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RESPONSE OF SOME WOODY TREE SEEDLINGS TO SEWAGE SLUDGE TREATMENTS IN SANDY SOIL

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ABSTRACT

The present work was conducted for two successive seasons (2004 and 2005) to determine the influence of sewage sludge at concentrations of 0, 3, 6, 9 and 12 % (w/w) on growth and chemical constituents of the seedlings of three tree species namely: *Albizzia lebbek*, Linn., *Taxodium distichum*(L)Rich. and *Machaerium tipu*, Benth. grown in sandy soil, as well as, some elements content in the treated soils.

Obtained results showed that in general, application of sewage sludge at 9 and / or 12 % led to some increments in stem length, stem diameter, fresh and dry weights of leaves and stem, N, P, K % in leaves, Pb content in leaves and soils, as well as N, P and K content in soils. Moreover, stem length, stem diameter, as well percentages of phosphorus and potassium in *Taxodium* leaf tree responded to sewage sludge at 9 and / or 12 % concentrations than other trees. Meanwhile, leaves fresh and dry weights of *Albizzia* tree also responded to these treatments (9 and / or 12 %) than the other ones, also K and Pb contents in soils accumulated more and Pb content in the leaves was more absorbed than other trees at 9 and / or 12 % sewage sludge concentrations. N % in soils by *Macharium* seedling accumulated more at 9 and / or 12 % sewage sludge concentration than other seedlings. Stem fresh and dry weights of *Taxodium* and *Machaerium* seedlings in the first

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and the second seasons, respectively responded to 9 and / or 12 % sewage sludge and more N % absorbed in leaves, and accumulated more in soils than with *Albizzia* tree seedlings.

INTRODUCTION

Albizzia lebbek is strong elastic tree belongs to Family leguminosae. It is used in making handsome furniture, cabinetwork and panelling. The burr wood is particularly prized for veneer and the red-brown gum coming from the trunk is used as a gum arabic substitute. It is also a very promising species for fuel forests. It contains 30 % protein in foliage which is lopped for fodder and for making good manure (Bugress, 1966, Viado, 1967 and Walters, 1971) . Moreover, it fixes nitrogen in soil and leads to improvement of soil properties.

Taxodium distichum L. is a coniferous tree belongs to family Taxodiaceae. It contains a high value of softwood which commonly used in constructing furniture and floor. The tree is cultivated for wind break and its wood can resist insects and fungi, may be due to it contains a high concentration of extracts content. Moreover, the volatile oil in seeds have been used in medicinal purposes.

Macharium tipu is a rapid growth tree, belongs to family Leguminosea. Its wood has economic value and the leaves are used as good fodder.

Sandy soils have many problems such as poor physical, chemical and nutritional properties. Sewage sludge is a potentially valuable resource of essential macro and micronutrients to plants. It is widely used as fertilizer can both augment crop yield and reduce the farmers costs for chemical fertilizer.

The sludge is considered as fertilizer substitute and / or a soil amendment. On average, one ton of sludge contains about 80 lb available nitrogen, 20 lb phosphorus as P₂O₅ and 50 lb Potassium as K₂O (Abdel – Hameed, 2003). Askar (1988) reported that sewage sludge is highly beneficial for sandy and calcareous soils and is described as the most suitable organic conditioner for the desert soil.

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Labrecque *et al.*, (1995) mentioned that utilization of sewage sludge caused fast-growing (*Salix spp*) can benefit while sludge is good fertilizers. They showed that the plants were able to absorb Cd and Zn, but were less able to absorb Pb, Cu, Ni and Hg and concluded that dried, and polluted sludge is good fertilizer for *Salix discolor*. *S. viminalis* can be used for biomass production as filters for wastewater sludge purification.

Several researchers studied the effect of sewage sludge on some trees. Sadik *et al.* (1987) showed that the use of sewage water for the irrigation of sandy soils augmented N and P uptake by citrus trees. Shehata *et al* (1985) found that utilizing of sewage sludge effluents in irrigation for sandy soils increased most of nutrients (N,P and K) in the leaves of citrus trees .

Application of sewage sludge to sandy soils caused an increase in the concentration of ammonium-N, nitrate + nitrate N, available P and water soluble K compared to untreated soil (Sikora *et al.*, 1980; El-Keiy 1983 ;Tan *et al.* 1985; Pietz *et al.* 1989 and Sabey *et al.* 1990).The available P and extractable K content in treated soil with sewage sludge were augmented in comparison with control (Soon and Bates, 1982; Hinedi *et al.* 1988 and Dawaly and Dolan 1989).

Chang *et al* (1984a;b) and Badawy (1987) demonstrated that soil content of both total and available Pb was increased by supplying sandy soil with sewage sludge. Sandy soils irrigation with sewage water augmented the concentration of extractable Pb content compared to the control (Khalil 1990, Mohamed, 1991, Ibrahim *et al*, 1992 and Raslan, 1992) .

Hassan *et al.* (1997) irrigated *Acacia saligna* and *Leucaena leucocephala* with two sources of sewage effluent and found that height and diameter of *L. leucocephala* plant were augmented but positive response was only in diameter for *A. saligna*, whereas leaf area was reduced. They also showed that Pb, Fe, Mn and Zn content of leaves in both trees were increased due to sewage effluent applied. In addition,

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they revealed that the DTPA-extractable Pb, Fe, Mn and Zn in soils irrigated with sewage effluent were increased from east than west sources. Aly (1996) reported that application of sewage sludge augmented seedling height, fresh and dry weights and N, P, K Pb uptake by *Leucaena* tree seedling. He also added that sewage sludge application to sandy soil caused an increase in total nitrogen, available P, available K and DTPA Pb in the treated soil after cutting the *Leucaena* tree seedlings.

Abbaas (2002) treated *Casuarina gluca* L., *Taxodium distichum* L. and *Populus nigra* L. with some heavy metals(Pb, Cr and Ni) in irrigation water and reported that application of heavy metals increased heavy metals content in these trees and K in whole seedling was increased by increasing concentration of heavy metals.

The objective of this investigation was to study the influence of sewage sludge application on growth, chemical composition of seedlings of three woody trees, as well as chemical composition of treated sandy soil. .

MATERIALS AND METHODS

This experiment was carried out during the two successive seasons of 2004 and 2005 at the Experimental Farm of Agric. Res. Station at Mallaway. One year old seedlings of *Albizzia lebbek*, *Taxodium distichum*, L. and *Machareium tipu* were used. Meanwhile, 25-30 cm , 45-50 cm and 28-35 cm long and 0.24-0.27cm, 0.92-0.97cm. and 0.26-0.30cm. diameter for the used seedlings of *Albizzia lebbek*, *Taxodium distichum*, L. and *Machareium tipu*, respectively. The seedlings were transplanted on March 7th. for the two seasons in polyethylene bags of 30cm. diameter filled with 5 kgs of sandy soil (every bag contained one seedling) .

Sewage sludge material in dried form was obtained from healthy drainage station of Abo- Korkas town, El-Minia Governorate and sieved through 2 mm. sieve then mixed with sandy soil at the

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concentrations of 0, 3, 6, 9 and 12 % .Physical and chemical properties of the experimental soil are given in Table 1. , Chemical characteristics of the used sewage sludge are shown in Table 2.

Table 1: Physical and chemical properties of the experiment soil .

Pb DTPA Ppm	K ppm	P Ppm	N (%)	O.M (%)	E.C. m .mohos	pH (1:2.5)	CaCo3 %	Clay %	Silt %	Sand %	Soil constituent
0.73	4.71	0.28	0.030	0.15	1.23	7.85	8.38	3.81	4.86	91.33	Value

Table 2: Chemical composition of sewage sludge

Pb DTPA ppm	K ppm	P ppm	N %	CaCo3 %	O.M. %	CEC,m/ 100g	EC 1:2.5 Ms/cm	pH 1:2.5
17.4	80.12	1.75	2.25	4.40	41.81	155.00	7.55	6.75

Complete randomized design with three replications was applied and all agricultural practices were performed as usual. At the end of the experiment (Oct.29th of each season) the following data were recorded: stem length, stem diameter, leaves fresh and dry weights, stem fresh and dry weights. N, P and K content in the dry leaves and soil were determined according to Page *et al.* (1982).Lead was extracted from dried leaves and soil by DTPA (Lindsay and Norvell, 1969) and determined by Atomic Absorption Spectrophotometer. The data were statistically analyzed according to Little and Hills (1978).

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RESULTS AND DISCUSSION

Vegetative growth:

Stem length:

Data presented in Table 3 reveal that the effect of sewage sludge on stem length of *Albizzia lebbek*, *Taxodium distichum* and *Machaerium tipu* trees seedlings was significantly differed in the two experimental seasons. Sewage sludge at all applied concentrations, except sewage sludge at 3 % significantly increased stem length of *Albizzia* tree seedlings compared to the untreated control in the two growing seasons. Also, application of sewage sludge at all concentrations led to an increase in stem length of *Taxodium* tree in comparison with the control in both seasons.

Similar observations were obtained for stem length of *Machaerium* tree seedling, except using of sewage sludge at 3 % in the second season was not effective. The tallest seedlings were observed with sewage sludge at 9 and / or 12% compared to the rest of treatments for all species in the two seasons.

Stem diameter :

Table 3 indicates that stem diameter of the three trees seedlings was significantly affected by application of sewage sludge in both seasons. Supplying *Albizzia* tree with sewage sludge caused a significant increase in stem diameter, except at 3 and 6 % concentrations in the first season and 3% concentration in the second season. All sewage sludge treatments, except 3% concentration caused a significant increase in stem diameter of *Taxodium* tree seedlings in the two seasons. Data showed that stem diameter of *Machaerium* tree seedlings increased significantly with sewage sludge treatment at all concentration, except 3 and 6 %sewage sludge concentration in the first season. In most cases, it was found that thicker seedlings of all species were obtained with sewage sludge at 9 or 12 %.

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Table 3 :.Effect of sewage sludge treatments on tree species seedlings during the 2004 and 2005 seasons .

sewage sludge concentrations	First season					Second season				
	Stem length (cm)	Stem diameter (cm.)	Leaves fresh weight (g/ plant)	Leaves dry weight (g/ plant)	Stem fresh weight (g/ plant)	Stem length (cm)	Stem diameter (cm.)	Leaves fresh weight (g/ plant)	Leaves dry weight (g/ plant)	Stem fresh weight (g/ plant)
<i>Albizia lebbek</i>										
0	78.7	0.51	61.71	17.81	29.35	83.6	0.57	66.50	23.12	27.51
3	84.8	0.58	71.52	26.17	31.15	92.2	0.63	73.92	27.50	31.25
6	94.5	0.60	79.93	29.75	37.83	100.0	0.67	85.45	31.75	39.00
9	106.2	0.68	89.75	33.12	44.95	107.0	0.71	92.83	34.33	47.30
12	118.1	0.69	98.33	35.25	50.11	122.0	0.73	101.95	36.65	54.80
LSD 0.05	8.6	0.1	9.38	4.86	6.17	11.7	0.09	4.96	4.34	6.09
0.01	12.2		13.34	6.92	8.78	16.7		7.05	6.18	8.66
<i>Taxodium distichum</i>										
0	90.2	1.33	65.81	21.30	23.16	92.6	1.35	70.40	25.70	31.60
3	101.4	1.38	71.13	25.25	26.23	100.3	1.39	74.13	29.33	35.25
6	109.0	1.47	76.17	27.75	35.20	112.2	1.45	81.75	30.00	41.80
9	114.2	1.51	84.83	32.81	40.75	118.5	1.52	86.12	33.40	43.75
12	122.9	1.55	92.81	34.55	55.17	124.6	1.59	95.62	35.25	50.25
LSD 0.05	6.5	0.13	7.42	5.53	7.98	7.4	0.09	6.85	4.56	6.79
0.01	9.3	0.18	10.56	7.86	11.35	10.5	0.12	9.74	6.46	9.62
<i>Machaerium tipu</i>										
0	67.9	0.42	62.95	19.25	24.80	76.7	0.40	60.82	22.50	27.10
3	78.0	0.45	70.31	24.75	31.70	80.9	0.49	79.33	25.75	32.70
6	86.0	0.53	76.82	26.50	36.80	92.3	0.51	81.25	29.90	40.60
9	96.6	0.60	81.45	28.60	45.30	101.0	0.56	85.91	30.50	46.30
12	103.3	0.68	87.35	30.81	52.50	110.0	0.61	93.70	32.25	55.40
LSD 0.05	8.6	0.12	8.31	6.41	6.36	6.9	0.08	7.57	5.15	5.48
0.01	12.3	0.17	11.83		9.04	9.8	0.12	10.77		7.80

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Leaves fresh and dry weights:

The main influence of sewage sludge treatments on leaves fresh and dry weight of the three species seedlings was significant in the two seasons. Fresh and dry weights of Albizzia leaves were augmented by addition of sewage sludge at all concentrations in the two seasons compared to the control.

It was noticed that adding sewage sludge at all concentrations, except the low concentration (3 %) resulted in a significant increase in leaf fresh and dry weights of Taxodium seedlings compared to the control in the two seasons. In case of Macharium seedlings, all sewage sludge concentrations significantly augmented leaf fresh and dry weights except 3% concentration in the first season and the same treatment for dry leaves in the second season compared to the control. In general, application of sewage sludge at 9 % or 12 % gave the heaviest leaf fresh and dry weights of the three tree seedlings species compared with the other treatments in the two experimental seasons, (Table 3).

Stem fresh and dry weights:

Data in Tables 3 and 4 show that stem fresh and dry weights of Albizzia, Taxodium and Macharium trees seedlings were significantly affected by application of sewage sludge in both seasons. Stem fresh weight, of all species increased significantly with sewage sludge at all concentrations compared to the untreated seedlings in the two seasons, except sewage sludge at 3% concentration in the two experimental seasons for both Albizzia or Taxodium trees.

Regarding stem dry weight data showed that sewage sludge at all concentrations, except 3 and 6 % for Albizzia and Taxodium seedlings in both seasons and 3% for Macharium seedlings in the first season significantly only affected stem dry weight. In general, treating all seedlings species with sewage sludge at 9 and / or 12 % gave the highest values of stem fresh and dry weights compared to other treatments in the two seasons (Table 4).

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Table 4: Effect of sewage sludge treatments on tree species seedlings during 2004 and 2005 seasons .

sewage sludge concentrations	First season					Second season				
	Stem dry weight (g / plant)	N % in Leaves	P% in leaves	K% in leaves	Pb (ppm) in leaves	Stem dry weight (g / plant)	N % in Leaves	P% in Leaves	K% in Leaves	Pb (ppm) in leaves
	<i>Albizia lebbek</i>									
0	8.5	2.10	0.17	2.63	30.0	8.3	2.07	0.21	2.70	29.5
3	9.3	2.21	0.19	2.70	30.5	10.2	2.22	0.23	2.75	29.7
6	11.2	2.45	0.23	2.74	32.0	11.4	2.39	0.25	2.81	33.0
9	14.6	2.51	0.28	2.79	33.1	16.8	2.48	0.29	2.85	33.5
12	18.3	2.76	0.33	2.82	35.3	19.7	2.68	0.34	2.91	34.0
LSD 0.05	3.6	0.16	0.07	0.12	3.4	3.5	0.17	N.S.	N.S.	3.3
0.01	5.1	0.23	0.10			5.0	0.24			
	<i>Taxodium distichum</i>									
0	8.8	2.37	0.22	2.45	25.7	9.5	2.43	0.20	2.50	26.8
3	9.1	2.45	0.26	2.52	27.0	10.8	2.51	0.28	2.59	26.9
6	12.7	2.63	0.31	2.61	28.0	12.3	2.72	0.30	2.64	27.2
9	15.2	2.77	0.35	2.73	28.6	17.5	2.86	0.39	2.78	29.0
12	21.3	2.85	0.37	2.80	29.5	19.8	2.97	0.36	2.85	30.1
LSD 0.05	4.4	0.16	0.09	0.17	N.S.	3.6	0.05	0.09	0.12	N.S.
0.01	6.2	0.23		0.24		5.1	0.07	0.13	0.18	
	<i>Machaerium tipu</i>									
0	7.9	2.25	0.19	2.22	23.2	8.7	2.30	0.22	2.30	21.6
3	8.6	2.33	0.21	2.31	26.4	10.5	2.51	0.25	2.48	23.0
6	11.0	2.51	0.25	2.43	30.3	12.0	2.69	0.26	2.56	24.5
9	14.8	2.64	0.27	2.62	31.7	16.3	2.91	0.31	2.68	27.7
12	17.6	2.77	0.32	2.75	34.9	20.2	3.10	0.35	2.81	29.0
LSD 0.05	3.6	0.12	0.08	0.16	2.5	4.0	0.19	N.S.	0.13	2.5
0.01	5.2	0.17		0.23	3.5	5.7	0.28		0.18	3.5

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Chemical constituents:

Nitrogen content in the leaves:

Data in Table 4 clearly show that the effect of adding sewage sludge on nitrogen percentage in leaves of seedling species was statistically significant in the two experimental seasons. It seemed that N content in the leaves of tree seedlings species was significantly augmented with sewage sludge at all concentrations except 3% concentrations for the first season in comparison with the check treatment in both seasons. Similarly at 3% concentrations sewage sludge had no significant effect on N content in the leaves of Albizzia seedlings compared to the untreated control.

Sewage sludge at 12 % concentrations gave a maximum value of N in the leaves of all tree species compared to the other treatments in the two seasons.

Phosphorus content in the leaves:

Data in Table 4 show that phosphorus content in tree leaves of the three species was significantly affected by application of sewage sludge in the two seasons, except in case of Albizzia and Machaerium seedlings in the second season. Addition of sewage sludge at all concentrations except, at 3 and 6 % for Albizzia and Machaerium seedlings significantly augmented P % in the leaves compared to control treatment in the first season. However, sewage sludge treatments, except at low concentration (3%) caused a significant increase in P content of Taxodium leaves compared with the untreated ones in both seasons. In most cases, the maximum values of P% in leaves of all tree species were attained with sewage sludge at 6, 9 and 12 concentration compared to other concentrations .

Potassium content in the leaves:

Data in Table 4 show that sewage sludge application had a significant effect on potassium content in the leaves of the three tree species in the two seasons, except those of Albizzia leaves in the second season. Adding sewage sludge at all concentrations, except 3

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and 6 % sewage for Albizzia and Taxodium seedlings, as well as 3 % sewage sludge for Machaerium seedlings in the same season significantly increased K % in the leaves of tree species seedlings compared to the control plants in the first season. Supplying Taxodium and Machaerium seedlings with sewage sludge at all concentrations, 3% the concentration for Taxodium seedlings caused a significant increase in K % in the leaves compared to the untreated plants in the second season. In general, leaves of tree species contain high amount of K % with sewage sludge level at 12 % in both seasons.

Lead content in the leaves :

Data in Table 4 show that application of sewage sludge significantly affected lead concentration in the leaves of tree species, except for Taxodium seedlings in both seasons. Pb concentration in the leaves of Albizzia and Machaerium seedlings was significantly increased with adding sewage sludge at all concentrations in comparison with untreated ones in both seasons, except 3, 6 and 9 % sewage sludge for Albizzia seedlings in the first season and 3 % sewage sludge for Albizzia and Machaerium seedlings in the second season. The maximum concentration of Pb in the leaves of Albizzia seedlings was detected with the application of sewage sludge at 6,9 or 12% in the two seasons. The highest Pb concentration in Machaerium leaves was obtained with supplying the seedlings with sewage sludge at 12 % in the first season and 9 % or 12 % in the second season.

Nitrogen percentage in soil:

Results in Table 5 show that sewage sludge treatments significantly affected nitrogen percentage in the soil in both seasons. Sewage sludge at all concentrations caused a significant increase in N % of the soils compared to the control treatment in both seasons, except 3% concentration for both Albizzia and Taxodium seedlings in the two seasons, and Machaerium seedlings in the second season. In most cases, application of sewage sludge at 9 or 12 % gave highest values of N % of soil in comparison with other treatments in both seasons.

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Table 5 : Effect of sewage sludge treatments on tree species seedlings during 2004 and 2005 seasons .

sewage sludge concentrations	First season				Second season			
	N % in soils	P (ppm) in soils	K (ppm) in soils	Pb (ppm) in soils	N % in Soils	P (ppm) in Soils	K (ppm) in soils	Pb (ppm) in Soils
	<i>Albizia lebbek</i>							
0	0.012	0.21	5.80	1.15	0.011	0.25	5.25	1.21
3	0.015	0.23	7.92	1.75	0.013	0.31	8.75	1.85
6	0.016	0.26	8.69	2.71	0.015	0.38	8.75	3.15
9	0.018	0.35	10.38	3.14	0.019	0.47	10.75	3.83
12	0.020	0.44	10.58	4.15	0.027	0.52	11.08	4.60
LSD 0.05	0.004	0.08	0.79	0.94	0.004	0.08	0.89	0.93
0.01	0.005	0.11	1.12	1.33	0.005	0.12	1.26	1.32
	<i>Taxodium distichum</i>							
0	0.014	0.23	6.25	0.87	0.012	0.27	5.75	1.05
3	0.016	0.26	7.89	1.50	0.015	0.29	8.24	1.73
6	0.017	0.28	8.45	2.90	0.017	0.36	9.39	2.99
9	0.021	0.34	9.95	3.25	0.023	0.41	10.25	3.55
12	0.024	0.48	10.10	3.54	0.026	0.56	10.40	4.25
LSD 0.05	0.003	0.10	0.93	0.62	0.004	0.08	1.27	0.72
0.01	0.004	0.15	1.32	0.88	0.006	0.12	1.80	1.02
	<i>Machaerium tipu</i>							
0	0.013	0.19	5.60	0.92	0.014	0.28	5.55	1.10
3	0.016	0.25	8.04	1.40	0.016	0.32	7.70	1.67
6	0.018	0.27	8.51	2.67	0.021	0.39	10.00	2.80
9	0.023	0.31	10.42	3.00	0.025	0.45	10.88	3.39
12	0.025	0.47	10.34	3.65	0.028	0.62	10.16	3.90
LSD 0.05	0.003	0.08	1.29	N.S.	0.004	0.07	1.46	0.51
0.01	0.005	0.12	1.84		0.005	0.10	2.08	0.73

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Phosphorus content in the soil:

Table 5 shows that application of sewage sludge had significant effect on phosphorus content in the soil in both seasons. Sewage sludge at all concentrations significantly augmented phosphorus content in the soil compared to the control in the both seasons, except sewage sludge at 3, 6 and 9 % for Albizzia seedlings in the first season, 3 and 6 % sewage sludge for Taxodium tree in the first season and the concentration of 3 % for both Machaerium tree in the two seasons, Albizzia and Taxodium seedlings in the second season. In most cases, applying of sewage sludge at 12 % gave the highest content of P in both seasons.

Potassium content in the soil:

Data in Table 5 show that the effect of sewage sludge treatments on potassium content in soil was statistically significant in the two seasons. Sewage sludge at all concentrations caused a significant increase in K content in the soil compared to the control treatment in both seasons. In most cases, application of sewage sludge at 9 or 12 % gave maximum values of K content in the soil in the two seasons.

Lead content in soil:

Table 5 reveals that the effect of sewage sludge treatments on lead content in the soil was statistically significant in both seasons, except for Machaerium seedlings in the first season.

All concentrations of sewage sludge significantly increased Pb content in the soil in both seasons, compared to the untreated control except the concentration of 3 % for both Albizzia seedlings in the two seasons and for Taxodium seedlings in the second one. In general, the highest values of Pb content in soil were obtained with the application of sewage sludge at 9 or 12 % in comparison with the check treatment in the two seasons.

The obtained results could be discussed as follow: Sewage sludge treatments led to an increase in growth, chemical constituents of leaves and soil of the seedlings of the three species. The increment in these

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characteristics as a result of using sewage sludge which contained organic matter and nutrients that are valuable resources for enhancing marginal land and as supplement to fertilizers and soil conditioners. Also, it has been as a slow release fertilizer in potting media to eliminate the need for additional fertilizers (Gouin, 1994).

Several investigators revealed that using of sewage sludge to soil led to an increase in organic matter, cation exchange capacity, total N, available P, as well as enhance the physical, chemical, biological properties and consequently soil fertility (El-Nennal *et al.*, 1982, El-Keiy,1983;Elsokkary and El-Keiy, 1989; Waly *et al.*, 1987 and Logan *et al.*, 1997). Taxodium tree surpassed either Albizzia or Machaerium trees and Albizzia surpassed other trees or Machaerium surpassed two other trees in some growth characters or chemical constituents both in leaves or soil in this investigation may be due to the difference in the genetic composition potentiality between the three tree species which play an important role in nutrients uptake and related to physiological and biochemical processes in plants for example, hormonal system, transpiration, and photosynthesis. Also, the important role of environmental factors and adapted these studied trees.

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دراسة استجابة شتلات بعض الأشجار الخشبية لمعاملات الحماية في الأراضي الرملية

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أجري هذا البحث خلال موسمين متتاليين 2004-2005 لدراسة تأثير الحماية بالتركيزات التالية صفر % 3, 6, 9, 12، على النمو والمكونات الكيميائية لشتلات أشجار اللبخ والتاكسوديم و أبو المكارم النامية في الأراضي الرملية .
وأوضح من النتائج الآتي:-

أن استعمال 12 أو % 9 من الحماية قد أدي إلي زيادة طول وسمك الساق والوزن الطازج والجاف للأوراق والسيقان والنسبة المئوية لعناصر النيتروجين والفوسفور والبوتاسيوم بالأوراق وكذا محتوى الرصاص بالأوراق وأيضا محتوى التربة من عناصر النيتروجين والفوسفور و البوتاسيوم والرصاص .

ولوحظ أن طول وقطر الساق والنسبة المئوية لعنصري الفوسفور والبوتاسيوم في أوراق التاكسوديم قد استجابت للمعاملة بالحماية عند تركيزات 9 أو % 12 عن باقي الأشجار الأخرى تحت الدراسة. بينما وجد أن الوزن الطازج والجاف لأوراق شتلات اللبخ

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قد استجابت أيضا لتلك المعاملة السابقة بنفس التركيزات 9 أو % 12 أكثر من الأشجار الأخرى ,وكذلك محتوى تراكم عنصري البوتاسيوم والرصاص بالتربة كان أكبر وكذا محتوى عنصر الرصاص الممتص بالأوراق كان أكبر من الأشجار المعاملة الأخرى وذلك راجع الي المعاملة بالحماة 9 أو % 12. النسبة المئوية لتراكم عنصر النيتروجين في التربة المنزرعة بأشجار أبو المكارم كانت أكبر عند المعاملة بالحماة عند تركيزات 12 أو % 9مقارنة بتراكمها في التربة المنزرعة بالشتلات الأخرى. ووجد أن الوزن الطازج والجاف لسيقان شتلات التمسويم وأبو المكارم في الموسم الأول والثاني علي التوالي قد إستجابا بصورة أكبر للمعاملة بالحماة بتركيز 12 أو % 9وكذلك امتصاص عنصر النيتروجين في الأوراق وتراكم لنفس العنصر بالتربة بصورة أكبر مقارنة بالنتائج المتحصل عليها من شتلات اللبخ