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EFFECT OF DIFFERENT BIOFERTILIZERS ON PRODUCTIVITY OF SOME ACACIA SPECIES UNDER WADI SUDR CONDITIONS

BY

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ABSTRACT

Response of three Acacia species i.e. *Acacia viectoria, Acacia coriacea* and *Acacia saligna* to different biofertilizer resources i.e. *Bradyrhizobium, jabonicum*, phosphate dissolving bacteria, (*bacillus megatherium*), *Bradyrhizobium* mixed with phosphate dissolving bacteria and control, were studied under Wadi Sudr conditions during the period extended from autumn 2001 to spring 2003. The obtained results revealed the following:

1. Superiority of biofertilizer treatments over all uninoculated ones.
2. The optimum conditions for both plant and soil microbial groups with mixed inoculation treated were mainly achieved for *Acacia saligna* at spring season.
3. The other high productive treatment gave sufficient options for using specific Acacia species engaged with appropriate biofertilizer.
4. There are significant relation between *Bradyrhizobium jabonicum + Bacillus megatherium* (Bio_4) and crude fiber, total ash percentage, shrubs height, crown cover and crown volume of Acacia species particularly *A. saligna*.
5. The interaction between biofertilizer resources and Acacia species had a significant effect on fresh and dry forage yield which superior with *Acacia coriacea*.
6. The highest significant increase for total microbial counts, CO_2 evolution, PDB counts and aerobic cellulose decomposers recorded with (Bio_4) and *Acacia saligna* at spring season.

Key words: Saline calcareous soil, *Bradyrhizobium jabonicum, Bacillus megatherium,* microbial parameters, *Acacia viectoria, Acacia coriaceae, Acacia saligna,* fresh and dry forage yield,chemical compositions.

INTRODUCTION

Using bioorganic agriculture has become a hobe for the Egyptian agriculture to minimize the non stop addition of the high doses of the chemical fertilizer especially when the economical and environmental point of view are considered.

Symbiotic N2 fixing bacteria inoculation is essential for increasing agricultural production through ability of fixing nitrogen, producing phytohormons biocontrol activity and stimulating other soil microorganisms (Abdel-Hamid, 2000). Phosphate dissolving bacteria as *Bacillus, Pseudomonas* and some fungi possess the ability to bring insoluble phosphate in soil into soluble forms were also used as biofertilizers (Taha *et al.*, 1969, Ishac *et al.*, 1985 and Mighaed *et al.*, 2004).

However, the main problems under Wadi Sudr conditions are weak soil structure, light texture, salinity reached hazardeous levels poor fertility, wind erosion and arid climatic conditions (Abd El-Ghany *et al.* 1997).Using biofertilizers under desert stress conditions in new reclaimed desert soils and sand dune regions are very important for resistant wind erosion and increasing biological vegetation.

Acacia is one of the most successful leguminous shrubs used to overcome the lack of fodder in the desert conditions due to rapid growth and its drought resistance (Abou-Deya *et al.*, 1990 and Topps, 1992). Also, Skerman, (1977) reported that leaves are palatable to livestock which used fresh or dried into hay. They are especially used as a supplementary feed for sheep and goats and it can be completely grazed off without harming the plants. Furthermore Ibrahem, 1981 pointed that Acacia includes several species which are introduced for developing the retrograded range lands, particularly under harsh environment, improvement soil and sand dune fixation in arid and semiarid regions.

Acacia saligna tolerates all desert environmental conditions and it is successfully grow in saline soil, (Sheha, 1984 and Zaght *et al.*, 1993).Meanwhile, its leaves are high protein content which considered as forage source for sheep and goats, during dry seasons, (Gutteridge, 1991, Tiedman and Johnson, 1992 and Kandeel *et al.*, 1994).

This work was carried out to investigate the effect of biofertilizer resources on soil microbial properties, resistant wind erosion by formation of difficult erodible grains and increasing the biological vegetation under desert stress conditions and sandune regions.Bioorganic agriculture without mineral fertilization was used for decreasing the environmental pollution and increasing the growth and forage yield as well as chemical content of different Acacia species under Wadi Sudr conditions.

MATERIAL AND METHODS

Two field experiments were carried out at Wadi Sudr experimental Station of Desert Research Center (DRC), South Sinai Governorate to study the effect of different resources of biofertilizer on productivity and quality of some Acacia species during the period extended from autumn 2001 (dry season) to spring 2003 (wet season) . The soil at the experimental site is characterized as calcarous sandy clay texture (56% $CaCO_3$, EC 8.3 mmhos/cm and pH value 8.0).

Nursery site:

Seeds of the three Acacia species i.e. A. viectoria(S1), A. coriacea (S2)and A. saligna (S3) were planted in polyethylene bags filled with sand and clay soil (1:1) on September 1999 in D.R.C. greenhouse under controlled conditions. After six months and before transplantation in the permanent site, seedling were treated with rhizobial suspention where CMC (0.5%) was used as an adhesive agent.

Permanent Site:

Seedlings of Acacia species, were transplanted in the permanent site at Wadi Sudr Exp. Station, after adding 30 m^3/fed of sheep manure, which mixed with soil surface layer one month before cultivation without using chemical fertilization. Seedlings, were distributed at a distance of 2x2 meter (1050 shrubs/fed.). After six months biofertilizers were used as foliar application for plants and surrounding roots. After good established with shrubs two years old cutting was carried out during the period extended from autumn 2001 to spring 2003. The under ground saline water (8000 ppm) was used in irrigation.

Organisms:

Bradyrhizobium jabonicum was isolated from active nodules obtained from Acacia spp. grown in calcareous soil. *Bacillus megatherium* (active phosphate dissolver) was isolated from the rhizosphere of wheat plants grown in calcareous soil. *Bacillus* and *Bradyrhizobia* isolates were purified and identified according to Sneath, (1994) and using Bunt and Rovira media (Taha *et al.* 1969), respectively.

Fresh liquid culture of 7 days old pure local strain either of *Bacillus* or *rhizobia* were intended as biofertilized in the form of single or mixture (1:1) at the rate of $\simeq 10^8$ cells/ml for each of the two bacterial strains. These bacterial cultures having the capability to with and stress desert soil conditions were provided from soil microbiology unit Desert Research Center, Cairo, (Abdel-Hamid, 2000).

The Biofertilizer treatments under study were:
Control (BiO_1); *Bradyrhizobium jabonicum* (BiO_2); *Bacillus megatherium* (BiO_3) and *Bradyrhizobium jabonicum* mixed with *Bacillus megatherium* (BiO_4).

Plant Measurements:

The following measurements were determined at each season, shrub height (cm), crown cover (m^2) and crown volume (m^3) by using the following formula, respected by Thalen (1979).

crown cover = $1/4\ \pi \times D_1 \times D_2$.

crown volume = $1/6\ \pi \times D_1 \times D_2 \times H$

where $\pi = 3.14$, D_1 and D_2 = the shortest and the longest diameters of the shrub, respectively.

and H = plant height.

Fresh yield (ton/fed) was calculated by multiplying the average trender phytomass of the shrubs by the number of shrubs/fed. Dry yield (ton/fed) was determined by taking fresh samples to dry in oven 70°c.Each treatment was milled to fine powder and used for subsequent chemical analysis:

- Crude protein: total nitrogen was determined by modified micro Kjeldahl according to peach and Tracy (1956) and multiplied by 6.25 (Tripathi *et al.*, 1971).

- Crude fiber and total ash were determined by using the method outlined by A.O.A.C. (1970).
- Sodium and potassium were estimated by using a flamphotometer according to Brown and Lilleland (1946).

Microbiological determinations:

Rhizosphere soil samples were taken during the period extended from autumn 2001 to spring 2003 and subjected to microbial determination. Total microbial counts on soil extract agar (Page *et al.*, 1982), Phosphate dissolving bacterial count on Bunt and Rovira agar medium after modification by (Taha *et al.*,1970), CO_2 evolution was determined according to (Atef and Nannipien, 1995) as index to microbial activity in soil. Total nitrogen and organic matter content in rhizosphere soil was estimated as described by Black *et al.* (1982) as a creteion of microbial nitrogen fixation and fertility.

The twelve treatments were arranged in randomized complete block design with three replications.

Data obtained were statistically analyzed using computer statistical program COSTAT according to procedures otulined by Snedecor and Cochran (1980). Means were compared using Duncan's new multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

1. Shrub growth characters:

Significant differences in some growth character i.e. shrub height, crown cover and crown volume were observed between different biofertilizer resources during wet (spring) and dry (autumn) seasons in both years, except during spring in the second year (Table 1).

Bradyrhizobium jabonicum (BiO_2) + *Bacillus megatherium* (BiO_3) mixture increased the significantly shrub height as compared with no biofertilizer,(BiO_1) followed by *bradyrhizobium* (BiO_2) and phosphate dissolving bacteria *(Bacillus megatherium)* (BiO_3).

Generally, the stimulating effect of bio mixed inoculation on growth (shrub height,crown cover &volume)may be attributed to provide the shrubs with continuous nitrogen supplying by nitrogen fixing bacteria (Abd El Hamid 2000) as well as providing them with available soluble phosphate produced by phosphate dissolving bacteria (Ishac, 1986).This may be produce phytohormones (Abd El-Hamid, 2000) and biological control elemination of the plant enemies including microbial pathogens (Lugtenberg *et al.*, 1991), that play an important role in plant organ. In this respect, Basu and McKabi (1987) inoculated 7 species of acacia seeds with either *Rhizobium* sp. or Rhiz. + *Azoto*, after 150 days, they found that nodulation and the plant growth were enhanced in all treatments compared with control, and the most effective treatment varied with legume species.

Table (1): Growth parameters, fresh and dry productivity and chemical content of some *Acacia* species as affected by different resources of biofertilizer during the period extended from autumn 2001 to spring 2003 seasons.

Year	2001/2002						
Treatments	Autumn						
	Biofertilizer resources				Acacia species		
Triats	BiO_1	BiO_2	BiO_3	BiO_4	S1	S2	S3
Shrub height (cm)	87.17b	138.33a	112.83ab	139.00a	67.38b	95.00b	195.63a
Crown cover (m^2)	0.423b	0.827ab	0.573ab	0.964a	0.328b	0.870a	0.892a
Crown volume (m^3)	0.254c	0.462bc	0.731ab	0.925a	0.164b	0.693a	0.923a
F. forage yield (ton/fed.)	0.132b	0.265b	0.164b	0.523a	0.098b	0.366a	0.349a
D. forage yield (ton/fed.)	0.050b	0.111b	0.067b	0.205a	0.044b	0.139a	0.141a
Crude protein (%)	5.98a	5.86a	5.41a	5.06a	5.52a	5.10a	6.12a
Crude fiber (%)	23.91a	24.85a	26.89a	23.04a	24.76a	28.00a	21.26b
Total ash (%)	6.29a	5.02a	5.41a	6.39a	5.81a	6.08a	5.43a
Na^+ (%)	0.554ab	0.628a	0.424b	0.443ab	0.571a	0.466a	0.500a
K^+ (%)	0.371a	0.398a	0.353a	0.344a	0.391a	0.339a	0.370a
	Spring						
Shrub height (cm)	102.83b	149.17ab	128.17ab	156.17a	80.88b	111.13b	210.25a
Crown cover (m^2)	0.596b	0.805b	1.100b	1.89a	0.577b	1.500a	1.215a
Crown volume (m^3)	0.715b	0.673b	1.224ab	1.975a	0.376b	1.747a	1.317a
F. forage yield (ton/fed.)	0.374b	0.549ab	0.467ab	0.818a	0.441b	0.346b	0.870a
D. forage yield (ton/fed.)	0.137a	0.165a	0.171a	0.270a	0.149b	0.137b	0.271a
Crude protein (%)	8.05a	9.14a	7.00a	9.06a	6.86a	9.00a	9.03a
Crude fiber (%)	16.37a	16.95a	18.13a	14.53a	18.65a	18.07a	12.77b
Total ash (%)	7.59ab	8.03a	7.59ab	6.56b	7.57a	7.06a	7.69a
Na (%)	0.593a	0.557a	0.533a	0.580a	0.623a	0.608a	0.468a
K^+ (%)	0.465a	0.4360a	0.425a	0.518a	0.486a	0.505a	0.410a
	2002/2003						
	Autumn						
Shrub height (cm)	115.83b	160.00ab	143.67ab	174.17a	95.63b	131.88b	217.75a
Crown cover (m^2)	0.828b	1.390ab	0.940b	2.230a	0.912b	1.824a	1.305ab
Crown volume (m^3)	0.866b	1.389b	0.994b	2.561a	0.495b	1.390a	1.932a
F. forage yield (ton/fed.)	0.700b	1.006ab	0.910ab	1.453a	0.840a	0.991a	1.221a
D. forage yield (ton/fed.)	0.318a	0.423a	0.413a	0.538a	0.357a	0.442a	0.470a
Crude protein (%)	6.04a	7.14a	6.17a	6.04a	6.41ab	4.88b	7.75a
Crude fiber (%)	26.49a	24.56a	24.09a	21.32a	21.43b	32.37a	18.54b
Total ash (%)	6.96a	4.76a	6.36a	6.66a	6.05a	5.51a	6.99a
Na (%)	0.617a	0.693a	0.593a	0.580a	0.680a	0.608a	0.575a
K^+ (%)	0.328a	0.383a	0.337a	0.332a	0.310a	0.331ab	0.394b
	Spring						
Shrub height (cm)	137.0a	160.33a	168.17a	178.50	110.00c	150.00b	223.00a
Crown cover (m^2)	0.997a	0.802a	0.885a	1.357a	0.550b	1.434a	1.046ab
Crown volume (m^3)	1.072a	0.930a	0.968a	1.817a	0.419b	1.569a	1.603a
F. forage yield (ton/fed.)	1.234a	0.910a	1.811a	2.476a	0.834b	3.130a	0.860b
D. forage yield (ton/fed.)	0.555a	0.467a	0.837a	1.111a	0.420b	1.401a	0.406b
Crude protein (%)	3.67c	5.63b	5.62b	8.04a	5.13b	7.13a	4.96b
Crude fiber (%)	26.15a	21.85ab	20.77b	18.46b	21.25a	24.18a	19.99a
Total ash (%)	8.36a	4.49a	8.42a	8.35a	8.28b	6.52c	9.66a
Na (%)	0.240a	0.267a	0.238a	0.276a	0.291a	0.228b	0.247ab
K^+ (%)	0.262a	0.272a	0.253a	0.270a	0.257a	0.248a	0.288a

Means having the same letters are not different significantly at P = 0.05 level of significantly.

BiO_1 = Control BiO_2 = *Bradyrhizobium jabonicum* BiO_3 = *Bacillus megatherium*

BiO_4 = BiO_2 + BiO_3 S1 = *A. viectoria* S2 = *A. coriaceae.* S3 = *A. saligna*

The growth characters (shrub height,crown cover &volume) differed significantly among acacia species, (Table 1). In general, it could be concluded that *Acacia saligna was* superior than other two species in most growth characters especially during autumn in both years followed by *Acacia coriacea*.This may be due to rapid growth and its drought resistance (Abou-Deya *et al.*, 1990 and Topps, 1992). Furthermore, they tolerate all desert environmental conditions and they give a successful growth under saline soil, (Sheha, 1984 and Zaght *et al.*, 1993).

The interaction between the two factors under study was not significant on the growth characters except crown cover and volume during spring in both years, (Table 2). The highest values were obtained when biomixed inoculation interacted with *Acacia coriacea.*

II. Forage productivity:

Data in Table (1) reveal that the fresh forage yield of acacia species significantly affected by various biofertilizer resources. These trend was noticed during different seasons in both years. An exception was observed in spring of the second year. The highest fresh forage yield was recorded by application of *Bradyrhizobium* mixed with phosphate dissolving bacteria treatment, which superior than the control by 296%, 135%, 108% and 101% during autumn and spring of the two years, respectively. This may be attributed to the effect of this treatment on the promotion of growth parameters.

On the other hand, the insignificant increase was observed for dry forage yield with different biofertilizer treatments except during autumn in the first year. The maximum values were also obtained with *Bradyrhizobium* mixed with phosphate dissolving bacteria.

With respect to the different acacia species, data in Table (1) indicate that *Acacia saligna* gave significantly higher fresh forage yield in spring and autumn of the first and second year, respectively, while *Acacia coriacea* was superior in autumn and spring of the first and second year,respectively.

It is evident from (Table 1) that dry forage yield followed closely the same trend of the fresh forage yield. The maximum fresh and dry forage yields of *Acacia saligna* were recorded during both seasons in the two years except in the spring of the second year.

The interaction between the main factors (biofertilizer resources and acacia species) had a significant effect on fresh and dry forage yields in autumn of the first year and during spring of the second year, Table (2). The highest fresh and dry forage yield were obtained when *Acacia coriacea* treated with *Bradyrhizobium* mixed with phosphate dissolving bacteria.

III. Chemical content:

The influence of biofertilizer resources on chemical composition of different acacia species during the period extended from autumn 2001 to spring 2003 (Table, 1)showed that there was gradual and slight insignificant effects on crude protein, crude fiber, total ash and mineral content percent by using different biofertilizer resources. This trend was true during autumn in the two years, whereas, in spring there was significant effect for total ash in first year, crude fiber and crude protein in the second year.

Table (2): Effect of the interaction between different biofertilizer resources and some *Acacia* species on growth parameters, forage productivity and chemical content during the period extended from *autumn* 2001 to spring 2003 seasons.

Years	2001/2002							
Seasons	Autumn				Spring			
Biofertilize season / Acacia species	BiO_1	BiO_2	BiO_3	BiO_4	BiO_1	BiO_2	BiO_3	BiO_4
Crown Cover (m^2)								
Acacia viectoria	-	-	-	-	0.189Aa	0.432Aa	0.656Aa	1.031Ac
Acacia coriaceae	-	-	-	-	0.551Da	0.709CDa	1.436BCD	3.305Aa
Acacia saligna	-	-	-	-	1.048Aa	1.276Aa	1.209Aa	.327Ab
Crown volume (m^3)								
Acacia viectoria	-	-	-	-	0.308Aa	0.122Aa	0.350Aa	0.727Ab
Acacia coriaceae	-	-	-	-	1.494Aa	1.511Aa	1.975Aa	.008Aa
Acacia saligna	-	-	-	-	0.344Da	0.388CDa	1.347BCD	3.190Aa
Fresh forage yield (Ton/fed.)								
Acacia viectoria	0.043Aa	0.116Aa	0.101Aa	0.134Ac	-	-	-	-
Acacia coriaceae	0.046Da	0.308BCD	.061CD	1.050Aa	-	-	-	-
Acacia saligna	0.309Aa	0.371Aa	0.329Aa	.387Ab	-	-	-	-
Dry forage yield (ton/fed.)								
Acacia viectoria	0.020Aa	0.055Aa	0.049Aa	0.053Ac	-	-	-	-
Acacia coriaceae	.019cD	0.124BCD	0.019Da	0.396Aa	-	-	-	-
Acacia saligna	0.110Aa	0.154Aa	0.134Aa	.166Ab	-	-	-	-
Total ash (%)								
Acacia viectoria	-	-	-	-	6.295DC	8.860Aa	8.440BCD	.680CD
Acacia coriaceae	-	-	-	-	6.310Abc	8.600Aa	6.545Aa	6.785Aa
Acacia saligna	-	-	-	-	10.175Aa	6.640CDa	7.710BCD	6.215Da
Crude fiber (%)								
Acacia viectoria	-	-	-	-	20.050Aa	16.425Cb	20.940Aa	7.175BC
Acacia coriaceae	-	-	-	-	16.920Cb	21.510Aa	20.140Bb	3.695D
Acacia saligna	-	-	-	-	12.145Bc	12.905Ac	13.300Ac	2.730AB
2002/2003								
Crown Cover (m^2)								
Acacia viectoria	-	-	-	-	0.494Aa	0.525Aa	1.093Aa	0.909Ac
Acacia coriaceae	-	-	-	-	.449BCD	0.82CDa	0.622Da	2.883Aa
Acacia saligna	-	-	-	-	1.049Aa	1.098Aa	0.940Aa	.097Ab
Crown volume (m^3)								
Acacia viectoria	-	-	-	-	0.340Aa	0.415Aa	0.845Aa	0.075Ac
Acacia coriaceae	-	-	-	-	1.425B-CDa	0.659CDa	0.646Da	3.548Aa
Acacia saligna	-	-	-	-	1.453Aa	1.717Aa	1.413Aa	.830Ab
Fresh forage yield (Ton/fed.)								
Acacia viectoria	-	-	-	-	0.788Aa	1.155Aa	1.155Aa	0.237Ac
Acacia coriaceae	-	-	-	-	2.468CDa	0.657Da	3.255BCD	6.143Aa
Acacia saligna	-	-	-	-	0.447Aa	0.919Aa	1.024Aa	.050Ab

Table (2) : Cont.

Seasons	Autumn				Spring			
Biofertilize season / Acacia species	BiO_1	BiO_2	BiO_3	BiO_4	BiO_1	BiO_2	BiO_3	BiO_4
Dry forage yield (Ton/fed.)								
Acacia viectoria	-	-	-	-	0.393Aa	0.565Aa	0.596Aa	0.125Ac
Acacia coriaceae	-	-	-	-	0.064CDa	0.400Da	1.402BCD	2.738Aa
Acacia saligna	-	-	-	-	0.209Aa	0.436Aa	0.511Aa	.470Ab
Total ash (%)								
Acacia viectoria	-	-	-	-	8.275Aab	7.185Abc	9.010Aa	8.635Aa
Acacia coriaceae	-	-	-	-	6.280Ab	5.245Ac	7.180Aa	7.375Aa
Acacia saligna	-	-	-	-	10.510Aa	10.350Aa	9.055Aa	9.040Aa
Crude fiber (%)								
Acacia viectoria	-	-	-	-	21.710Ac	21.725Aa	18.750Aa	2.820A
Acacia coriaceae	-	-	-	-	34.665Aa	23.730BCD	9.875CD	8.450Da
Acacia saligna	-	-	-	-	22.070Abc	20.100AB	23.695Aa	4.100B

- : Not significant.

The same average in the same row is indicated by capital letters whereas in the same column in indicated by small letters.

BiO_1 = Control BiO_2 = *Bradyrhizobium jabonicum* BiO_3 = *Bacillus megatherium*
BiO_4 = BiO_2 + BiO_3

No clear and insignificant effects were observed for the different chemical percentages concerning the different Acacia species in autumn and spring of the first year. An exception was noticed in crude fiber which, *Acacia saligna* had a lower value and there was no significant difference between the two other species. However, in the second year the contrary was true, there was significant differences between Acacia species in their chemical content. The maximum values of crude protein and total ash percentages were obtained from *Acacia saligna* in spring season, while, the lowest value of crude fiber percent was recorded.

Biofertilizer resources interacted with different Acacia shrubs species causing significant effect on crude fiber and total ash percentages in spring of the two years, Table (2).

IV. Microbiological determinations:

A- Total microbial counts:

Regarding biofertilizer application either individuals or as a mixture could be significantly affected on microbial counts and inorder arranged as follows: (*Bacillus megatherium* (Bio_3) + *Bradyrhizobium japonicum* (Bio_2) > Bio_2 > Bio_3 > uninoculated (Table 3). Thus mixed inoculation increased counts as much as 3 folds if compared with uninoculated one.

The rhizosphere of *A. saligna* plant recorded the highest counts significantly followed in descending order *A. coriaceae* and the least significant by *A. viectoria*.

Thus, the highest total microbial counts recorded at spring season using mixed inoculation and *A. saligna rhizosphere being* $303x10^5$ CFU/gm dry soil and increased counts N 3 folds if compared with uninoculated (control) treatment.

Table (3): Influence of *Bradyrhizobium japonicum*, *Bacillus megatherium* strains (individual or mixture) into rhizosphere of *Acacia* species. trial on microbial counts during autumn and spring seasons (2001/2003).

Treatment	(Counts x 10^5 CFU g dry soil)			
	Acacia viectoria	*Acacia coriaceae*	*Acacia saligna*	Mean
	Autumn season			
Cont. Bio_1	55.50 c	66.67 c	85.33 d	69.17 d
Brad. Bio_2	152.27 b	203.67 b	213.33 b	189.76 b
PDB Bio_3	149.67 b	197.00 b	206.33 c	184.33 c
Brad + PDB Bio_4	194.33 a	245.00 a	257.33 a	232.22 a
Mean	137.94 c	178.08 b	190.58 a	
	Spring season			
Cont. Bio_1	78.28 c	99.74 c	118.68 c	98.90 c
Brad. Bio_2	174.73 b	245.43 b	252.50 b	224.22 b
PDB Bio_3	171.70 b	244.42 b	247.45 b	221.19 b
Brad + PDB Bio_4	228.26 a	277.75 a	303.00 a	269.67 a
Mean	163.24 c	216.83 b	230.41 a	

Initial count = 30 x 10^5 CFU g dry soil.
BiO_1 = Control. BiO_2 = *Bradyrhizobium jabonicum*
BiO_3 = *Bacillus megatherium* BiO_4 = BiO_2 + BiO_3
Mean values in the same box sharing an alphabet are not significantly different.

The results are in agreement with Subba Rao (1988). Abd-El Ghany (1996), Abdel-Hamid (2000) and Abd-El Rahman (2003) who stated that microbial inoculation increased the number and biological activity of desired microorganisms in the root environment.

B- CO_2 evolution:

Obtained results recorded in Table (4) apparently reveal that mixed inoculation gave the highest CO_2 evolution levels in comparison to individuals which gave slightly lower CO_2 evolution figures.

In all cases the rhizosphere of uninoculated *Acacia* species plants gave the lowest Co_2 evolution values.

Results in Table (4) show that CO_2 evolution is positively correlated with total microbial counts under different inoculant either alone or as a mixture as concluded by Khalil *et al.* (1991), Faid (1994), Abd El-Hamied (1995), and Abo-Alaa (2002).

C- PDB

It is clear from the data presented in Table (5) that counts of PDB at spring season were higher than those at autumn season. Mixed inoculation significantly increased PDB $\simeq$ 2 folds if compared with individuals and 3 folds in comparison to control.

Table (4): Influence of *Bradyrhizobium japonicum, Bacillus megatherium* strains (individual or mixture) into rhizosphere of *Acacia* species, on Co_2 evolution during autumn and spring seasons (2001-2003).

Treatment	Co_2 evolution (mg Co_2/100g dry soil/24 hr)			
	Acacia viectoria	*Acacia coriaceae*	*Acacia saligna*	Mean
	Autumn season			
Cont. Bio_1	0.48 c	0.62 c	0.91 c	0.67 c
Brad. Bio_2	0.87 b	1.11 b	1.45 b	1.14 b
PDB Bio_3	0.86 b	1.11 b	1.41 b	1.13 b
Brad + PDB Bio_4	1.06 a	1.60 a	2.08 a	1.58 a
Mean	0.82 c	1.11 b	1.46 a	
	Spring season			
Cont. Bio_1	0.56 c	0.86 c	1.24 c	0.89 c
Brad. Bio_2	1.11 b	1.43 b	1.74 b	1.43 b
PDB Bio_3	1.06 b	1.41 b	1.74 b	1.40 b
Brad + PDB Bio_4	2.34 a	2.57 a	2.79 a	2.57 a
Mean	1.27 c	1.57 b	1.88 a	

Initial CO_2 evaluation 0.25

Mean values in the same box sharing an alphabet are not significantly different.

Table (5): Influence of *Bradyrhizobium japonicum, Bacillus megatherium* strains (individual or mixture) into rhizosphere of *Acacia* species,on phosphate dissolving bacteria during autumn and spring seasons (2001-2003).

Treatment	Densities of P-dissolvers 10^2 CFU/g dry soil			
	Acacia viectoria	*Acacia coriaceae*	*Acacia saligna*	Mean
	Autumn season			
Cont. Bio_1	49.24 c	63.13 c	76.26 c	62.87 c
Brad. Bio_2	152.76 b	206.04 b	216.14 b	191.65 b
PDB Bio_3	152.01 b	202.00 b	214.12 b	189.38 b
Brad + PDB Bio_4	189.38 a	252.50 a	277.75 a	239.88 a
Mean	135.85 c	180.92 b	196.07 a	
	Spring season			
Cont. Bio_1	66.66 c	92.42 c	102.01 c	87.03 c
Brad. Bio_2	188.87 b	228.51 b	245.43 b	220.94 b
PDB Bio_3	186.85 b	224.22 b	245.43 b	218.83 b
Brad + PDB Bio_4	205.03 a	287.85 a	328.25 a	273.71 a
Mean	161.85 c	208.25 b	230.28 a	

Initial count = 30 x 10^2 CFU/ g^{-1} dry soil.

Mean values in the same box sharing an alphabet are not significantly different.

Also, the counts of PDB was significantly increased by acacia species in ascending order 161.85, 208.25, 230.28 x 10^2 CFU/gm dry soil as means average in the rhizosphere of *A. viectoria, A. coriaceae* and *A. saligna* at spring season, respectively.

Thus, mixed inoculation (PDB + Brad) stimulated the counts of PDB in the rhizosphere of *A. saligna* which significantly doubled if compared with control.

D. Aerobic cellulose decomposers:

Cellulose decomposers are the first group of bacteria attacking organic matter and breaking its complexity that encourage the proliferation of other group of microorganisms.

Table (6) show that densities tended to increase by using different types of biofertilizers rather than the control. The highest density was recorded in the treatment inoculated with (PDB + Bradyrhizosphere) followed in descending order by individuals.

The highest cellulose decomposers densities were significantly recorded with *A. saligna* followed in descending order by *A. coriaceae* and *A. viectoria* at both seasons.

The highest significant value was recorded with rhizosphere of *A. saligna* plant using (PDB + *Bradyrhizobium*) as mixed inoculation,this increased densities as much as 4 folds if compared with uninoculated treatment at spring season.

E- Organic Matter(O.M):

The mixed inoculation significantly increased O.M.% followed in descending order by individual treatments and uninoculated one under *A. saligna* > *A. coriaceae* > *A. viectoria* at spring and autumn seasons, (Table 7).

F. Total Nitrogen(T.N).:

Data presented in table (8) show that the highest total nitrogen content was observed by using biofertilized treatment for *A. saligna* at spring season. The high pH value, high calcium carbonate may cause N volatization in the from of ammonia resulting in decrease of the total nitrogen available for the growing plants.

Finally, the study maintains a lot of options which could be used up in any farm conditions.

It could be concluded from the above results that application of biofertilizers activated soil microorganisms particularly in plant rhizosphere region and was more efficient for root colonization and tolerant desert stress conditions. (Subba Rao, 1988, Abd El-Hamid 2000, Migahaed *et al.*, 2004) using biofertilizer essential for wind erosion control under Wadi Sudr conditions because biofertilization enhancing the formation of difficult erodible grains (Abd El Ghany *et al.*, 1997) and also the interaction between biofertilizer resources and acacia species had a significant effect on shrubs height, crown cover, crown volume, crude fiber and total ash. Finally it is very important for resistant wind erosion by formation of difficult erodible grains and increasing the biological vegetation under desert stress conditions and sandune regions. Using bioorganic agriculture with might mineral fertilization for decreasing the environmental pollution and increasing the growth and forage yield as well as chemical content of different Acacia species under Wadi Sudr conditions.

Table (6): Influence of *Bradyrhizobium japonicum, Bacillus megatherium* strains (individual or mixture) into rhizosphere of *Acacia* species. plants, on aerobic cellulose decomposers densities during autumn and spring seasons (2001-2003).

Treatment	MPN of cellulose decomposers 10^5 cells/g dry soil			
	Acacia viectoria	*Acacia coriaceae*	*Acacia saligna*	Mean
	Autumn season			
Cont. Bio_1	0.61 c	0.63 d	0.91 d	0.71 d
Brad. Bio_2	0.94 b	1.21 b	1.82 b	1.32 b
PDB Bio_3	0.93 b	1.11 c	1.72 c	1.25 c
Brad + PDB Bio_4	1.41 a	1.82 a	2.22 a	1.82 a
Mean	0.97 c	1.19 b	1.67 a	
	Spring season			
Cont. Bio_1	1.11 d	1.41 c	1.72 c	1.41 d
Brad. Bio_2	2.22 c	2.83 b	2.83 b	2.63 c
PDB Bio_3	2.42 b	2.83 b	2.85 b	2.70 b
Brad + PDB Bio_4	2.83 a	3.54 a	5.45 a	3.94 a
Mean	2.15 c	2.65 b	3.21 a	

Initial count = 0.3 x 10^5 cells/g dry soil
Mean values in the same box sharing an alphabet are not significantly different.

Table (7): Influence of *Bradyrhizobium japonicum, Bacillus megatherium* strains (individual or mixture) into rhizosphere of *Acacia* species. plantson organic matter percent in soil.

Treatment	Organic matter content %			
	Acacia viectoria	*Acacia Coriaceae*	*Acacia saligna*	Mean
	Autumn season			
Cont. Bio_1	0.21 c	0.30 c	0.39 c	0.30 c
Brad. Bio_2	0.49 b	0.68 b	0.81 b	0.66 b
PDB Bio_3	0.54 b	0.66 b	0.81 b	0.67 b
Brad + PDB Bio_4	0.73 a	0.87 a	1.17 a	0.92 a
Mean	0.49 c	0.63 b	0.80 a	
	Spring season			
Cont. Bio_1	0.41 c	0.46 d	0.57 d	0.48 d
Brad. Bio_2	0.57 b	0.78 b	0.94 b	0.76 b
PDB Bio_3	0.56 b	0.74 c	0.89 c	0.73 c
Brad + PDB Bio_4	0.83 a	1.05 a	1.39 a	1.09 a
Mean	0.59 c	0.76 b	0.95 a	

Initial soil organic matter content 0.12.
Mean values in the same box sharing an alphabet are not significantly different.

Table (8): Influence of *Bradyrhizobium japonicum, Bacillus megatherium* strains (individual or mixture) into rhizosphere of *Acacia* species. plants on total nitrogen percent in soil during autumn and spring seasons (2001-2003).

Treatment	Total nitrogen %			
	Acacia viectoria	*Acacia coriaceae*	*Acacia saligna*	Mean
	Autumn season			
Cont. Bio_1	0.028 d	0.028 c	0.051 c	0.036 d
Brad. Bio_2	0.034 b	0.030 b	0.064 b	0.034 b
PDB Bio_3	0.030 c	0.030 b	0.063 b	0.041 c
Brad + PDB Bio_4	0.057 a	0.071 a	0.081 a	0.069 a
Mean	0.037 a	0.040 b	0.064 a	
	Spring season			
Cont. Bio_1	0.0323 d	0.0343 d	0.0566 d	0.0404 d
Brad. Bio_2	0.0444 b	0.0626 b	0.0758 b	0.0609 b
PDB Bio_3	0.0424 c	0.0606 c	0.0737 c	0.0589 c
Brad + PDB Bio_4	0.0667 a	0.0838 a	0.0949 a	0.0818 a
Mean	0.0460 c	0.0603 b	0.0752 a	

Initial soil total nitrogen 0.016 %

Mean values in the same box sharing an alphabet are not significantly different.

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دراسات على إنتاجية ونوعية بعض أنواع الاكاسيا تحت تأثير مصادر مختلفة من التسميد الحيوى بمنطقة وادى سدر

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** قسم خصوبة ميكروبيولوجيا الأراضى – مركز بحوث الصحراء – المطرية – القاهرة

أجرى هذا البحث لدراسة تأثير مصادر مختلفة من التسميد الحيوى (مثبتات آزوت تكميليـة – بكتريا مذيبة للفوسفات – مخلوط مثبتات الأزوت + بكتريا مذيبة للفوسفات – والمقارنة) وذلك على إنتاجية ونوعية بعض أنواع الآكاسيا تحت ظروف رأس سدر – محافظة جنوب سيناء خلال الفترة من خريف ٢٠٠١ حتى ربيع ٢٠٠٣ .
وكانت أهم النتائج المتحصل عليها :

١- أدى استخدام السماد الحيوى بكل أشكاله الى زيادة النشاط الميكروبى مقارنة بمعاملة الكنترول.

٢ -أدى استخدام مخلوط مثبتات الأزوت التكاملية مع البكتريا المذيبة للفوسفات الى زيادة معنوية فى صفات النمو الخضرية وبعض المكونات الكيميائية .

٣ -تفوقت الأكاسيا سالجنا على الأنواع الأخرى فى معظم الصفات.

٤ -تم الحصول على أعلى قيمة فى معظم القياسات عند استخدام المخلوط الحيوى مع الاكاسيا سالجنا.

٥ - زيادة العدد الكلى للميكروبات ومعدل تصاعد ثانى أكسيد الكربون وأعداد الميكروبات المذيبة للفوسفات وكذلك أعداد الميكروبات المحللة للسيليلوز هوائيا وذلك عند استخدام المخلوط الحيوى مع الاكاسيا سالجنا فى موسم الربيع .