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IMPROVEMENT OF THE EFFICIENCY OF *Acacia* AND *Prosopis* FOR CONTROLLING SHIFTING SAND USING BIO AND MINERAL NITROGEN FERTILIZATION

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ABSTRACT

Field experiment was carried out in Toshka region 300 km south Aswan city during two successive years of 2003 and 2004 to study the efficiency of bio and mineral nitrogen fertilization on growth performance improvement of *Acacia saligna* and *Prosopis juliflora* trees cultivated as shelterbelt for sand encroachment control in the area.

Obtained results showed that the growth characters of *Acacia saligna* and *Prosopis juliflora* trees were significantly higher in biofertilized and nitrogen fertilization compared to control treatment.

Regarding the nutrients content in leaves, results indicated that the highest values of N, P and K were observed in the treatment of biofertilization combined with nitrogen application at a rate of 150 kg N/fed. Also, obtained results revealed that the biofertilization treatments gave higher values of organic matter content of soil rather than nitrogen fertilization one .Nutrients content of soil (N,P,K,Fe,Cu,Mn and Zn)was significantly higher in the treatment of biofertilization combined with nitrogen application at a rate of 100kg N/fed .

Moreover, biofertilization treatments in presence of nitrogen application (100 kg N/fed) gave lower records of sand accumulation compared with nonbiofertilization ones.

Shelterbelt efficiency was higher in the treatment of biofertilization combined with nitrogen application at a rate of 100 or 150 kg N /fed being 36.4and 35.0% for *Acacia saligna* and *Prosopis juliflora*, respectively. But, there is no significant difference of shelterbelt efficiency between 100 or 150 kg N/fed application.

Generally, it can be recommended that the biofertilization process could be applied with *Acacia saligna* and *Prosopis juliflora* cultivated as shelterbelt combined with mineral nitrogen application at a rate of 100kg N/fed under similar conditions.

Key words: biofertilization, nitrogen fertilizer, *Acacia saligna*, *Prosopis Juliflora*, sand accumulation, Toshka, shelterbelt.

INTRODUCTION

Over the last twenty five years, a large area of newly reclaimed deserts (more than two million feddan) was added to the cultivated area in Egypt. Toshka is hyper arid region located in south west part of Egypt at 300 km of Aswan city. Shifting sand in these places is considered one of the most important environmental features which affect on the agriculture land and water running in EL-Sheikh Zayed canal. Ujah and Adeoye (1984) reported that shelterbelt reduced wind velocity on the lee word side. Reduction in wind velocity ranged from 20 to 10% at a distance of 20 and 150m from the belt. Zhenda *et al.* (1988) gave evidence that the macro and micro environmental and climatic properties of the local aeolian soil have changed only a few years after the implementation of the dunes fixation program, at Beijing – Tongliao railway line.

Toshka region is newly reclaimed soil. Therefore, the agriculture information is not available concerns the appropriate plant types, irrigation and fertilization programms. The integration of trees, especially nitrogen fixing leguminous trees into agroforestry and silvo-pastoral systems can make a major contribution to sustainable agriculture by restoring and maintaining soil fertility and in combating erosion and desertification as well as for providing fuel wood.
The particular advantage of nitrogen fixing leguminous trees in addition to their symbiotic nitrogen fixation with rhizobia, their ability to establish in nitrogen deficient soils and the benefits of the nitrogen fixed and extra organic matter to succeeding or associated trees Pramila *et al.*(1990)and Badhwar *et al.* (2002). Inoculation of N2 - fixing trees with rhizobia and bradyrhizobia is necessary for good inoculation and growth particularly in soil where indigenous rhizobial populalation is not adequate for good nodulation such as Toshka soils.

Acacia nodulation was studied by different investigators around the world. Badji *et al.* (1987) found that *Rhizobium* strains isolated from *Acacia saligna* and *Acacia lacta* and used as inocula, increased plant N-content by 49% in *Acacia saligna* and 98% in *Acacia lacta*. Turk *et al.* (1992) determined the relationship between yield response to inoculation and rhizobial population density for leguminous trees. They found that the magnitude of the response was inversely related to the density of rhizobia in the soil. Chang *et al.* (1986), Newton *et al.* (1990), Arya *et al.* (1999), and Sarr *et al.* (2005) reported that inoculation with *Rhizobium* enhanced dry matter accumulation and P - uptake as well as plant productivity .

Generally, about 50% of the nitrogen requirements of leguminous trees could be saved by biofertilization with *Rhizobium*. That is of great interest especially when public health and environmental pollution were considered (Abdel-Wahab *et al.* (1998) and Abdel-Rahim *et al.* (1998).
This study was designed to enhancement of *Acacia saligna* and *Prosopis juliflora* growth in Toshka region cultivated as shelterbelt for sand encroachment control by inoculation with nodulating rhizobia and comparison with chemical nitrogen fertilization.

MATERIALS AND METHODS

Field experiment was carried out in Toshka region during two successive seasons of 2003 and 2004. This study was carried out to study the effect of bio and mineral nitrogen fertilization on growth performance of *Acacia saligna* and *Prosopis juliflora* trees cultivated for sand encroachment control.

Particle size distribution of the experimental soil was estimated according to Jackson (1973). While, soil chemical analysis was determined according to Black *et al.* (1982). The data of some physical and chemical properties of the experimental soil are presented in Table (1). However,chemical properties of irrigation water is presented in Table (2).

Table (1, a): Particle size distribution of the experimental soil .

Soil depth (cm)	> 2 mm	2-1 mm	1 - 0.5 mm	0.5 – 0.25 mm	0.25 – 0.125 mm	0.125 – 0.063 mm	< 0.063 mm	Textural class	sand	silt	clay
0 – 30	-	-	-	-	-	-	-	Sandy clayey loam	61.7	14.2	24.1
30 – 60	-	-	-	-	-	-	-	Sandy loam	75.0	14.5	10.5
60 – 90	5.86	13.36	15.8	20.8	27.12	15.48	1.58	Sandy	-	-	-

Table (1,b):Some physical and chemical properties of the experimental soil .

Soil depth (cm)	pH	EC ds/m^{-1}	O.M %	$CaCO_3$ %	T.N ppm	Available nutrient (ppm)	
						P	K
0-30	7.64	2.45	0.09	5.65	30.1	1.75	35.0

Table (2): Chemical analysis of the water used for irrigation .

pH	EC dSm^{-1}	Soluble Cations (me / l)				Soluble anions (me / l)				SAR
		Ca^{2+}	Mg^{2+}	K^+	Na^+	Co_3^{--}	Hco_3^-	So_4^{--}	Cl^-	
7.74	3.04	7.97	0.70	0.85	22.76	-	4.59	13.69	14.0	10.9

SAR: Sodium adsorption ratio.

Rhizobium leguminosarum strain was obtained from Biofertilizers production Unit, Soils, Water and Environment Research Institute, Agric. Res. Center, Giza, Egypt as a source of Bio N-fertilizer.

Inoculum preparation.

For preparation of *Rhizbium leguminosarum* inoculum, yeast mannitol broth medium (Vincent, 1970) was inoculated with the effective strain of *(R. leguminosarum)*, then incubated at 32C for 7 days.

Experimental design.

A split plot design with four replicates was used in this study. The main plots were assigned to biofertilization (uninoculation, inoculation). While, four nitrogen fertilization treatments (zero, 50, 100 and 150 kg N/fed as ammonium sulphate) were randomly distributed in the sub plots.

Cultivation process.

Cultivation process was performed by sowing either uninoculated or inoculated *Acacia* and *prosopis* transplants in rows (96 m length) with a distance of 3m length x 3m width .Number of rows in the experiment was four from each of *Acacia saligna* and *Prosopis juliflora*. *Acacia* and *Prosopis* trees were cultivated as shelterbelt. Cultivation process was performed by sowing of *Acacia* and *Prosopis* parallel with EL-Sheikh Zayed canal and perpendicular on wind direction. Sowing of *Acacia* and *Prosopis* transplants took place on February15th in 2003 year. After sowing, soil was directly irrigated to provide suitable moisture for *Rhizobium* inoculum. Drip irrigation system was applied in this experiment.

In this experiment, maize plants were cultivated around the transplants of *Acacia* and *Prosopis* in a circle one meter in diameter to protect the transplants especially during the early growth period. Regarding the chemical nitrogen fertilization, ammonium sulphate (20.5% N) was used as nitrogen fertilizer. Nitrogen fertilizer levels were applied in three equal doses. Application of N-fertilizer was repeated in the second year at the same levels mentioned above.

Sand collectors (Bagnold, 1941) were fixed at up and down wind of each trees treatments during 2004 year for evaluation of shelterbelt efficiency.

Determinations:

A- Growth characters of *Acacia* and *Prosopis* plants.

Crown cover (m^2) and crown volume (m^3) were estimated by the method described by Thalen (1979).

Growth rate was determined in the two years

In the first year the following equation was used:-

Growth rate (first year) = $\frac{CV_2}{CV_1} \times 100$ where:

CV2 = crown volume at the end of first year.

CV1 = crown volume at cultivation time.

In the second year the following equation was used:-

Growth rate (second year) = $\frac{CV_3}{CV_2} \times 100$ where:

CV3 = crown volume at the end of second year.

CV2 = crown volume at the end of first year.

B- Chemical properties of experimental soil for different investigated treatments was analyzed at the end of experiment for (pH, Ec, organic matter, total nitrogen and available P, K, Fe, Cu, Mn and Zn).

C- Macro nutrients content in leaves of *Acacia* and *Prosopis* were determined as follows:

- Total nitrogen according to A.O.A.C(1980).

- Total phosphorus according to A.P.H.A.(1992).
- Total potassium according to Dewis and Freitas (1970).
- Organic matter, pH and EC were estimated in soil according to Black *et al.* (1982).
- Micro-nutrients (Fe, Zn, Mn and Cu) were determined in the DTPA- soil extract by using Atomic absorption apparatus according to Soltanpour and Schwab (1977).

D- Shelterbelt efficiency (%) was calculated using the following equation: Shelterbelt efficiency = $\frac{A-B}{A}$x100 where:

A= sand accumulation(g/cm width)in the front of shelterbelt.
B= sand accumulation(g/cm width) behind of shelterbelt.

E- Statistical analysis:
Data were subjected to statistical analysis according to Snedecor and Cochran(1980).Least significance difference L.S.D. at 0.05 probability was applied for comparing means.

RESULTS AND DISCUSSION

A. Plant growth characters:

Concerning the effect of bio and mineral nitrogen fertilizer,data in Table (3) showed that growth characters of *Acacia* and *Prosopis* trees were significantly increased in the biofertilization treatment compared to unbiofertilized one. However,growth characters of *Acacia* and *Prosopis* plants were increased with the increasing of nitrogen fertilizer level.

No significant difference in growth characters of *Acacia* and *Prosopis* was observed when nitrogen fertilizer was supplied at 100kg nitrogen or 150kg nitrogen. Application of nitrogen fertilizer at a rate of 50kg N/fed, gave lower significant values of growth characters for *Acacia* and *Prosopis* plants as compared to the applicatin of nitrogen at a rate of 100 or 150kg N/fed treatments. Mean values of growth characters were increased as a result of applying nitrogen levels at a rat of 100 and 150 kg/fed as compared to control treatment. These results are in agreement with those obtained by Mansour (1998), Pryia *et al.* (1999), Badhwar *et al.* (2002) and Bnbrahim and Ismaili (2002) who reported that rhizobial inoculation of leguminous trees such as *Acacia spp* and *Prosopis spp* resulted in a significant increase in plant biomass in comparisen with non-inoculted plants. Also, a linear relationship was found between the amount of fixed nitrogen and growth characters. Moreover, they found that inoculation of *Acacia* and *Prosopis* seedlings with specific strains of rhizobia resulted in maximum plant growth and best nodulation.

Concerning the effect of interaction between biofertilization and N-fertilizer, results recorded in Table (4) indicated that significant differences were obtained for some studied growth characters namely plant height, crown cover, crown volume and growth rate in the first year and plant height and growth rate in the second year of *Acacia* plants.

Table (3): Effect of bio and mineral nitrogen fertilization on growth characteristics of *Acacia* and *Prosopis* plants.

Characters / Treatments	Plant height (cm)	Stem diameter (mm)	Crown cover (m^2)	Crown volume (m3)	Growth rate (%)	Plant height (cm)	Stem diameter (mm)	Crown cover (m^2)	Crown volume (m^3)	Growth rate (%)
	Acacia saligna					*Prosopis juliflora*				
	First year									
	Biofertilization									
Non biofertilized	174.3	37.5	2.49	3.42	376.3	170.2	28.7	2.09	3.07	374.8
Biofertilized	183.7	43.4	3.46	4.44	487.0	198.8	31.8	3.47	4.03	490.8
L.S.D 0.05	5.35	6.2	0.08	052	32.4	15.1	2.5	0.10	0.36	42.6
	Nitrogen fertilizer levels									
Control	117.7	23.3	1.35	1.63	179.0	89.8	18.0	1.12	1.25	153.0
50 kg n / fed.	169.2	35.0	2.54	2.86	314.5	175.2	28.3	2.63	3.08	376.5
100 kg n / fed.	213.8	50.3	3.97	5.47	601.5	235.5	37.0	3.61	4.71	574.0
150 kg n / fed.	215.3	53.2	4.06	5.75	631.5	237.5	38.0	3.77	5.14	627.5
L.S.D 0.05	9.18	8.77	0.32	0.38	37.5	16.0	4.9	0.22	0.54	43.9
	Second year									
	Biofertilization									
Non biofertilized	200.8	56.4	3.43	5.24	184.0	205.8	4.02	3.34	4.61	165.5
Biofertilized	241.7	60.1	4.36	6.36	173.5	243.4	4.58	4.55	6.69	145.0
L.S.D 0.05	35.0	3.20	2.19	2.50	0.62	51.0	1.20	4.41	6.00	32.6
	Nitrogen fertilizer levels									
Control	163.3	45.0	5.52	4.23	259.0	188.3	2.33	2.44	3.16	132.0
50 kg n / fed.	218.3	54.5	3.73	5.90	223.0	225.0	4.10	3.94	5.90	215.0
100 kg n / fed.	241.7	61.7	4.24	6.34	116.0	236.7	4.72	4.43	6.49	136.5
150 kg n / fed.	261.7	73.0	5.08	6.73	116.5	248.3	6.05	4.97	7.06	137.5
L.S.D 0.05	29.9	0.70	1.45	1.55	3.58	51.0	1.22	1.02	1.62	27.9

Table (4): Effect of the interaction between bio and mineral N. fertilization on growth characteristics of *Acacia* and *Prosopis* plants.

Biofertilization	N. fertilizer	Plant height (cm)	Stem diameter (mm)	Crown cover (m2)	Crown volume (m3)	Growth rate (%)	Plant height (cm)	Stem diameter (mm)	Crown cover (m2)	Crown volume (m3)	Growth rate (%)
		Acacia saligna					*Prosopis juliflora*				
First year											
Non biofertilized	**control**	108.0	20.0	0.86	1.62	178.0	70.0	16.3	0.48	1.22	149.0
	50 kg/fed	164.0	30.7	1.88	1.93	212.0	157.3	25.3	1.69	1.76	215.0
	100 kg/fed	211.7	47.7	3.57	4.89	537.0	216.7	36.0	2.99	4.31	525.0
	150 kg/fed	213.7	51.7	3.70	5.26	578.0	221.7	37.3	3.22	5.00	610.0
Biofertilized	**without**	127.3	26.7	1.84	1.64	180.0	108.7	21.0	1.76	1.29	157.0
	50 kg/fed	174.3	39.3	3.22	3.80	417.0	185.0	31.3	3.57	4.41	538.0
	100 kg/fed	216.0	53.0	4.36	6.06	666.0	248.3	38.3	4.23	5.11	623.0
	150 kg/fed	217.0	54.7	4.44	6.24	685.0	253.3	40.0	4.32	5.19	632.0
L.S.D 0.05		25.1	N.S	1.1	0.14	50.9	45.2	N.S	N.S	0.65	16.5
Second year											
Non biofertilized	**control**	133.3	43.3	2.04	2.13	131.0	156.7	18.0	1.38	1.64	134.0
	50 kg/fed	213.3	49.7	2.12	2.83	147.0	193.3	39.7	2.53	2.76	157.0
	100 kg/fed	230.0	59.6	3.79	7.87	161.0	236.7	45.0	3.94	6.86	162.0
	150 kg/fed	226.7	71.7	4.77	8.42	160.0	236.7	58.0	4.53	7.88	158.0
Biofertilized	**without**	193.3	46.7	1.99	2.13	129.0	220.0	28.7	3.51	1.68	130.0
	50 kg/fed	223.3	59.0	4.35	5.46	143.0	236.7	42.3	4.35	6.04	136.0
	100 kg/fed	253.3	63.7	4.69	8.80	145.0	256.7	49.3	4.92	7.61	149.0
	150 kg/fed	296.7	74.3	5.39	9.34	150.0	260.0	63.0	5.42	7.44	143.0
L.S.D 0.05		28.1	N.S	N.S	N.S	8.99	33.2	N.S	N.S	N.S	37.8

N.s. Non significant Note be the average values of the crown volume at cultivation time were 0.91and 0.82m^3 for *Acacia* and *Prosopis*, respectively.

However, the highest mean values for plant height was detected from Biofertilized and application of 150 kg N /fed. Concerning *Prosopis* plants, similar trend was detected where plant height as well as growth rate were significantly affected by the interaction of biofertilization and nitrogen fertilization.

Also, data in Table (4) clearly indicated that growth characters of *Acacia* and *Prosopis* trees were significantly higher in biofertilized and no nitrogen application treatment than without both bio and mineral nitrogen fertilization. The lowest values of growth characters of *Acacia* and*Prosopis* were recorded in the treatment of non inoculated and no fertilized with nitrogen. Biofertilization treatments in presence of nitrogen fertilization gave significant higher values of growth characters of *Acacia* and *Prosopis* compared to nitrogen fertilization treatments without inoculation. This trend of results was observed in different growth periods. These results are in accordance with Jacob *et al.* (1998), Arya *et al.* (1999) and Ubaidullah *et al.* (2001) who found that the application of nitrogen fertilizer at higher level inhibited nodules formation on roots of leguminous plants.Morever, Jacob *et al.* (1998) found that the application of nitrogen fertilizer in the form of nitrate nitrogen prevented nodules formation although it promoted seedlings growth, while the ammoniacal nitrogen was the best source of nitrogen applied as regards both nodules production growth and plant development. Non significant differences were observed when the plants were fertilized with either 100kg N/fed or 150kg N/fed. Application of nitrogen at a rate of 50kg N/fed in presence of biofertilization showed lower significant records of growth characters of *Acacia* and *Prosopis* trees as compared to the application of nitrogen at a rate of 100 and 150kg N/fed. Except of control treatments, the lowest records of growth characters of *Acacia* and *Prosopis* trees were observed in the treatment of non biofertilization and 50kg N/fed supplementation. Similar results were observed by Lamani *et al.* (2003) who found that maximum collar diameter and plant height were recorded with the application of nitrogen fertilizer at a rate of 200kg N/ha as compared to the addition of nitrogen fertilizer at a rate of 100 or 300kg N/ha. Also, crown diameter of *Acacia* trees was obtained at the same level of nitrogen mentioned above (200kg N/ha).

B. Chemical analysis in leaves of *Acacia* and *Prosopis*.

Regarding the interaction effect between bio and mineral nitrogen fertilization on chemical analysis of *Acacia* and *Prosopis*, Results recorded in Table (5) showed that values of N,P and K values in leaves of *Acacia* and *Prosopis* were lower in non inoculated treatments than inoculated (biofertilized) ones. These results are in agreement with the findings of Kamal (2000), Ubaidullah *et al.* (2001), Rustagi *et al.* (2003) and Sinha *et al.* (2005) who reported that maximum growth and NPK content in *Acacia* and *Prosopis* plants were observed in the treatment of *Rhizobium* inoculation.

The lowest values of N, P and K were observed in non biofertilized and no nitrogen application treatment (control). While, the highest values of N, P and K were observed in the treatment of biofertilization combined with nitrogen application at a rate of 150N/fed. But,these differences were significant in case of K content of *Acacia* treatments;N and P contents of *Prosopis* treatments.

Table (5): Effect of the interaction between bio and mineral N. fertilization on chemical analysis in leaves of *Acacia* and *Prosopis*.

Biofertili-zation	N. ferti-lizer (Kg/fed)	N%	P%	K%	N%	P%	K%
		Acacia saligna			*Prosopis juliflora*		
Non biofertilized	control	1.02	0.200	1.00	0.88	0.203	0.50
	50	1.12	0.305	1.25	1.00	0.283	0.60
	100	1.22	0.340	1.50	1.03	0.301	0.65
	150	1.23	0.344	1.53	1.00	0.320	0.67
Biofertilized	Without	1.20	0.220	1.03	1.40	0.240	1.01
	50	1.50	0.320	1.29	1.88	0.320	1.12
	100	1.54	0.350	1.69	2.03	0.360	1.38
	150	1.58	0.360	1.88	2.06	0.380	1.49
L.S.D. 0.05		N.S	N.S	0.08	0.01	0.063	N.S

From the data presented in Table (5) it is clear that *Acacia* trees showed higher content of N, P and K as compared to *Prosopis* trees. This result is likely be due to the high N2-fixed by *Acacia* comparison with *Prosopis* plants.

Regarding the interaction effect, data in Table (5) showed that biofertilization treatment combined with 100 or 150kg N/fed application didn't show any significant effect in nitrogen, phosphorus and sodium content in leaves of *Acacia* trees. While, potassium content in leaves of *Acacia* showed significant effect between nitrogen levels (100 and 150kg N/fed) addition.

Moreover, obtained results in Table (5) indicated that significant effect was observed in nitrogen and phosphorus content in leaves of *Prosopis* plants when nitrogen fertilizer was supplemented at a rate of 100 or 150kg N/fed. in presence of biofertilization. Whereas, potassium and sodium content in leaves of *Prosopis* trees didn't show any significant effect between nitrogen levels (100 and 150kg N/fed) supplementation.

C-Soil chemical properties.

Concerning the interaction effect between bio and mineral nitrogen fertilization on some chemical properties of soil, data in Table (6) indicated that the pH values in soil didn't significantly affected by the nitrogen fertilizer levels under study. But the pH values were lower in the biofertilization treatments as compared to non-biofertilized ones.

Concerning the electric conductivity (EC) values, obtained results showed that biofertilization treatments exhibited relatively higher values of EC compared to nitrogen fertilization treatments. EC values in the biofertilization treatments didn't reach the level to be inhibit *Acacia* or *Prosopis* plants. It is worthy to mention that the applied treatments in this research decreased the electric conductivity (EC) of soil since it was 2.45 dsm^{-1} at the beginning of experiment Table (1, b). Also, obtained results showed that *Prosopis juliflora* treatment exhibited slightly higher values of EC in comparison with *Acacia saligna* treatments. This result is likely be due to the difference of root exudates and secretions between *Acacia saligna* and *Prosopis juliflora* trees.

As regard to the organic matter content in soil, obtained data emphasized that biofertilization treatments gave higher organic matter content of soil rather than mineral nitrogen fertilization ones. The higher organic matter content of soil in case of biofertilization treatments is expected, since the biofertilization leads to vigorous plant growth and consequently the root debris will be increased in soil. The highest organic matter content of soil was observed in the treatment of biofertilization combined with 100kg N/fed. application. From the data presented in Table (6) it can be concluded that *Prosopis juliflora* treatments were higher in soil organic matter content as compared to *Acacia saligna* ones.

These results are in accordance with those obtained by Draz and El-Maghraby (1997) who reported that the afforestation of sand dunes plays a significant role in the improvement of both the fertility and chemical properties of the soil.

Table (6): Effect of the interaction between bio and mineral N. fertilization on some chemical properties of soil.

Biofertilization	N-fertilizer (Kg/fed)	pH	Ec dSm^{-1}	O.M %	T.N ppm	Available nutrient (ppm)					
						P	K	Fe	Cu	Mn	Zn
	Acacia saligna										
Non-biofertilized	Control	8.30	0.20	0.12	46.2	5.00	44	1.85	0.120	1.61	0.43
	50	8.50	0.11	0.24	97.1	15.56	62	5.61	0.228	3.10	1.11
	100	8.50	0.11	0.25	101.7	13.90	104	5.30	0.368	5.50	1.08
	150	8.50	0.15	0.27	106.3	15.00	96	5.61	0.824	6.99	1.10
Biofertilized	without	8.30	0.49	0.21	83.2	14.40	128	2.93	0.17	2.70	0.70
	50	8.00	0.39	0.30	120.2	23.90	172	14.86	0.414	7.20	1.18
	100	8.10	0.39	0.32	129.5	23.90	188	14.65	0.436	6.50	1.12
	150	8.00	0.42	0.27	106.3	22.78	160	15.22	0.632	3.20	1.15
L.S.D. 0.05		N.S	0.08	18.0	18.0	4.11	N.S	1.9	N.S	3.6	N.S
	Prosopis juliflora										
Non-biofertilized	control	8.46	0.69	0.18	64.70	6.66	82	2.75	0.138	1.56	0.89
	50	8.36	0.25	0.23	92.47	17.78	110	6.98	0.488	8.18	1.82
	100	8.20	0.16	0.42	166.44	15.56	168	8.02	0.856	5.46	1.67
	150	8.40	0.12	0.23	92.47	1500	170	3.11	0.900	5.32	1.75
Biofertilized	without	8.15	0.67	0.32	73.97	3.32	116	2.30	0.958	2.80	0.50
	50	8.18	0.47	0.35	138.7	23.32	154	11.08	1.314	10.70	1.88
	100	8.12	0.31	0.46	129.5	20.80	124	11.32	1.770	11.50	1.77
	150	8.18	0.11	0.36	184.9	20.90	186	14.56	1.378	12.65	1.86
L.S.D. 0.05		N.S	0.11	0.08	31.9	2.3	30	2.9	0.05	N.S	0.51

Regarding the total nitrogen content in soil, obtained results showed that biofertilization treatments recorded significant higher values of total nitrogen in soil in comparison with nitrogen fertilization treatments without biofertilizer. Except the control treatment, the lowest value of total nitrogen was observed in the treatment of nitrogen fertilizer application at a rate of 50kg N/fed. Whereas, the highest value of total nitrogen in case of *Acacia* treatments was observed in the treatment of biofertilization combined with nitrogen application at a rate of 100kg N/fed. While, the highest values of total nitrogen in case of *Prosopis* treatments was observed in the treatment of biofertilization and nitrogen application at a rate of 150 kg N/fed. These results are in agreement with the findings of Zahir *et al.* (1997) and Mahendran and Kumar (1998) who reported that biofertilizers application increase organic matter and nutrients content NPK in soil in comparison with inorganic nitrogen fertilizers.

With respect to the available nutrients content in soil, obtained data revealed that available nutrients (P, K, Fe, Cu, Mn and Zn) content was lower in nitrogen fertilization treatments without inoculation. But, when biofertilization process was done the available nutrients content was increased. This trend of results was observed in *Acacia* and *Prosopis* treatments.

In general, from the data recorded in Table (6) it is obvious that the rhizosphere of *Prosopis* treatments contained slightly higher records of available nutrients content rather than the rhizosphere of *Acacia* treatments.

D. Sand accumulation behind of shelterbelts.

Data in Table (7) showed that non biofertilized treatments gave significant higher values of sand accumulation rather than the biofertilized ones. The same trend of results was observed during different year months. With respect to the nitrogen fertilizer levels effect, data in Table (7) revealed that the control treatment (without fertilization) gave the highest values of sand accumulation during different determination periods. This result was expected since the studied growth characters (Table, 3) showed the lowest values in this treatment and consequently the sand transmission was increased.

When nitrogen fertilizer was supplemented at a rate of 100 or 150kg N/fed gave significant lower values of sand accumulation compared to the application of N- fertilizer at a rate of 50kg N/fed. The lower values of sand accumulation which observed in case of N- fertilizer application at a rate of 100 or 150kg N/fed may be due to the high growth performance of *Acacia* and *Prosopis* trees which obtained in this treatment (Table, 3).

Data recorded in Table (7) indicated that the highest values of sand accumulation were observed during March and April and this was true in various treatments. The higher sand accumulation which recorded in this period is likely be due to the increase of wind movement during this period from year.

Concerning the interaction effect between bio and mineral nitrogen fertilization on sand accumulation, data in Table (8) indicated that the control treatment (non biofertilized and no N-application) gave the highest significant records of sand accumulation as compared to different investigation treatments. The same trend of results was obtained in both *Acacia* and *Prosopis* trees.

Table (8): Effect of the interaction between bio and mineral nitrogen fertilization on sand accumulation (g/cm width) during 2004 year.

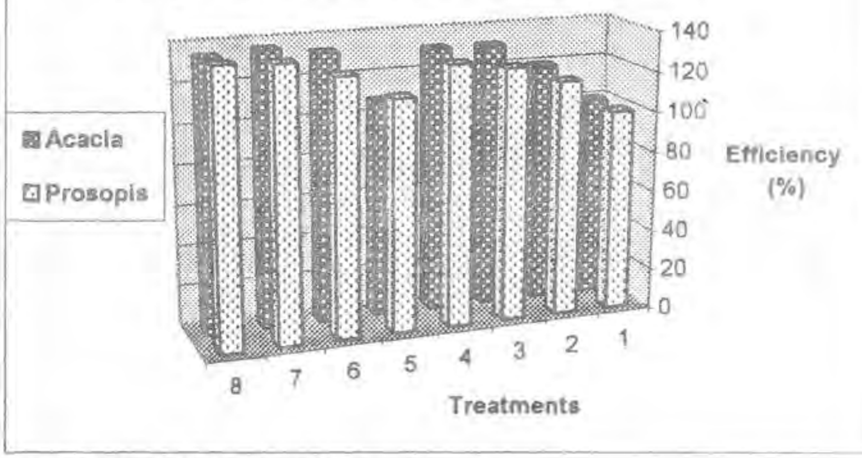
Bio ferti-lizer	N kg/fed	Jan.	Feb.	March	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.
	Acacia saligna												
Non Bio-fertilized	control	9.7	13.8	48	44	34	15.9	9.0	40.0	36.8	26.7	19.0	30.0
	50	7.7	10.7	42	39.9	30.4	15.6	6.3	28.0	27.6	21.6	15.0	18.4
	100	6.5	10.3	33.3	36.5	28.4	10.1	9.0	18.0	22.1	18.3	16.9	15.0
	150	5.7	6.2	25.9	19.9	9.7	3..3	5.1	15.0	18.0	15.6	10.0	12.5
Bio fertilized	witout	5.3	6.0	26.1	19.0	8.9	4.0	5.0	15.0	17.0	15.0	10.0	12.0
	50	6.6	7.4	27.1	25.9	18.9	7.0	7.0	18.0	22.6	19.7	12.0	16.2
	100	6.1	9..9	30.6	32.1	22.7	10.3	8.0	17.0	22.0	18.0	16.0	14.6
	150	7.7	11.2	31.5	27.3	19.7	8.0	8.0	20.0	24.6	20.9	17.0	17.4
L.S.D. 0.05		0.8	1.1	3..9	3.1	2.8	1.8	N.S	2.6	1..9	1..5	N.S	2.7
	Prosopis juliflora												
Non – Biofertilized	control	10.1	15.11	45.0	46.0	33.6	16.3	8.1	45.9	38.5	29.9	20.0	25.9
	50	9..3	11.90	40.0	40.1	27.6	14.2	8.0	40.8	30.6	20.6	15.0	19.8
	100	8.6	11.00	37.0	35.2	27.0	10.6	7.0	35.2	25.4	20.1	16.3	15.1
	150	8.1	10.6	36.0	34.1	26.5	10.1	7.0	34.1	20.3	19.9	16.1	15.0
Bio fertilized	witout	8.5	12.9	35.0	28.5	20.1	9.8	6.9	30.1	30.5	25.0	15.2	18.6
	50	6.9	9.7	25.0	24.6	17.6	8.0	5.1	21.6	25.6	19.5	10.3	16.1
	100	6.1	8.4	20.1	20.9	15.8	6.7	4.6	20.0	20.3	16.9	8.1	10.8
	150	6.0	8.0	20.1	20.8	15.7	6.2	4.5	20.1	20.0	16.2	7.9	10.2
L.S.D. 0.05		0.3	N.S	4.1	5.4	5.1	0.7	N.S	3..5	5..8	2.3	0.5	N.S

Generally, the lower values of sand accumulation which recorded in the treatment of biofertilization in presence of nitrogen fertilizer at a rate 100 or 150kg N/fed is likely be due to the vigorous growth of *Acacia* and *Prosopis* trees under these treatments. From the obtained results in Table (8) it can be concluded that the sand accumulation records were the highest during March and April months. This may be due to the higher sand movement during this period from the year.

E- Shelterbelt efficiency (%).

Data in Fig (1) indicated that shelterbelt efficiency of *Acacia* and *Prosopis* treatments were significantly increased in the biofertilization treatment compared to unbiofertilized one. Shelterbelt efficiency of *Acacia* and *Prosopis* trees was increased with the increasing of nitrogen fertilizer level. No significant difference in treatments efficiency of *Acacia* and *Prosopis* was observed in presence of biofertilization when nitrogen fertilizer was supplied at a rat of 100 or 150kgN/fed.

Fig (1) : Interaction effect for biofertilization and nitrogen fertilizer on shelterbelt efficiency



1-Control (Non biofertilized and No N-application).
2-50kgN/fed. 3-100kgN/fed. 4-150kgN/fed.
5-Biofertilized and No N-application 6- Biofertilized +50kgN/fed.
7- Biofertilized +100kgN/fed. 8- Biofertilized +150kgN/fed.

Application of nitrogen fertilizer at a rate of 100 or150kg N/fed. gave higher values of shelterbelt efficiency as compared to the applicatin of nitrogen at a rate of 50kg N/fed . But, when nitrogen fertilizer was applied at a rate 50kg N/fed showed higher values of shelterbelt efficiency rather than control treatment. The higher shelterbelt efficiency which observed when nitrogen fertilizer was supplemented at a rat of 100 or 150 kgN/fed combined with biofertilization is likely be due to the soil properties improvement and growth enhancement of *Acacia* and *Prosopis* trees.

CONCLUSION AND RECOMMENDATION

In view of the given results, it could be concluded that the biofertilization and nitrogen fertilizer plays a significant role in the improvement of soil fertility and chemical properties. Summing up, inoculation of *Acacia* and *Prosopis* plants with a specific strains of symbiotic N_2-fixers (Rhizobia) and application of moderate N-fertilizer dose (100 kg N/fed.) increased the growth characters of these trees as well as, the soil chemical properties were improved. Higher growth performance of *Acacia* and *Prosopis* trees positively reflected on shelterbelt efficiency since,the efficiency of shelterbelt for controlling shifting sand was increased with the application of bio and mineral nitrogen fertilization.

Therefore, the biofertilization process and 100kgN/fed. application could be recommended in a large scale in the areas of similar condition

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تحسين كفاءة أشجار الأكاسيا والبروسوبس للتحكم فى حركة الرمال باستخدام التسميد النتروجينى الحيوى والمعدنى.

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** قسم النبات الزراعى -كلية الزراعة بمشتهر -جامعة بنها

أقيمت تجربة حقلية بمنطقة توشكى خلال عامى٢٠٠٣/٢٠٠٤الدراسة كفاءة التسميد الحيوى والنيتروجينى فى تحسين نمو أشجار الأكاسيا والبروسوبس المنزرعة للتحكم في حركة الرمال بتوشكى،ولقد اوضحت النتائج الاتى:-

١- معاملات التسميد الحيوى والنيتروجيني لأشجار الأكاسيا والبروسوبس أدت الى الحصول على زيادة معنوية فى صفات النمو المدروسةبالمقارنة بمعاملة الكنترول.

٢- محتوى أوراق الأشجار تحت الدراسة من النيتروجين والفوسفور والبوتاسيوم قد زاد معنويا بمعاملة التسميد الحيوي مع إضافة السماد النيتروجيني بمعدل ١٠٠ كجم نيتروجين للفدان .

٣- بخصوص محتوي الأرض من المادة العضوية فقد اظهرت النتائج ان التسميد الحيوي أدى إلى زيادة معنوية فى نسبة المادة العضوية للتربة .

٤- عند إضافة السماد النيتروجين بمعدل ١٠٠ كجم نيتروجين للفدان مع التسميد الحيوى لوحظ زيادة معنوية فى محتوى التربة من عناصر النيتروجين والفوسفور والبوتاسيوم والحديد والنحاس والزنك والمنجنيز .

٥- بالنسبة لكفاءة المعاملات المستخدمة فى حجز الرما ل فقد أوضحت النتائج أن التسميد الحيوى في وجود السماد النيتروجينى بمعدل١٠٠ كجم نيتروجين للفدان ادى الى نقص معنوى فى كمية الرمال النافذة خلف الحزام الأخضر.

وعموما فقد أوضحت النتائج أن معاملة التسميد الحيوى في وجود ١٠٠ او١٥٠ كجم نيتروجين للفدان أدى إلي زيادة كفاءة الحزام المنزرع بالأشجار تحت الدراسة في حجز الرمال بنسبه ٣٦,٤ ٠/٠ فى اشجار الأكاسيا و٣٥ ٠/٠ فى أشجار البروسوبس . وبوجه عام يمكن التوصيه باجراء عمليه التسميد الحيوى مع إضافه ١٠٠ كجم نيتروجين للفدان عند زراعه أشجار الأكاسيا والبروسوبس فى المنا طق المشابهه لظروف هذه المنطقه .