.68
1500	1.59	1.81	1.92	2.26	1.89	1.74	1.89	1.99	2.07	1.92
3000	1.79	1.98	2.03	2.31	2.02	1.92	2.09	2.11	2.49	2.15
Mean (B)	1.54	1.72	1.86	2.10		1.69	1.89	1.95	2.14	
L.S.D. at 0.5% for	A= 0.189 B=0.165 AB=0.330					A=0.21 B= 0.18 AB= 0.36				
	Total carbohydrate									
Control	17.1	17.4	17.9	18.1	17.63	16.70	16.90	17.70	17.90	17.30
1500	17.6	18.2	18.5	18.6	18.23	16.60	16.80	18.10	18.30	17.45
3000	15.9	16.2	16.5	16.9	16.38	15.40	15.90	16.20	16.40	15.98
Mean (B)	16.87	17.2	17.6	17.8		16.23	16.53	17.33	17.53	
L.S.D. at 0.5% for	A= 0.33 B=0.17 AB=0.34					A=0.11 B= 0.28 AB= 0.56				

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دراسة بعض العوامل المؤثرة على النمو والمواد الفعالة في نبات المصاص:
١ – تأثير مستويات مختلفة من ملوحة ماء الري والكمبوست

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أجرى هذا البحث في مزرعة الشيخ زويد التابعة لمركز بحوث الصحراء بمحافظة شمال سيناء خلال عامي ٢٠٠٣/٢٠٠٤ ، ٢٠٠٤/٢٠٠٥ بهدف دراسة تأثير استخدام مستويات مختلفة من الكومبوست (صفر ، ٤، ٨ ، ١٢ م٣ / فدان) ، وملوحة مياه الري (٦٠٠، ١٥٠٠، ٣٠٠٠ جزء في المليون)، والتفاعل بينهما على النمو والمواد الفعالة والمحتوى الكيماوي لنبات المصاص. ولقد أشارت النتائج إلى أنه قد أمكن تسجيل أعلى محصول من المواد الفعالة (القلويدات، والأنابزين، الروتين) وأعلى قيم لصفات النمو الخضري (ارتفاع النبات، عدد الأفرع، الوزن الجاف للأوراق/ نبات، الوزن الجاف للنبات) ومحتوى النبات من العناصر المعدنية (نتروجين، فوسفور، بوتاسيوم، زنك، منجنيز، حديد) عند ري النباتات بماء مالح (١٥٠٠ جزء في المليون) مع إضافة الكومبوست للتربة عند تجهيزها للزراعة بمعدل ١٢م٣/ فدان.