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EFFECT OF SOIL SALINITY CYCOCEL GIBBERELIC ACID AND KINETIN ON GROWTH AND CHEMICAL COMPOSITION OF NEEM (*Azadirachta indica* L.) SEEDLINGS

BY

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ABSTRACT

This study was carried out during 2000 and 2001 seasons at king Abdelaziz Univ. Experimental Station in Wadi Hoda AL-Sham, Jeddah, Saudi Arabia to examine the effect of four soil salinity levels namely 0.0, 0.2, 0.4 and 0.8% of $NaCl + CaCl_2$ at 1:1 by weight as well as 25-100 GA_3, 5-20 ppm Kinetin and 500-2000 ppm CCC on growth and chemical composition of Neem plants (*Azadirachta indica* L).

There was a slight reduction on plant height, leaf area, dry weight of leaves/plant, number of laterals, length of the main roots, number of secondary roots dry weight of root/plant, chlorophyll a and b and carotenoids and leaf NPK with increasing soil salinity from 0.0 to 0.4%. These parameters were substantially depressed with raising soil salinity from 0.4 to 0.8%.

In most cases GA_3 kinetin and CCC was favorable in alleviating the adverse effects of salinity on growth criteria and chemical constituents of Neem plants.

These results suggested that Neem plants could tolerate 0.4% soil salinity without obvious adverse effects on growth and chemical composition of the leaves. Application of GA_3, kinetin and CCC under soil salinity higher than 0.4% was necessary for alleviatiny or counteract some of the harmfull effects imposed by salinity on effects imposed by salinity on different growth parameters and chemical constituents of the leaf.

INTRODUCTION

Neem tree has an outstanding was in our life such as firewood, excellent wood, seed oil, wind break splendid street tree soil improvement and industrial chemicals such as tannins and soaps. It is very important for using seeds and leaves as an insect repellent, since they contain azadirachtin It is grown well on all locations around the world. Neem as a woody tree is one of the most important natural sources allover the world. The increasing needs to woody trees nowadays for man uses facilitates the efforts for establishing other Neem plantations.

Soil salinity may affects the growth of ornamental plants in two ways: (1) Osmotic pressure of soil could be high enough to limit water availability for the plant roots (2) High concentrations of salts in soil solution could facilitate the uptake of the studied ions so that an accumulation could result and cause derangement of the normal metabolism. (Miller *et al.*, 1990) .

Salinity conditions are known to have different adverse and impaired effects on growth of bean plants (Starck and Karwowska 1978), *Dimorphatica ecklonis, Callistephus chinensis, Lantana Camara* and *Myoporum pictum* (EL-Mahrouk, 1980), Young ber (Mehta 1982), Thuya orientalis (Nofal *et al.*, 1983) Casurina species (Clemens *et al.*, 1983) and *Laucaena levcocephala* (Hansen and Munns 1984). Increasing soil salinity level upto 0.4% was very effective in reducing chemical constituents particularly leaf pigments, K% , P% and was responsible for enhancing by Ca, Na and Cl in the leaves as reported by Singh and Yadav (1985) on *Eucalyptus hybridat*, Omran (1986) on Eucalyptus species, Remison and Iremiren (1990) on Coconut, Shehata (1992) on *Cupressus sempervirens* and *Cupressus camaldulensis*, Ismail (1993) on *Adhatoda vasica, Nerium oleander* and *Lantana camara*, Mohamed (1993) on various ornamental shrubs and Younis *et al.*, (1993) on *Phaseolus vulgaris*.

On the other hand gibberellic acid was reported to induce considerable stimulation on most growth criteria of *Chrysanthemum frutescens* (Abou-Dahab, *et al.*, 1987). *Borago officinals* (Aly and Badran, 1988), *Chrysanthemum morifolium* Romt (Abdall-Nadia *et al.*, 1989), Luffa clindrica (Badran *et al.*, 1989), pot marigold (EL-Sayed, 1991 and Hassan *et al.*, 1991) and *Chrysanthemum morifolium* (Attia and Ahmed, 1997). The beneficial effect of GA_3 on stimulating growth could counteracted the adverse effects of soil salinity on it. Concerning the other growth regulator namely Cycocel CCC, it was found to reduce plant height of *Chrysanthemum* (Sachs and Kofranek, 1963, Fikry, 1983 and EL-Dessouki, 1988) and borago (Aly and Badran, 1988). In addition CCC at different concentrations was also effective in stimulating stem diameter branch number as well as fresh and dry weights of shoots of chrysanthemum (EL-Dessouki, 1988) and borag (Aly and Badran, 1988)-Abou-Zied and Bakry (1978) added that CCC was responsible for promoting fresh and dry weights of leaves of primula.

Kinetin not only promoted stem thickness, number of leaves per plant leaf area and fresh and dry weights of shoots but also it enhanced K uptake and inhibited Na in various ornamental plants (Miller, 1956), grapevines (Allam-Aida *et al.*, 1988), *Tagetes minula* (Abd-Alazeem, 1993) and Iris (Manoly, 1996). This trend of kinetin proved to be very effective in alleviating the growth and nutritional disturbance of sunflowers occurred under salt stress conditions (Ilan, 1971).

The role of GA_3, CCC and Kinetin in alleviating, modifying or contracting the adverse effects of salinity on growth and chemical constituents of different plant species was reported by Starck and Karwowska (1978) on *Pheseolus vulgaris*, Badran *et al.*, (1984) on *Tropaeolum majus*, EL-Nimr (1986) an some vegetable crops, Manoly (1989) on tuberose and Makary (1991) on chrysanthemum. Similarly, CCC was found to improve stem diameter and fresh and dry weight of shoots of datura (Dawh, 1982) and chrysanthemum (Fikry, 1983).

The present study is designed to investigate the ability of Neem plants to grow under different soil salinity levels and /or GA_3, CCC and Kinetin concentrations. Nutritional status of the plants in response to salinity and the three growth regulators was also studied.

MATERIAL AND METHODS

This study was carried out during 2000 and 2001 seasons at the Experimental Farm of king Abdulaziz Univ. at Hoda Al-Sham located 120 km north east of Jeddah, Saudia Arabia.

Uniform one year old seedling of Neem (*Azadirachta indica* L) wereplanted in 25 cm clay pots on the first week of April for both seasons (one seedling /pot). Each pot was filled with 4.0 kg of sandy soil Analysis of the tested soil (according to Piper (1950) are shown in Table (1).

Table (1): Some physical and chemical properties of the soil used

Particle size distribution (%):	
Sand %	96.0
Silt %	1.1
clay %	2.9
Texture	sandy
pH (1:2.5 extract)	8.02
E.C.(1:2.5 extract) mmhos/1cm 25°C	0.85
$CaCo_3$ %	5.0
O.M.%	0.123
Ion concentrations (meq 1^{-1}) (in saturated extract)	
HCO_3	3.20
CL^-	3.18
SO_4	1.70
Ca^{++}	3.40
Mg^{++}	0.50
Na^+	3.91
K^+	0.35
Total N%	0.01
Available P (ppm, Olsen)	16.5
Available K (ppm, ammonium acetate)	38.0

Soil was mixed with different levels of Nacl+$Cacl_2$ before planting four levels of soil salinity were used by mixing equal amounts of Nacl+$Cacl_2$ at the rate of 0.0, 0.2, 0.4 and 0.8% with the soil. The assigned amounts of both salts for each pot were throughly mixed with the soil before filling the pots. The plants were sprayed three times at two weeks intervals started at one month after planting with nine different growth reguletor treatment namely, GA_3 at 25,50 or 100 ppm, Kinetin at 5,10,or 20 ppm, or CCC at 500,1000 or 2000 ppm in addition to the control treatment which sprayed with tap water. The split plot design with four replicates was followed in this experiment where the four soil salinity levels assigned to the main plots and the ten growth regulator concentrations occupied the subplots. Therefore, the experiment included forty treatments, four replicates per each (three plants per replicate).

Fertilization was done for all Neem seedlings at the rate of 3 g ammonium nitrate (33.5%N), 3 g calcium superphosphate (15.5% P_2O_5) and 1.5 g potassium sulphate (48% K_2O) per pot. Fertilizers were added at four times starting two months from transplanting and every three weeks thereafter. All other agricultural practices were carried out as usual.

After six months from the start of the experiment the following data were registered.

1- Plant height (cm)
2- Stem diameter at base and at top (mm)
3- Number of leaves per plant
4- leaf area $(cm)^2$ according to Jain and Misra (1966)
5- Dry weight of leaves/plant (g)
6- Number of lateral shoots/plant
7- length of the main roots (cm)
8- Number of secondary roots
9- Dry weight of root system
10- Photosynthetic pigments namely chlorophyll a and b as well as carotenoids (mg/1 g fresh weight) using the method described by Moran (1982)
11- Percentages of N,P and K in the dry leaf according to Evenhuis (1978).

All the obtained data were tabulated and statistically analyzed according to Snedecor and Cochran (1972) using L.S.D. test.

RESULTS AND DISCUSSION

1- Effect of soil salinity, GA3, CCC and Kinetin on plant height and stem diameter at base and top:

It is clear from the data in Tables (2 & 3) that increasing soil salinity levels from 0.0 to 0.8% was followed by a gradual reduction on plant height and stem diameter at base and at top. Insignificant differences were observed in this connection when soil salinity was increased from 0.0 to 0.4%. Soil salinity caused by using 0.8% from NaCl + $CaCl_2$ resulted in significant reduction on such growth criteria compared to the other concentrations. These results were true in both seasons.

Table (2): Effect of soil salinity levels as well as concentrations of GA_3 kinetin and CCC on plant height and stem diameter at base of *Azadirachta indica* L. plants during 2000 and 2001 seasons.

Character growth regulator conc. (ppm.) (B)	Plant height (cm).									
	2000					2001				
	Soil salinity level (A)									
	0.0	0.2%	0.4%	0.8%	Mean (B)	0.0	0.2%	0.4%	0.8%	Mean (B)
Control 0.0	41.3	40.0	39.3	36.3	39.2	43.4	43.2	43.1	41.0	42.8
GA_3 at 25	44.5	44.0	43.7	40.0	43.1	46.7	46.7	46.6	44.5	46.1
GA_3 at 50	49.0	48.5	48.0	45.2	47.7	51.5	51.4	51.2	49.2	50.8
GA_3 at 100	49.3	49.0	48.3	46.0	48.2	51.6	51.5	51.4	50.0	51.1
Kinetin at 5	42.2	41.7	41.0	38.3	40.8	44.3	44.2	44.0	42.5	43.8
Kinetin at 10	43.0	42.5	42.0	39.1	41.7	45.2	45.2	45.1	43.9	44.9
Kinetin at 20	43.5	43.0	42.3	39.9	42.2	45.3	45.2	45.1	43.4	44.8
CCC at 500	38.0	36.0	36.0	33.3	35.8	39.9	39.9	39.8	38.0	39.4
CCC at 1000	36.1	36.0	36.0	33.8	35.5	38.0	38.0	37.8	36.0	37.5
CCC at 2000	36.1	36.0	36.0	33.0	35.3	37.9	38.0	37.6	35.9	37.4
Mean (A)	42.3	41.7	41.3	38.5		44.4	44.3	44.2	42.4	
LSD at 5 %	A 2.1		B 2.5		AB 5.0	A 1.3		B 1.2		AB 2.4
Character	Stem diameter at base (mm)									
Control 0.0	3.00	2.97	2.95	2.87	2.95	3.18	3.17	3.16	3.11	3.16
GA_3 at 25	2.90	2.89	2.88	2.80	2.88	3.07	3.06	3.06	3.00	3.05
GA_3 at 50	2.77	2.74	2.73	2.66	2.73	2.94	2.93	2.92	2.88	2.92
GA_3 at 100	2.75	2.72	2.71	2.63	2.70	2.92	2.91	2.91	2.86	2.90
Kinetin at 5	3.55	3.52	3.51	3.41	3.50	3.76	3.75	3.75	3.70	3.74
Kinetin at 10	3.75	3.74	3.71	3.64	3.71	3.98	3.98	3.98	3.92	3.97
Kinetin at 20	3.79	3.77	3.72	3.65	3.73	4.02	4.01	4.00	3.95	4.00
CCC at 500	3.33	3.31	3.30	3.24	3.30	3.53	3.52	3.51	3.46	3.51
CCC at 1000	3.41	3.40	3.38	3.30	3.37	3.61	3.60	3.60	3.54	3.59
CCC at 2000	3.42	3.41	3.39	3.33	3.39	3.62	3.61	3.60	3.52	3.59
Mean (A)	3.27	3.25	2.23	3.15		3.46	3.45	3.44	3.39	
LSD at 5 %	A 0.05		B 0.07		AB 0.14	A 0.04		B 0.03		AB 0.06

Such reduction on plant height and stem diameter due to salinity might be attributed to the inhibiting effect of salinity on cell division and cell elongation as well as collapsing the biosynthesis of organic foods (Nieman, 1962). These results were confirmed by Starck and Karwowska (1978) on bean plants, EL-Mahrouk (1980) on *Dimorphatica ecklonis, Callistephus chinensis, Lantana camara* and *Myoporum pictum* and Mehta (1982) on young ber.

Table (3): Effect of soil salinity levels as well as concentrations of GA_3 kinetin and CCC on stem diameter at top and number of leaves /plant of *Azadirachta indica* L. plants during 2000 and 2001 seasons.

Character growth regulator conc. (ppm) (B)	Stem diameter at top (mm)									
	2000					2001				
	Soil salinity level (A)									
	0.0	0.2%	0.4%	0.8%	Mean (B)	0.0	0.2%	0.4%	0.8%	Mean (B)
Control 0.0	2.61	2.60	2.58	2.50	2.57	2.74	2.72	2.71	2.66	2.71
GA_3 at 25	2.49	2.48	2.47	2.40	2.46	2.61	2.60	2.60	2.55	2.59
GA_3 at 50	2.41	2.40	2.39	2.31	2.37	2.53	2.52	2.51	2.55	2.52
GA_3 at 100	2.40	2.39	2.38	2.30	2.36	2.52	2.51	2.50	2.45	2.49
Kinetin at 5	3 .30	2.29	3.27	3.20	3.26	3.47	3.46	3.45	3.39	3.44
Kinetin at 10	3.41	3.40	3.39	3.30	3.37	3.58	3.57	3.55	3.49	3.54
Kinetin at 20	3.43	3.42	3.40	3.32	3.39	3.60	3.60	3.59	3.55	3.58
CCC at 500	2.92	2.91	2.89	2.80	2.38	3.07	3.06	3.05	3.00	3.04
CCC at 1000	2.99	2.98	2.96	2.89	2.95	3.14	3.12	3.11	3.05	3.11
CCC at 2000	3.04	3.02	3.01	3.00	3.01	3.19	3.18	3.17	3.11	3.16
Mean (A)	2.90	2.88	2.87	2.80		3.04	3.03	3.02	2.98	
LSD at 5 %	A 0.06		B 0.07		AB 0.14	A 0.05		B 0.03		AB 0.06
Character	Number of leaves /plant									
Control 0.0	9.0	9.0	9.0	9.0	9.0	10.3	10.2	10.0	7.5	9.5
GA_3 at 25	12.5	12.0	12.0	9.0	11.3	13.5	13.4	13.0	10.3	12.6
GA_3 at 50	15.0	14.5	14.0	12.0	13.9	16.6	16.5	16.3	14.1	15.9
GA_3 at 100	15.0	15.0	15.0	13.0	19.3	17.0	17.0	17.0	14.9	16.5
Kinetin at 5	10.0	10.0	10.0	8.0	9.5	10.3	10.2	10.0	7.8	9.6
Kinetin at 10	11.0	11.0	11.0	8.5	10.4	10.4	10.3	10.0	7.9	9.7
Kinetin at 20	11.0	11.0	11.0	8.3	10.3	10.6	10.5	10.3	8.0	9.8
CCC at 500	9.0	9.0	8.5	8.0	8.6	10.0	10.0	10.0	8.0	9.5
CCC at 1000	10.0	10.0	9.5	7.2	9.2	10.0	10.0	10.0	8.0	9.5
CCC at 2000	10.0	9.5	9.5	7.1	9.0	10.0	10.0	10.0	8.0	9.5
Mean (A)	11.3	11.1	11.0	9.0		11.9	11.8	11.7	9.5	
LSD at 5 %	A 2.0		B 3.0		AB 6.0	A 2.0		B 3.0		AB 6.0

In respect with the effect of GA_3, Kinetin and CCC, plant height was increased with using GA_3 at 25-100 ppm and kinetin at 5-20 ppm, while using CCC at 500-2000 was significantly responsible for reducing plant height. Spraying GA_3 was preferable than kinetin in improving plant height. The tallest plants were recorded due to spraying 100 ppm GA_3. Spraying 1000-2000 ppm CCC produced the shortest plants. In most cases, no significant effects were observed between using the higher two concentration of GA_3, Kinetin and CCC.

Data concerning the effect of the three growth regulators on stem diameter, clearly show that Kinetin and CCC treatments were favorable in increasing stem diameter than control treatment. The superiority of three growth regulations. on increasing stem diameter could be arranged as follows in ascending order, GA_3, CCC and Kinetin. A slight effect on such growth parameters was detected due to raising GA_3 concentrations from 50 to 100 ppm, CCC from 1000 to 2000 ppm and Kinetin from 10 to 20 ppm. Spraying kinetin at 10-20 ppm produced the thicker stems and the untreated plants had thinner stems. Spraying GA_3 at 25-100 ppm was responsible for reducing stem diameter than the other involved treatments.

The promoting effect of GA_3 and kinetin might be attributed to their recognized role in stimulating cell division and expansion, while the retarding effect of CCC on plant height might be due to the antagonism between CCC and endogenous promoters. The obtained results are in close agreement with those reported by Abou-Dahab *et al.*, (1987) on *Chrysanthemum frutescensis*, Aly and Badran (1988) on *Borago officinalis* and Adalla, Nadia *et al.*, (1989) on *Chrysanthemum morifolium*, with the findings of Abd-Alazeem (1993) on *Tagetes minata* and Manoly (1996) on Iris, in regard to kinetin and with the results of Sachs and Kofranek (1963), Fikry (1983) and EL-Dessouki (1988) on chrysanthemum plants in regard to CCC.

The interaction between soil salinity and the three growth regulators was significant in both seasons. It indicated that GA_3 at 25-100 ppm, Kinetin at 5-20 ppm and CCC at 500-2000 ppm were able to modify or counteract the depressive effects of soil salinity on plant height. However, Kinetin and CCC were proved to alleviate the reducing effect of salinity on stem diameter. The reverse action of these auxins and salinity on growth could explain the present results. These results are in harmony with those obtained by Badran *et al.*, (1984) on *Tropaeolum majus*, EL-Nimr (1986) on some vegetable crops and Makary (1991) on chrysanthemum.

2- Effect of soil salinity, GA_3. CCC and Kinetin on number of leaves per plant leaf area, dry weight of leaves and number of lateral shoots per plant.

Data in Tables (3 & 4 & 5) clearly show that there was a gradual reduction on the four growth aspects namely number of leaves per plant, leaf area, dry weight of leaves and number of laterals with increasing soil salinity from 0.0 to 0.8%. Raising soil salinity from 0.0 to 0.4% had meaningless reduction on the four growth criteria. A great and significant depression on these growth traits were observed due to salinizing the soil with 0.8 $NaCl+CaCl_2$ compared to the other salinity treatments. This means that Neem plants tolerated soil salinity with $NaCl+CaCl_2$ till 0.4% without any impaired effects on growth parameters. These results were true in both seasons.

The unfavorable effects of salinity on cell divisions, the biosynthesis of organic food, conductive tissues and the uptake of nutrients could explain the present findings. The adverse effects of salinity on growth traits were confirmed by the results of Nofal *et al.* (1983) on Casurina species and Hansen and Munus (1984) on *Laucaena levcocephala.*

Table (4): Effect of soil salinity levels as well as concentrations of GA_3 kinetin and CCC on leaf area and dry weight of leaves / plant of *Azadirachta indica* L. plants during 2000 and 2001 seasons.

Character growth regulator conc. (ppm) (B)	Leaf area /plant $(cm)^2$									
	2000					2001				
	Soil salinity level (A)									
	0.0	0.2%	0.4%	0.8%	Mean (B)	0.0	0.2%	0.4%	0.8%	Mean (B)
Control 0.0	30.0	30.0	29.3	27.3	29.2	32.3	32.0	31.9	29.9	31.5
GA_3 at 25	30.3	30.0	29.0	27.3	29.2	32.0	32.0	31.8	29.8	31.4
GA_3 at 50	30.0	30.0	30.0	28.3	29.6	32.0	32.0	31.8	29.8	31.4
GA_3 at 100	30.0	30.0	30.0	28.0	29.5	32.4	32.0	32.0	30.0	31.6
Kinetin at 5	40.0	39.9	39.0	39.0	39.2	49.0	48.3	48.0	46.3	47.9
Kinetin at 10	43.0	42.9	42.7	39.3	43.2	55.3	55.0	54.3	52.3	54.2
Kinetin at 20	43.8	43.7	43.6	42.5	43.4	55.6	55.6	55.3	52.3	54.7
CCC at 500	30.3	30.0	29.9	28.0	29.6	32.0	32.0	32.0	29.3	31.3
CCC at 1000	30.5	30.0	29.9	28.0	29.6	32.0	32.0	31.9	30.0	31.5
CCC at 2000	30.5	30.0	29.9	28.0	29.6	32.0	32.0	31.8	29.9	31.4
Mean (A)	33.8	33.7	33.3	28.7		38.5	38.3	38.1	36.0	
LSD at 5 %	A 1.0		B 0.9		AB 1.8	A 1.3		B 1.0		AB 2.0
Character	Dry weight of leaves / plant									
Control 0.0	8.5	8.4	8.3	7.4	8.2	8.9	8.8	8.7	7.9	8.6
GA_3 at 25	9.7	9.6	9.6	8.6	9.4	10.2	10.1	10.0	9.2	9.9
GA_3 at 50	10.8	10.8	10.7	9.8	10.5	11.3	11.2	11.1	10.3	11.0
GA_3 at 100	11.0	11.0	11.0	10.1	10.8	11.5	11.4	11.3	10.4	11.2
Kinetin at 5	11.5	11.4	11.3	10.4	11.2	12.1	12.0	12.0	11.3	11.9
Kinetin at 10	13.0	12.9	12.8	12.0	12.7	13.7	13.6	13.6	12.8	13.4
Kinetin at 20	13.3	13.2	13.2	12.4	13.0	13.9	13.8	13.7	12.8	13.6
CCC at 500	10.0	10.0	9.9	9.1	9.8	10.6	10.5	10.5	9.6	10.3
CCC at 1000	11.3	11.2	11.1	10.0	10.9	11.9	11.8	11.7	11.0	11.6
CCC at 2000	11.5	11.4	11.3	10.2	11.1	12.0	11.9	11.8	11.1	11.7
Mean	11.1	11.0	10.9	10.0		11.6	11.5	11.4	10.6	
LSD at 5 %	A 0.8		B 0.7		AB 1.4	A 0.7		B 0.6		AB 1.2

Result, further reveal that spraying CCC at 500-2000 ppm was responsible for increasing dry weight of leaves per plant and number of laterals per plant and had a sight effect on the number of leaves per plant and leaf area compared to the control treatment. Number of leaves per plant, dry weight of leaves per plant and number of laterals per plant tended significantly to promote with using GA_3 at 25-100 ppm. Leaf area did not alter significantly with GA_3 treatments. Spraying Kinetin at 5-20 ppm significantly improved the four growth parameter compared to the check treatment and the other growth substances.

Table (5): Effect of soil salinity levels as well as concentrations of GA_3 kinetin and CCC on number of lateral shoots / plant and length of the main roots of *Azadirachta indica* L. plants during 2000 and 2001 seasons.

Character Growth Regulator conc. (ppm) (B)	Number of lateral shoots / plant									
	2000					2001				
	Soil salinity level (A)									
	0.0	0.2%	0.4%	0.8%	Mean (B)	0.0	0.2%	0.4%	0.8%	Mean (B)
Control 0.0	1.00	1.00	0.99	0.8 0	0.94	1.09	1.08	1.07	0.89	1.03
GA_3 at 25	1.31	1.30	1.30	1.12	1.25	1.50	1.50	1.49	1.30	1.45
GA_3 at 50	1.51	1.50	1.50	1.33	1.46	1.66	1.65	1.63	1.44	1.60
GA_3 at 100	1.53	1.52	1.51	1.34	1.47	1.70	1.70	1.69	1.50	1.65
Kinetin at 5	1.57	1.57	1.57	1.41	1.53	1.81	1.80	1.80	1.62	1.76
Kinetin at 10	1.77	1.76	1.75	1.59	1.71	1.95	1.94	1.93	1.75	1.89
Kinetin at 20	1.74	1.78	1.78	1.63	1.74	1.96	1.95	1.94	1.76	1.90
CCC at 500	1.89	1.88	1.87	1.72	1.84	1.96	1.96	1.95	1.77	1.91
CCC at 1000	2.52	2.50	2.50	1.34	2.21	2.56	2.55	2.53	2.35	2.50
CCC at 2000	2.53	1.52	1.51	1.35	1.72	2.59	2.57	2.54	2.36	2.52
Mean (A)	1.74	1.63	1.63	1.36		1.89	1.87	1.86	1.67	
LSD at 5 %	A 0.15		B 0.13		AB 0.26	A 0.18		B 0.13		AB 0.26
Character	Length of the main roots (cm)									
Control 0.0	20.3	20.2	20.1	18.3	19.7	21.2	21.1	21.0	19.9	20.8
GA_3 at 25	22.3	22.2	22.1	20.8	21.9	24.3	24.2	24.1	23.0	23.9
GA_3 at 50	25.0	24.8	24.7	23.2	24.4	25.8	25.7	25.6	24.3	25.4
GA_3 at 100	25.3	25.1	25.0	23.6	24.8	26.0	25.8	25.7	26.4	26.0
Kinetin at 5	21.5	21.5	21.3	19.8	21.0	22.4	22.3	22.2	21.0	22.0
Kinetin at 10	21.7	21.6	21.4	19.9	21.2	22.8	22.7	22.6	21.0	22.3
Kinetin at 20	21.9	21.8	21.7	20.4	21.5	22.9	22.8	22.7	21.5	22.5
CCC at 500	21.9	21.9	21.8	20.2	21.5	22.6	22.5	22.4	21.3	22.2
CCC at 1000	23.8	23.8	32.7	22.3	23.4	24.0	23.8	23.7	22.5	23.5
CCC at 2000	24.0	23.9	32.8	22.4	23.5	24.2	24.2	24.1	22.9	23.85
Mean (A)	22.8	22.7	22.6	21.1		23.6	23.5	23.4	22.4	
LSD at 5 %	A 1.3		B 1.0		AB 2.0	A 0.8		B 0.9		AB 1.8

The promoting effect of GA_3 and Kintetin could be attributed primarily to their simulative effect on cell division and expansion. The effect of GA_3 was supported by the results of EL-Sayed (1991) and Hassan *et al.* (1991) on pot marigold, Abd-Alazeem (1993) on *Tagetes minuta* and Manoly (1996) on Iris who mentioned that Kinetin was favorable for increasing number of leaves, leaf area and dry weight of leaves. Results regarding the effect of CCC were confirmed by the results of Abou-Zied and Bakry (1978) on primula, Fikry (1983) on chrysanthemum and Aly and Badran (1988) on *Borago officinalis.*

Under soil salinity conditions, spraying Neem plants with GA_3, CCC or Kinetin was very necessary for avoiding the adverse effects of soil salinity on growth. Values of growth criteria were enhanced significantly in plants under salinity stress and subjected to spray CCC, GA_3 and Kinetin compared to soil salinity without the addition of them. These results were nearly the same in both seasons.

The synergistic influence of salinity and growth regulators was emphasized by the results of Dawh (1982) on datura; Badran *et al.*, (1984) on *Tropaeolum majus*, Manoly (1989) on tuberose and Makary (1991) on chrysanthemum.

3- Effect of soil salinity, GA_3, CCC and Kinetin on length of the main roots, number of secondary roots and dry weight of roots per plant.

Data in Tables (5&6) clearly show that increasing soil salinity was followed by a gradual reduction on root characters namely the length of main shoots, number of secondary roots and dry weight of roots per plant of Neem plants. The reduction was insignificant till soil salinity reached 0.4% then become highly significant. The minimum values were recorded on medium salinized with $NaCl+CaCl_2$ at 0.8%. These results clarified that Neem plants tolerated soil salinity till 0.4% in $NaCl+CaCl_2$ form Nearly similar results were obtained in both seasons.

The adverse effects of soil salinity on aerial parts of Neem plants leads to reduce the biosyntheses and translocation of carbohydrates and other organic foods to roots. These results are agreement with those obtained by Mehta (1982) on Young ber., Nofal *et al.* (1983) on *Thuya orientalis* and Ismail (1993) on *Adhatoda Vasica, Nerium Oleander* and *Lantana Camara.*

Data concerning the effect of GA_3, Kinetin and CCC on root parameters clearly show that spraying GA_3 at 25-100 ppm Kinetin at 5-20 ppm and CCC at 500-2000 ppm was very effective in increasing length of the main roots number of secondary roots and dry weight of roots per plant compared to the control treatment. The promotion on root criteria was associated with increasing concentrations of GA_3, Kinetin, and CCC. Significant differences between all treatments except between using the plant growth regulator. Spraying GA_3, CCC and Kinetin in descending order materially promoted such root parameters in both seasons. Similar results were obtained.

These results could be attributed to the positive action of GA_3, Kinetin and CCC on stimulating fresh and dry weights of aerial parts in favour of amending the roots with their requirements from carbohydrates.

These results regarding the effect of GA_3 were supported by Badran *et al.* (1989) on *Luffa clindrica* and EL-Sayed (1991) and Hassan *et al.* (1991) on pot marigold. The improving effect of Kinetin on root characters was confirmed by Abd-Alazeem (1993) on *Tagetes minuta* and Manoly (1996) on Iris plants. The results of Sachs and Kofranek (1963), Fikry (1983) and EL-Dessouki (1988) on *Chrysanthemum confirmed* the benefits of using CCC on roots.

Table (6): Effect of soil salinity levels as well as concentrations of GA_3 kinetin and CCC on number of secondary roots and dry weight of root system of *Azadirachta indica* L. plants during 2000 and 2001 seasons.

Character growth regulator conc. (ppm) (B)	Number of secondary roots									
	2000					2001				
	Soil salinity level (A)									
	0.0	0.2%	0.4%	0.8%	Mean (B)	0.0	0.2%	0.4%	0.8%	Mean (B)
Control 0.0	3.11	3.10	3.09	2.92	3.05	3.27	3.25	3.22	3.05	3.19
GA_3 at 25	4.11	4.10	4.10	3.92	4.05	4.32	4.32	4.30	4.04	4.24
GA_3 at 50	4.32	4.32	4.32	4.10	4.26	4.54	4.53	4.52	4.32	4.47
GA_3 at 100	4.35	4.34	4.33	4.12	4.28	4.57	4.56	4.55	4.39	4.51
Kinetin at 5	3.41	3.40	3.40	3.20	3.35	3.58	3.58	3.57	3.37	3.52
Kinetin at 10	3.63	3.60	3.59	3.39	3.55	3.81	3.81	3.80	3.64	3.76
Kinetin at 20	3.64	3.63	3.63	3.41	3.57	3.82	3.80	3.79	3.61	3.75
CCC at 500	3.61	3.61	3.60	3.39	3.55	3.79	3.77	3.75	3.58	3.72
CCC at 1000	3.80	3.80	3.79	3.57	3.74	3.99	3.99	3.98	3.81	3.94
CCC at 2000	3.81	3.81	3.80	3.60	3.75	4.00	3.98	3.96	3.80	3.93
Mean (A)	3.77	3.77	3.76	3.56		3.96	3.95	3.94	3.76	
LSD at 5 %	A 0.23		B 0.15		AB 0.30	A 0.25		B 0.14		AB 0.28
Character	Dry weight of root system (g)									
Control 0.0	1.41	1.40	1.40	1.29	1.37	1.48	1.47	1.47	1.34	1.44
GA_3 at 25	1.84	1.83	1.82	1.71	1.80	1.93	1.92	1.41	1.77	1.88
GA_3 at 50	1.92	1.92	1.92	1.80	1.89	2.02	2.00	2.00	1.87	1.97
GA_3 at 100	1.93	1.93	1.92	1.81	1.89	2.03	2.02	2.01	1.85	1.97
Kinetin at 5	1.52	1.52	1.51	1.35	1.47	1.60	1.59	1.58	1.45	1.55
Kinetin at 10	1.63	1.63	1.63	1.51	1.60	1.72	1.72	1.72	1.56	1.68
Kinetin at 20	1.63	1.62	1.62	1.51	1.59	1.73	1.72	1.71	1.57	1.68
CCC at 500	1.62	1.60	1.60	1.48	1.57	1.70	1.70	1.69	1.55	1.66
CCC at 1000	1.71	1.70	1.69	1.67	1.69	1.80	1.80	1.78	1.65	1.75
CCC at 2000	1.72	1.71	1.70	1.58	1.67	1.82	1.82	1.81	1.69	1.78
Mean (A)	1.69	1.68	1.68	1.57		1.93	1.77	1.76	1.63	
LSD at 5 %	A 0.11		B 0.09		AB 0.18	A 0.12		B 0.06		AB 0.16

The interactions between soil salinity and the three growth regulators caused an announced effect on root parameter. Results showed that values of length of the main roots, number of secondary roots and dry weight of roots per plant in salinized media and in untreated plants with GA_3, Kinetin and CCC significantly reduced compared to salinity conditions. Using GA_3 at 25-100 ppm Kinetin at 5-20 ppm to plants under salinity conditions considerably counteracted the adverse effects of soil salinity on growth of roots. These results were true in both seasons.

The effects of GA_3 , Kinetin and CCC on conflicting the unfavorable effects of salinity could explain the present results. The merits of using GA_3 , Kinetin and CCC to plants under soil salinity was supported by the results of Ilan (1971) on sunflower, Dawh(1982) on datura, Badran *et al.* (1984) on *Tropaeolum majus* and Manoly (1989) on tuberose.

4- Effect of soil salinity, GA_3 , CCC and Kinetin on leaf pigments:

It is clear from the data in Tables (7&8) that there was a gradual reduction on chlorophyll a and b and carotenoids in the leaves with increasing soil salinity from 0.0 to 0.8%. Insignificant reduction was observed as salinity levels increased from 0.0 to 0.4%. However, significant reduction was observed when soil salinity levels increased from 0.4 to 0.8% Concentration of 0.8% soil salinity caused the minimum values. These results were true in both seasons.

The reducing effect of soil salinity on chlorophyll a and b and carotenoids could be attributed to its effect in interrupting meristematic activity, chloroplastids structure, plastids and reducing Mg uptake (Miller *et al.*, 1990). The obtained results go in the same line with those of Omran (1986) on Eucalyptus species, Remison and Iremiren (1990) on coconut and Mohamed. (1993) on *Ornomental shrubs*.

Data concerning the effect of GA_3 , Kinetin and CCC on leaf pigments clearly reveal that spraying Neem plants with GA_3 at 25-100 ppm, CCC at 500-200 ppm, Kinetin at 5-20 ppm, in descending order was responsible for enhancing chlorophyll a and b as well as carotenids in the leaves compared to untreated plants. The promotion was associated with increasing their concentrations. Meaningless increase was detected between the higher two concentration of each plant growth regulator in most cases. The maximum values were recorded on Neem plants received 50-100 ppm GA_3 . Similar results were obtained in both seasons.

The important role of plant growth regulators on forming healthy tissues particularly chloroplastids and meristematic tissues (Van-Overbeek, 1959) could explain the present results. These results are in agreement with those obtained by EL-Sayed (1991) and Hassan *et al.*, (1991) on pot marigold and Attia and Ahmed (1997) on *Chrysanthemum morfolium* in regard to GA_3, Abd-Alazeem (1993) on *Tagetes minuta* and Manoly (1996) on Iris in regard to Kinetin and Aly and Badran (1988) on *Borago afficinalis* and EL-Dessouki (1988) on Chrysanthemum in regard to CCC.

The interaction between soil salinity and the studied three growth regulators on leaf pigments was significant in both seasons. Combined application of GA_3, Kinetin or CCC with soil salinity was accompanied with enhancing the three leaf pigments compared to plants under soil salinity conditions only. These results emphasized the alleviating effect of using GA_3, Kinetin or CCC on adverse effects of soil salinity on chemical constituents of Neem plants since values of chlorophyll a and b caroteniods were higher in plants under saline conditions and received these auxins and did not receive any of them. These results were suppported by Manoly (1989) on tuberose and Makary (1991) on chrysanthemum.

Table (7): Effect of soil salinity levels as well as concentrations of GA_3 kinetin and CCC on chlorophyll a and b of *Azadirachta indica* L. plants during 2000 and 2001 seasons.

Character growth regulator conc. (ppm) (B)	Chlorophyll a content (mg / g fresh weight)									
	2000					2001				
	Soil salinity level (A)									
	0.0	0.2%	0.4%	0.8%	Mean (B)	0.0	0.2%	0.4%	0.8%	Mean (B)
Control 0.0	2.01	2.00	1.99	1.71	1.93	2.11	2.08	2.07	1.88	2.04
GA_3 at 25	2.45	2.44	2.41	2.11	2.35	2.57	2.56	2.55	2.27	2.49
GA_3 at 50	3.15	2.13	2.12	1.89	2.32	3.31	2.30	2.29	2.10	2.50
GA_3 at 100	3.17	3.17	3.17	2.94	3.11	3.33	3.33	2.32	3.14	3.28
Kinetin at 5	2.22	2.21	2.21	1.98	2.16	2.33	2.31	2.30	2.11	2.26
Kinetin at 10	2.42	2.40	2.40	2.15	2.34	2.54	2.53	2.52	2.34	2.48
Kinetin at 20	2.43	2.42	2.41	2.18	2.36	2.55	2.54	2.53	2.35	2.49
CCC at 500	2.43	2.43	2.42	2.18	2.37	2.55	2.55	2.55	2.36	2.50
CCC at 1000	2.62	2.61	2.60	2.38	2.55	2.75	2.74	2.73	2.54	2.69
CCC at 2000	2.63	2.60	2.60	2.39	2.56	2.78	2.75	2.74	2.55	2.71
Mean (A)	2.55	2.44	2.43	2.19		2.68	2.57	2.56	2.36	
LSD at 5 %	A 0.22		B 0.18		AB 0.36	A 0.20		B 0.18		AB 0.36
Character	Chlorophyll b content (mg / g fresh weight)									
Control 0.0	0.603	0.602	0.600	0.568	0.593	0.633	0.632	0.631	0.602	0.625
GA_3 at 25	0.736	0.733	0.732	0.704	0.726	0.773	0.772	0.771	0.733	
GA_3 at 50	0.445	0.444	0.443	0.915	0.937	0.992	0.991	0.991	0.950	0.762
GA_3 at 100	0.950	0.448	0.948	0.918	0.941	0.998	0.997	0.996	0.955	0.981
Kinetin at 5	0.668	0.668	0.667	0.632	0.659	0.701	0.700	0.698	0.669	0.987
Kinetin at 10	0.726	0.725	0.724	0.691	0.717	0.762	0.761	0.760	0.731	0.692
Kinetin at 20	0.725	0.723	0.722	0.692	0.716	0.761	0.760	0.759	0.728	0.753
CCC at 500	0.723	0.722	0.721	0.685	0.713	0.752	0.751	0.750	0.711	0.752
CCC at 1000	0.785	0.784	0.783	0.750	0.776	0.824	0.823	0.823	0.790	0.741
CCC at 2000	0.787	0.785	0.783	0.751	0.777	0.826	0.825	0.825	0.794	0.815
Mean (A)	0.765	0.763	0.762	0.731		0.802	0.801	0.800	0.766	
LSD at 5 %	A 0.030		B 0.029		AB 0.058	A 0.030		B 0.028		AB 0.056

Table (8): Effect of soil salinity levels as well as concentrations of GA_3 kinetin and CCC on caratonoids content and leaf N % of *Azadirachta indica* L. plants during 2000 and 2001 seasons.

Character growth regulator conc. (ppm) (B)	Caratonoids content (mg / g fresh weight)									
	2000					2001				
	Soil salinity level (A)									
	0.0	0.2%	0.4%	0.8%	Mean (B)	0.0	0.2%	0.4%	0.8%	Mean (B)
Control 0.0	1.21	1.20	1.19	1.04	1.16	1.31	1.30	1.30	1.19	1.28
GA_3 at 25	1.81	1.80	1.80	1.66	1.77	1.95	1.43	1.42	1.80	1.90
GA_3 at 50	1.94	1.93	1.93	1.80	1.90	2.03	2.02	2.01	1.90	1.99
GA_3 at 100	1.95	1.95	1.94	1.80	1.90	2.06	2.06	2.05	1.94	2.03
Kinetin at 5	1.36	1.35	1.34	1.19	1.31	1.47	1.46	1.45	1.33	1.43
Kinetin at 10	1.48	1.47	1.45	1.30	1.43	1.61	1.60	1.59	1.49	1.57
Kinetin at 20	1.49	1.49	1.48	1.35	1.45	1.62	1.62	1.61	1.50	1.59
CCC at 500	1.50	1.49	1.36	1.22	1.39	1.62	1.60	1.60	1.49	1.58
CCC at 1000	1.62	1.60	1.60	1.45	1.57	1.75	1.74	1.73	1.60	1.71
CCC at 2000	1.63	1.62	1.61	1.46	1.58	1.77	1.75	1.75	1.62	1.72
Mean (A)	1.60	1.59	1.57	1.37		1.72	1.71	1.70	1.59	
LSD at 5 %	A 0.13		B 0.11		AB 0.22	A 0.10		B 0.09		AB 0.18
Character	Leaf N %									
Control 0.0	2.66	2.65	2.64	2.30	2.56	2.87	2.86	2.85	2.64	2.81
GA_3 at 25	2.40	2.40	2.39	2.19	2.35	5.59	2.57	2.55	2.35	2.52
GA_3 at 50	2.10	2.08	2.05	1.70	1.98	2.27	2.26	2.25	2.06	2.21
GA_3 at 100	2.09	2.07	2.04	1.66	1.97	2.27	2.26	2.25	2.07	2.21
Kinetin at 5	2.90	2.90	2.90	2.60	2.83	3.13	3.11	3.10	2.88	3.06
Kinetin at 10	3.15	3.14	3.12	2.88	3.07	3.41	3.40	3.39	3.16	3.34
Kinetin at 20	3.16	3.15	3.15	2.90	3.09	3.43	3.40	3.40	3.20	3.36
CCC at 500	3.11	3.10	3.09	2.80	3.03	3.36	3.33	3.31	3.11	3.28
CCC at 1000	3.40	3.40	3.40	3.09	3.32	3.67	3.67	3.65	3.45	3.61
CCC at 2000	3.41	3.41	3.40	3.10	3.33	3.68	3.68	3.66	3.46	3.62
Mean (A)	2.84	2.83	2.82	2.52		3.07	2.05	3.04	2.84	
LSD at 5 %	A 0.22		B 0.18		AB 0.36	A 0.18		B 0.16		AB 0.32

5- Effect of soil salinity, GA_3, CCC and Kinetin on percentages of N,P and K in the leaf.

Percentages of N,P and K in the leaf of Neem plants gradually reduced with increasing soil salinity from 0.0 to 0.8%. Meaningless and insignificant reduction on these nutrients was observed due to raising salinity levels from 0.0 to 0.4% Significant reduction on these nutrients was recorded due to raising soil salinity from 0.4 to 0.8%. Soil salinity at 0.8% caused maximum reduction on N,P and K in the leaves.

The interrupting effect of salinity on uptake of N,P and K could be due to the disturbance on balance between nutrients in the soil and the increase in the osmotic pressure of soil solution which lowered the movement of water and solvents from roots via aerial parts (Miller *et al.* (1990). Besides, the reducing effect of salinity on the activity of xylem tissues which in turn reduces the absorption and translocation of nutrients towards vegetative organs can give another interpretation for the inhibiting effect of salinity on N,P and K uptake (Miller *et al.*, 1990). These results are in harmony with those obtained by Omran (1986) on Eucalyptus species,Remison and Iremiren (1990) on coconut and Shehata (1992) on *Cupressus sempervirens* and *Cupressus camaldulensis*.

Table (9): Effect of soil salinity levels as well as concentrations of GA_3 kinetin and CCC on percentages of P and K in the leaves of *Azadirachta indica* L. plants during 2000 and 2001 seasons.

Character growth regulator conc. (ppm) (B)	Leaf P %									
	2000					2001				
	Soil salinity level (A)									
	0.0	0.2%	0.4%	0.8%	Mean (B)	0.0	0.2%	0.4%	0.8%	Mean (B)
Control 0.0	0.20	0.20	0.18	0.14	0.18	0.22	0.22	0.21	0.16	0.20
GA_3 at 25	0.18	0.17	0.16	0.13	0.16	0.19	0.18	0.17	0.13	0.16
GA_3 at 50	0.16	0.16	0.16	0.13	0.15	0.17	0.16	0.15	0.11	0.14
GA_3 at 100	0.15	0.15	0.14	0.11	0.13	0.16	0.15	0.14	0.10	0.13
Kinetin at 5	0.23	0.22	0.22	0.18	0.21	0.25	0.25	0.24	0.19	0.23
Kinetin at 10	0.26	0.25	0.25	0.21	0.24	0.28	0.27	0.27	0.23	0.26
Kinetin at 20	0.27	0.26	0.25	0.21	0.24	0.29	0.28	0.27	0.23	0.26
CCC at 500	0.28	0.27	0.27	0.24	0.26	0.30	0.30	0.29	0.23	0.28
CCC at 1000	0.31	0.30	0.30	0.26	0.29	0.35	0.35	0.34	0.29	0.33
CCC at 2000	0.31	0.30	0.30	0.26	0.29	0.35	0.35	0.33	0.29	0.33
Mean (A)	0.23	0.22	0.22	0.18		0.25	0.25	0.24	0.21	
LSD at 5 %	A 0.03		B 0.02		AB 0.04	A 0.03		B 0.03		AB 0.10
Character	Leaf K %									
Control 0.0	2.50	2.50	2.44	2.28	2.44	2.71	2.70	2.70	2.50	2.65
GA_3 at 25	2.35	2.35	2.33	2.13	2.29	2.54	2.53	2.52	2.33	2.48
GA_3 at 50	2.30	2.30	2.29	2.09	2.24	2.48	2.46	2.46	2.26	2.41
GA_3 at 100	2.29	2.27	2.26	2.06	2.22	2.47	2.46	2.46	2.26	2.41
Kinetin at 5	2.63	2.62	2.61	2.41	2.56	2.84	2.83	2.82	2.26	2.77
Kinetin at 10	2.79	2.78	2.77	2.57	2.72	3.01	3.00	2.99	2.63	2.91
Kinetin at 20	2.80	2.80	2.77	2.37	2.68	3.02	3.00	2.98	2.64	2.91
CCC at 500	2.80	2.79	2.79	2.59	2.75	3.02	3.00	2.96	2.74	2.93
CCC at 1000	2.93	2.92	2.91	2.70	2.86	3.17	3.16	3.15	2.95	3.10
CCC at 2000	2.94	2.93	2.92	2.71	2.87	3.18	3.17	3.16	2.96	3.11
Mean (A)	2.63	2.62	2.61	2.39		2.84	2.83	2.82	2.58	
LSD at 5 %	A 0.19		B 0.12		AB 0.24	A 0.18		B 0.10		AB 0.20

Spraying CCC at 500-2000 ppm, Kinetin at 5-20 ppm. significantly was responsible for improving the percentages of N,P and K in the leaves compared to check treatment. Spraying CCC and Kinetin, in decreasing order was favorable in enhancing the three nutrients.

Spraying GA_3, at 25-100 ppm significantly reduced the leaf content of N,P and K compared to the other treatments.

The promotion on nutritional status of the Neem plants was associated with increasing their concentration. Significant differences were observed between most auxin treatments except between using the higher two concentrations of each auxin.

In harmony with the present results those obtained by EL-Sayed (1991) and Hassan *et al.* (1991) on pot marigold, in regard to GA_3, and those for Abd-Alazeem (1993) on *Tagetes minula* and Manoly (1996) on Iris, concerning Kinetin and Singh and Rajput (1985) an bean vegetable and Aly and Badran (1988) on *Borago officinalis* in regard to CCC.

Application of CCC and Kinetin to plants grown under salinity conditions was beneficial for counteracting the adverse effects of salinity on uptake of N,P and K. It is necessary for alleviating the adverse effects of soil salinity on uptake of nutrients by using CCC at 1000-2000 ppm or Kinetin at 10-20 ppm. These results were reported by Manoly (1989) on tuberose and Makary (1991) on Chrysanthemum.

It could be concluded from the previous results that Neem plants withstand soil salinity levels till 0.4%, since growth and chemical constituents of the plants at such levels did not alter negetively A trond of modifying, alleviating or , ounteracting the impaired or injurious of salinity on growth the use of 25 ppm GA_3, 1000 ppm CCC or 10 ppm Kinetin could be clearly noticed.

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تأثير ملوحة التربة ، السيكوسيل ، حامض الجبريليك والكينتين على النمو والتركيب الكيماوى لشتلات النيم

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– أجريت هذه الدراسة خلال موسمى ٢٠٠٠ ، ٢٠٠١ بمحطة الأبحاث الزراعية بجامعة الملك عبد العزيز بهدى الشام – جدة المملكة العربية السعودية وذلك لأختبار تأثير أربعة مستويات من ملوحة التربة وهى صفر –٠,٢ – ٠,٤ – ٠,٨ % المخلوط من كلوريد الصوديوم وكلوريد الكالسيوم بنسبة ١:١ بالوزن وكذلك حامض الجبريليك بتركيز ٢٥–١٠٠ جزء فى المليون ، والكينتين بتركيز ٥–٢٠ جزء فى المليون والسيكوسيل بتركيز ٥٠٠–٢٠٠٠ جزء فى المليون على النمو والتركيب الكيماوى لنباتات النيم

– لوحظ ان هناك نقص طفيف فى ارتفاع النبات ، سمك الساق ، عدد الأوراق للنبات، مساحة الورقة ، الوزن الجاف لأوراق النبات ، عدد الأفرع الجانبية ، طول الجذور الرئيسية ، عدد الجذور الثانوية ، الوزن الجاف للجذور للنبات الواحد ، كلورفيلى أ ، كلورفيل ب ، الكاروتينات فى الأوراق ومحتوى الأوراق من النيتروجين والفوسفور والبوتاسيوم عند زيادة مستوى الملوحة فى التربة من صفر الى ٠,٤% بينما حدث نقص كبير فى هذه المقاييس عند زيادة معدل ملوحة التربة من ٠,٤% الى ٠,٨% فى معظم الحالات كان استخدام حامض الجبريليك ، الكينتين ، السيكوسيل مفيداً فى تخفيف وتقليل حدة الآثار الغير مرغوبه لملوحة التربة على صفات النمو والتركيب الكيماوى لنباتات النيم.

وتؤكد نتائج هذه الدراسة بأن نباتات النيم يمكن أن تتحمل ملوحة التربة حتى ٠,٤% بدون أضرار واضحة على النمو والتركيب الكيماوى للشتلات كما ان الدراسة تؤكد أهمية استخدام حامض الجبريليك والكينتين والسيكوسيل تحت ظروف ملوحة التربة التى تزيد عن ٠,٤% وذلك لتقليل حدة التأثيرات الغير مرغوبة للملوحة على النمو والتركيب الكيماوى.

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