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EFFECT OF SOME BIOFERTILIZERS ON THE MORPHOLOGICAL AND ANATOMICAL CHARACTERS OF GUAR PLANT UNDER DIFFERENT SALINITY LEVELS .

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ABSTRACT

The present investigation was carried out to find out the effectiveness of some biofertilizer treatments for improving the salinity tolerance and vegetative yield of guar plants. Results indicated that: in both seasons, averages of all the studied characters; plant height, numbers of branches, leaves and internodes/ main stem, average root length; fresh and dry weights of shoot and root as well as yield components were decreased by all used salinity levels comparing to the control. This reduction increased progressively with raising salinity levels and reached its maximum at 6000 ppm. All biofertilizer treatments caused a significant increase in all studied characters, especially the Composite inoculum (N_2- fixers + phosphorein).

The anatomical study of the treated plants, with 6000 ppm salinity level, exhibited a considerable decrease in thickness of stem and its tissues; epidermis, cortex and vascular cylinder. The same trend was also occurred with all leaf tissues. On the contrary, biofertilizer (Composite inoculum) caused an increase in most tissues of the stem and leaf comparing with the control plants.

INTRODUCTION

Guar (*Cyamopsis tetragonoloba* (L.) Taubert is a leguminous plant at semi-arid regions (Omar *et al.*, 1993), being moderately tolerant to salinity and drought. Guar plant gives high yield under favorable conditions and needs low nitrogen fertilization. The plant is slightly affected by pests and diseases(Stutzel,1989). Therefore, it is recommended to grow a belt of guar plants surrounding cotton fields to protect the fields against pests.

Guar is originally grown in India and Pakistan as a vegetable and green manure crop. It is used as a summer forage crop rich in protein (16%), instead of corn (9% protein). Guar plants gives two cuttings, the first is after two months (apx.10 tons/fed). The second is one month more (apx. 6 tons/fed). After the first cutting, the plants left to obtain the yield of seeds (500 kg/fed). Many industries uses depend on guar seeds; i.e, gum extraction, medical purposes (laxative) and food manufacturing (Staffored and Hymowitz, 1980).

It was found that using biofertilization either as single or multi application (using several bacterial strains; such as *Bacillus, Azotobacter, Azospirillum* and *Pesudomonas*) induced significant increases in plant growth and yield Saber and Gomma,1993; Awad,1998 and Hewedy,1999). According to soil fertility and organic manure, applying biofertilizers alone without simulative rates of mineral fertilizers(25, 33, 50 or 75% from the recommended chemical fertilizers) less effective than the recommended rates of NPK fertilizer(Saber and Gomaa, 1993; Abd el Ati *et al*,1996 ; Awad, 1998 and Hewedy, 1999).

The goal of this investigation was to study the effectiveness of some biofertilizer treatments; N_2- fixers (*Rhizobium* sp), phosphorein (phosphate dissoliving becteria) and Composite inoculum (1 N_2 fixers+ 1 phosphorein) for improving salinity tolerance of guar plants. In addition to the effect of these treatments for increasing the vegetative yield as animal food.

MATERIALS AND METHODS

Pot experiments were conducted in green house at the Agricultural Experiments and Research Station, Faculty of Agriculture, Cairo University, Giza, Egypt during the two successive seasons 2004 and 2005.

Number of bacterial strains belong to genera *Rhizobium* sp and *Bacillus* sp were purified and indentified according to API microtube system (Logan and Berklay,1984). Bacterial strains i.e. N_2- fixers (*Rhizobium* spp) and Phosphorein (*Bacillus* sp) known also as phosphate dissolving bacteria were used in inoculation treatments. Each strain was precultrued in nutrient broth medium at 30°C in incubator with shaking rate at 140 rpm for 3-5 days. Four combinations of bacterial strains treatments were tested for inoculation the guar plants in pot experiments as follows:

1- Uninoculated plants (control),
2- *Rhizobium* sp (N_2- fixers),
3- Phosphorein (*Bacillus* sp) and
4- 1 ml of *Rhizobium* (N_2- fixers) + 1 ml of *Bacillus* sp as a composite inoculated.

Four salinity levels (0,2000,4000 and 6000 ppm) were prepared by mixing sodium chloride, calcium chloride and magnesium sulphate at the rate of 2: 2 :1 by weight, respectively.

Seeds of guar, cv. Local Land Race, were secured from Forage Crop Research Department, Agricultural Center, Giza. The experiment was conducted in a complete randomized block design with four replicates. Guar seeds were sown on 15 th May in both seasons in black plastic pots 30 cm in diameter and 30 cm in depth. Pots filled with mixture of clay and sand (2:1 by weight). Bacterial inoculum was carried on beat moss and coating the cultivar seeds. Five seeds/ pot were sown and irrigated weekly with one liter of tap water.

Data for the following parameters were recorded:

A) Vegetative characters

1- Plant height (cm)
2- Number of branches/plant
3- Number of leaves/plant
4- Number of internodes/ main stem
5- Average root length (cm)
6- Fresh and dry weights (g) of the shoot and roots.

B) Yield component characters:

1- Average number of pods/plant
2- Average number of seeds/pod
3- Average number of seeds/plant
4- Weight of seeds/plant (g)
5- weight of 100 seeds (g).

Data were subjected to different methods of statistical analysis according to computer software designed for statistical analysis (MSTAT, 1986).

C) Anatomical studies

Vegetative samples from the control plants and the treatments that showed the highest morphological variations; Composite inoculum (N_2- fixers + phosphorein) and 6000 ppm salinity level were taken in the second season at beginning of the flowering stage to study the effect of salinity and Composite inoculum on the anatomical structure of plant organ,(stem and leaf). Specimens were taken from the middle internode of the main stem. Similarly, samples 1 cm^2 were taken from the middle portion of a leaf blade including midrib on the same node. Specimens were killed and fixed in F.A.A. (10 ml formalin, 5 ml glacial acetic acid and 85 ml ethyl alcohol 70%). Fixed materials were washed in 50 % ethyl alcohol, dehydrated in a normal butyl alcohol series, and embedded in paraffin wax (mp 56 C°). Sections 20 (μ) thick were cut and stained by crystal violet and erythrosine combinations (Jackson,1926), cleared in xylene and mounted in Canada balsam (Willey, 1971).

RESULTS AND DISCUSSION

A- Morphological characters:

The mean values of the morphological characters of guar plant on the two successive seasons are presented in Table (1).

1- Plant height:

All biofertilizer treatments gave significantly higher values of the plant height compared to the control. Moreover, the Composite inoculum (N_2-fixer+ phosphorein) showed an increase of the above character than the other two individual treatments in both seasons. In the first season, the percentage increases in the plant height were 6.15, 9.98 and 14.89 % for N_2-fixers, phosphorein and composite, respectively. While, in the second season, these percentages were 1.15, 4.33 and 8.49 % in the same order. Generally, the results revealed that, biofertilization caused a significant increase in plant height in both seasons. These results are in agreement with those reported by Abd Alla *et al* (1994) on wheat and Shah and Joshi (1986) on cereal.

Concerning the effect of salinity on plant height under biofertilizer conditions, the results in Table (1) showed that plant height values were significantly reduced with increasing salinity levels by 3.38, 12.55 and 22.27% for 2000, 4000 and 6000 ppm, respectively. The decrease in plant height was reported by Youssef (2003) on guar plant, in addition to Elham (2002) on mung bean.

2 -Number of branches/ plant

Data concerning number of branches/ plant, on both seasons, as affected by biofertilization under different levels of salinity are presented in Table (1). Generally, the results indicated that the number of branches/ plant was significantly increased with all biofertilizer treatments under different salinity levels.

Table 1: Effect of biofertilizer treatments on vegetative characters of guar plant under different levels of salinity in both seasons

seasons	Characters	plant height (cm)					Number of branches/ plant					Number of leaves/ plant					Number of internodes/ main stem					Average root length (cm)				
	Salinity / biofertilizer	0	2000	4000	6000	Mean	0	2000	4000	6000	Mean	0	2000	4000	6000	Mean	0	2000	4000	6000	Mean	0	2000	4000	6000	Mean
2004	Control	160.5	140.9	135.2	117.8	138.5	4.5	3.5	.2.9	2.1	3.3	45.4	40.3	36.2	30.1	38	32.4	28.5	25.1	21.2	26.8	18.4	15.6	12.3	9.4	13.9
	N2 fixers	164 7	156.4	140	127	147	4.9	4.3	3.2	2.4	3.7	49.5	44.8	40.1	33.2	41.9	36.5	31.6	28.4	24.6	30.3	22.6	18.9	15.4	12.4	17.3
	Phosphorein	167.2	162.8	149.2	130	152.3	5.2	4.6	25.8	3.8	4.4	55.4	46.7	42.4	37.8	45.6	38.9	32.6	30.1	25.8	31.9	25.2	21.2	17.6	14.6	19.7
	Composite	170.4	170.2	155.4	140.4	159.1	5.5	5.1	4.5	4.3	4.9	59.2	48.2	46.4	40.1	48.8	40.4	34.9	33.2	27.1	33.9	29.1	24.6	20.4	18.4	23.2
	Mean	165.7	160.1	144.9	128.8		5.1	4.4	3.6	3.2		52.4	45	41.3	35.3		37.1	31.9	29.2	24.7		23.8	20.1	16.4	13.7	
	L.S.D.																									
	S.	4					0.6					2.4					2.25					2.1				
	B.	4.2					0.3					3.6					3.01					2.6				
	S*B	5.1					0.8					4					3.3					3				
2005	Control	170.2	161.2	138.4	120.2	147.5	5.1	4.2	3.1	1.9	3.6	48.2	43.2	39.1	32.2	40.7	35.6	31.6	28.1	22.6	29.5	20.8	16.2	13.1	10.6	15.2
	N2 fixers	175.4	163	144.2	130	149.2	5.3	4.8	4.1	2.5	4.2	52.9	46.8	43.2	35.8	44.7	39.1	34.2	31.4	25	32.4	24.8	21.2	17.4	13.1	19.1
	Phosphorein	178.9	166.4	149.1	134.1	153.9	5.6	4.8	4.3	2.9	4.4	56.4	48.7	46.8	39.2	47.8	41	35.6	33.1	26.2	34	26.7	22.6	18.2	14.9	20.6
	Composite	181.4	168.2	156.2	144.2	160	5.9	5.1	4.4	3.5	4.7	61.6	51.2	49.5	41.4	50.9	42.1	37.6	34.4	28.4	35.6	30.2	25.1	21.1	19.2	23.9
	Mean	168.9	162.5	146.9	132.1		5.5	4.7	4	2.7		54.8	47.5	44.7	37.2		39.5	34.8	31.8	25.6		25.6	21.3	17.5	14.5	
	L.S.D.																									
	S.	1.02					0.2					2.9					2.2					0.41				
	B.	1.30					0.4					3.2					2.7					0.5				
	S*B	1.85					1.0					3.9					3					1.2				

Compared to the control, these increases were 12.12, 33.3 and 48.5% with N_2- fixers, phosphorein and Composite inoculum, in the first season and 16.7, 22.2 and 30.6% in the second season, respectively.

Concerning salinity effects, data in Table (1) showed significant decrease in number of branches/ plant. These obtained data clearly revealed that the response to producing branches when guar plants were stressed by various salinity levels was similar to that previously described with plant height as affected by the same salinity levels in both seasons. The reduction in number of branches/ plant was recorded earlier by Essa (2002) on soybean and Youssef (2003) on guar plant.

3- Number of leaves/ plant

All biofertilizer treatments significantly increased the number of leaves/ plant as compared to the control in both seasons. Relative to the control percentage numbers of leaves increased by 10.3, 20.0 and 28.4 % in the first season and 9.8, 17.4 and 25.1 % , in the second season after inoculation with N2- fixers, phosphorein and Composite inoculum, respectively.

Data represented in Table (1) clearly showed that, the stressed guar plant by increasing the salinity levels caused highly reduction in number of leaves/ plant. Reda *et al*. (2000) reported that increasing salt concentration during irrigation of the *Leucacena* plant significantly decreased number of compound leaves/ plant.

4- Number of internodes/ main stem

Number of internodes/ main stem , in both seasons, as affected by biofertilization under different levels of salinity are presented in Table (1). The results indicated that, this number increased with all biofertilizer treatments under different salinity levels. The three salinity levels significantly decreased number of internodes/ plant compared to control. The reduction was corresponding with the increments of the salinity levels. The same result was reported by Youssef (2003) on guar plant.

5- Root length

Data in Table (1) showed similar trend to that obtained with the plant height. This indicated that the biofertilizer treatments enhanced the root length (cm), in the two seasons. The percentage of root length in the first season was increased by 24.5, 41.7 and 66.9 % after treated the plant by N_2- fixers, phosphorein and composite, respectively, and 25.7, 35.5 and 57.2 % , respectively in the second season in the same order. In both seasons, the highest values of root length, compared to control, were obtained by treated the plant with Composite inoculum mixture. The increase of root length may be attributed to the increase in cell growth enhancement by endogenous hormone after inoculation by biofertilizer treatments.

The obtained data in Table (1) revealed that, relative to the control the reduction in mean values of root length as affected by different salinity levels were significant. This indicated that, salinity had an adverse effect to biofertilizer on the root length at various levels. The depressing effect of salinity on the root length of faba bean plants was also recorded by Salem *et al*. (2002).

6- Growth analysis (Fresh and dry weight)

Averages of fresh and dry weights of shoot and root are presented in Table (2). All biofertilizer treatments represented a significant values of fresh weight of shoot and root as compared with untreated plants in both seasons. Values of shoot fresh weight , in the first season, were increased by 8.2, 11.1 and 15.1 % after treated the plant with N_2- fixers, phosphorein and composite, and 7.2, 9.1 and 15.3 % in the second season, respectively. The same trend was observed with the values of dry shoot weight .

The values of fresh weight of root were significantly increased with all biofertilizer treatments, by 45.5, 90.7 and 136.5 % with N2- fixers, phosphorein and composite, respectively in the first season and 18.3, 63.4 and 93.9 % in the second season, in the same order. The same trend of the dry weight of root was occurred. It is worthy to note that the highest value of averages fresh and dry weights of shoot and root were obtained with Composite inoculum.

Results of fresh and dry weights of guar plant under three salinity levels are presented in Table (2). The three salinity levels significantly decreased fresh and dry weights, compared to the control. The reduction was corresponding with the increasing in salinity levels. This finding is in agreement with those obtained by Youssef (2003) on guar plant. It is also, evident that the interaction effect between salinity and biofertilizer treatments were significant indicating that biofertilizer treatments mainly affected guar plants by compensating the harmful effects that may be caused by salinity levels. So, it is obvious that Composite inoculum showed the highest recorded values for fresh and dry weight.

In this respect, Mass and Nieman (1978) attributed the reduction in plant growth to the effect of salinity on many metabolic processes including enzyme activity, protein and nucleic acids syntheses, and activity of both mitochondria and chloroplasts. Also, Feng and Barker (1992) on tomato and Amzallage *et al.* (1992) on soybean mentioned that salinity induced growth inhibition, may result from unbalance in phytohormone levels, and through its effect on either the biosynthesis or the destruction of the plant hormone action.

It is also, evident that the interaction effects between salinity and biofertilizer treatments were significant indicating that biofertilizer treatments mainly affected guar plants by compensating the harmful effects that may be caused by salinity levels. So, it is obvious that Composite inoculum showed the highest recorded values for plant height, numbers of branches, leaves, internodes, average root length and growth analysis.

Yield components characters

Results of yield and its components under the biofertilizer and the three salinity levels are shown in Table (3). Regarding the effect of biofertilizer under different levels of salinity in both seasons, it was found that all biofertilizer treatments tended to increase numbers of pods/ plant, seeds/ pod, seeds / plant , weight of seeds and 100 seeds weight.

Table 2: Mean values of fresh and dry weights of shoots and roots of guar plants as affected by different biofertilizer treatments under different levels of salinity in both seasons

seasons	Characters	Shoot fresh weight (g)					Root fresh weight (g)					Shoot dry weight (g)					Root dry weight (g)				
	Salinity / biofertilizer	0	2000	4000	6000	Mean	0	2000	4000	6000	Mean	0	2000	4000	6000	Mean	0	2000	4000	6000	Mean
2004	Control	95.6	90.4	83.2	72.6	85.5	6.4	4.3	2.49	1.5	3.67	19.16	15.5	12.4	8.2	13.8	2.9	2.1	1.7	1.02	1.93
	N2 fixers	100.4	96.6	92.6	80.2	92.5	8.42	6.44	3.6	2.9	5.34	22.4	18.4	15.4	9.8	16.5	3.2	2.8	2.1	1.82	2.48
	Phosphorein	101.2	97.5	95.8	85.4	95	9.22	8.5	5.8	4.31	7	26.26	20.5	17.6	11.4	18.9	4.6	3.91	2.6	2.02	3.28
	Composite	106.4	100.2	97.2	89.6	98.4	11	10.11	8.41	5.2	8.68	31.81	24.6	20.2	15.4	22	6.5	4.62	3.81	3.41	4.59
	Mean	100.9	96.18	92.2	82		8.76	7.34	5.08	3.48		24.9	19.8	16.4	11.2		4.3	3.4	2.6	2.1	
	L.S.D.																				
	S.	1.02					0.11					1.4					0.2				
	B.	1.21					0.11					1.4					0.3				
	S*B	1.82					0.36					1.6					1.0				
2005	Control	97.8	92.5	84.6	75.4	87.6	7.9	5.8	3.9	2.95	5.13	21.2	17.6	14.2	9.6	15.65	3.8	3.0	2.1	1.92	2.7
	N2 fixers	102.6	98	92.8	82.4	93.9	9.2	7.2	4.8	3.1	6.07	25.3	20.6	17.9	11.8	18.9	4.6	3.8	2.9	2.0	3.3
	Phosphorein	103.4	96.9	95	87.2	95.6	11.5	10	6.4	5.6	8.38	29.01	23.71	20.5	13.99	21.8	6.1	4.6	4.0	2.8	4.4
	Composite	107.7	104.2	99.8	92.3	101	12.2	11.1	10.2	7.11	10.15	32.2	26.9	23.1	18.6	25.2	8.4	6.8	4.6	3.6	5.9
	Mean	102.9	97.9	93.1	84.3		10.2	8.5	6.3	4.7		26.9	22.2	18.9	13.5		5.7	4.6	3.4	2.6	
	L.S.D.																				
	S.	1					0..2					1.21					0.22				
	B.	1.6					0.41					1.61					0.31				
	S*B	1.9					0.88					2.02					0.81				

Table 3: Effect of biofertilizer treatments on yield and its components of guar plant under different levels of salinity in both seasons

Seasons	Characters	Number of pods/ plant					Number of seeds/ pod					Number of seeds/ plant					Seed weight / plant (g)					100 seed weight (g)				
	Salinity / biofertilizer	0	2000	4000	6000	Mean	0	2000	4000	6000	Mean	0	2000	4000	6000	Mean	0	2000	4000	6000	Mean	0	2000	4000	6000	Mean
2004	Control	59.5	56.2	52.1	42.0	52.5	6.4	6.1	5.4	5.0	5.7	381	343	281	213	303.8	144.2	129.8	106.4	80.6	115.3	34.58	31.1	25.5	19.33	27.6
	N2 fixers	70.9	64.0	55.5	44.9	58.8	6.5	6.2	5.6	5.2	5.9	460	396	310	233	349.8	179.9	151.6	113.5	86.7	120.4	45.94	32.0	27.2	20.8	28.9
	Phosphorein	72.9	69.4	58.0	45.5	61.5	6.7	6.5	6.1	5.8	6.3	488	451	353	263	389.3	189.3	166.1	137.2	99.9	133.1	48.20	35.0	30.5	23.9	31.9
	Composite	73.5	70.2	60.0	48.5	63.1	7.0	6.9	6.8	5.9	6.7	514	484	406	286	423	198.4	177.1	156.8	108.2	145.1	50.40	37.67	35.2	25.9	34.8
	Mean	69.2	65.0	56.4	45.2		6.7	6.4	6.0	5.5		460.8	418.5	338	273		155.5	141.2	123.5	93.9		44.8	33.9	29.6	22.5	
	L.S.D.																									
	S.	1.80					0.02					4.5					3.9					0.4				
	B.	2.00					0.04					6.2					4.5					0.8				
	S*B	2.30					0.20					8.6					5.1					1.2				
2005	Control	60.0	54.2	50.0	38.9	50.8	6.5	6.0	5.1	4.5	5.5	390	325	255	175	286.3	147.6	123	96.5	66.2	108.3	35.4	29.5	18.3	13.0	24.1
	N2 fixers	61.5	56.0	52.0	41.6	52.8	6.8	6.4	5.3	4.9	5.9	418	358	276	204	314	158.2	135.5	104.5	77.2	118.9	37.9	33.1	23.3	15.0	27.3
	Phosphorein	63.1	59.0	55.0	46.2	55.8	7.0	6.5	5.6	5.3	6.1	442	384	308	245	344.8	167.3	145.3	116.6	92.7	130.5	40.1	34.8	29.4	21.2	31.4
	Composite	64.5	61.2	57.0	50.0	58.2	7.2	6.8	6.2	5.8	6.5	465	416	353	290	381	176.0	157.4	133.6	109.8	144.2	42.2	37.7	32.1	24.8	34.2
	Mean	62.3	57.6	53.5	44.2		6.9	6.4	5.6	5.1		428.8	370.8	298	228.5		162.3	140.3	112.8	86.5		38.9	33.8	25.8	18.5	
	L.S.D.																									
	S.	0.13					0.1					6.3					4.2					1.2				
	B.	0.18					0.2					9.5					6.1					1.5				
	S*B	0.20					0.8					10.2					7.2					2.01				

The percentage values of number of pods/ plant were increased over the control plants by 12.0, 17.1 and 20.2 % in the first season and by 3.9, 9.8 and 14.6% in the second season after treated the plant with N2- fixers, phosphorein and composite, respectively. Number of seeds/ pod in the first season by 3.5,10.5 and 17.5 % and 7.3, 10.9 and 18.2 % in the second season under N_2- fixers, phosphorein and Composite inoculum, respectively. Number of seeds/ plant increased by 15.1, 28.1 and 39.2 % with N2- fixers, phosphorein and composite, respectively as compared to the control in the first season. Also, these numbers were 9.7, 20.4 and 33.1 %, respectively in the second season. Weight of seeds/ plant and 100 seed weight were significantly increased with all biofertilizer treatments.

Results of yield and its components under the three salinity levels are presented in Table (3). The salinity levels sinificantly decreased all the studied characters than the control plant. The significant reduction was corresponded with the increasing salinity levels. The maximum reduction was observed at 6000 ppm. Increasing the salinity levels in the irrigation water decreased growth and yield components of guar plants. These results were in accordance with those reported by Francois *et al.* (1990), Afria (1998) and Youssef (2003) on guar plant.

So, it is obvious that in both seasons, Composite inoculum showed the highest increased percentages as compared with control for number of pods/ plant, number of seeds/ pod, number of seeds/ plant, seed yield and 100 seed weight being 20.2, 10.9, 39.2, 25.48 and 26.09% for the first season and 14.6, 18.2, 33.1, 33.1 and 41.9 for the second season, respectively.

Anatomical studies

From the pervious studies it was realized that both biofertilizer (composite inoculum) and the highest salinity level (6000 ppm) shown the most distinguishable morphological changes comparing with the control plant for this reason, were chosen for the anatomical study. Samples from the middle internode of the main stem, in addition to leaf from the same node were chosen. The measurements (μ) were shown in Tables (4 and 5) and Figs. (1 and 2, a, b and c).

Regarding the stem structure the anatomical results indicated that, biofertilizer (composite inoculum) increased the stem diameter 9229 (μ) as compared with 8600 (μ) of the control. Relative to the control, epidermis was thicker 32 (μ) than the control 30 (μ). Also, thickness of cortex were 925.5 (μ) and 850 (μ) for the composite inoculum and control, respectively. This was accompanied by the increase in number of layers from 10 in control to 11 in composite inoculum. Thickness of vascular cylinder increased from 1590 (μ) in control to 2150 (μ) in composite inoculum. Its also realized that composite inoculum resulted in an increase in average xylem vessel diameter showed 9.3% increase as compared with the control . While, pith diameter of the treated plant was decreased than the control, since it was 2740 (μ) with Composite inoculum and 3220(μ) in the control.

Results of the anatomical study revealed that, composite inoculum as compared with the control had a stimulative effect in increasing all measurements and counts of stem except that of pith diameter. Epidermis thickness showed 6.67% increase in composite inoculum . Also, cortex thickness was increased due to the increase in number of cortex layers by 10% and the average cortex cell diameter showed an increase as compared with the control. The vascular cylinder was also showed a remarkable increments due to the increase occurred in both number and diameter of xylem vessels.

Transverse sections in the main stem of guar plant, as affected by 6000 ppm salinity showed that treatment caused decreased the stem diameter being 8.25 % less than the control. This reduction was accompanied by a decrease in most included tissues, as the decrease percentages were 20, 5.88, and 21.79 % for epidermis , cortex and vascular cylinder thickness, respectively. While, pith diameter of the treated plant was increased than the control by 8.76 %.

Concerning leaf structure, Table 5 and Fig. 2 (a, b and c) shown the measurements of different tissues of the leaf blade of the control and treated plants with Composite inoculum.

Results indicated that, Composite inoculum gave thinner blade than the control, being 557 (µ) thinner palisade and spongy tissues, being 285 and 225 (µ), respectively compared with 300 and 258 (µ) of the control.

Table 4: Measurements (in µ) and counts of certain histological features in transverse sections of the middle internode of the main stem of guar plant as effected by biofertilizer (Composite inoculum) and 6000 ppm salinity level.

Characters	Control	Composite inoculum	6000 ppm
Stem diameter	8600	9229	7890
Thickness of epidermis	30	32	24
Thickness of cortex	850	925.5	800
No. of cortical layers	10	11	10
Thickness of vascular cylinder	1790	2150	1400
Average vessel diameter	86	94	76
Pith diameter	3220	2740	3502

Table 5: Measurements (in µ) of certain histological features in transverse sections through leaf blade on the middle node of the main stem of guar plant as effected by biofertilizer (Composite inoculum) and 6000 ppm salinity level.

Characters	control	Composite inoculum	6000 ppm
Thickness of blade	590	557	520
Thickness of plisade tissue	300	285	240
Thickness of spongy tissue	258	225	220
Thickness of midrib	580	680	510
Dimensions of midrib bundle			
Length	220	270	200
width	195	200	180

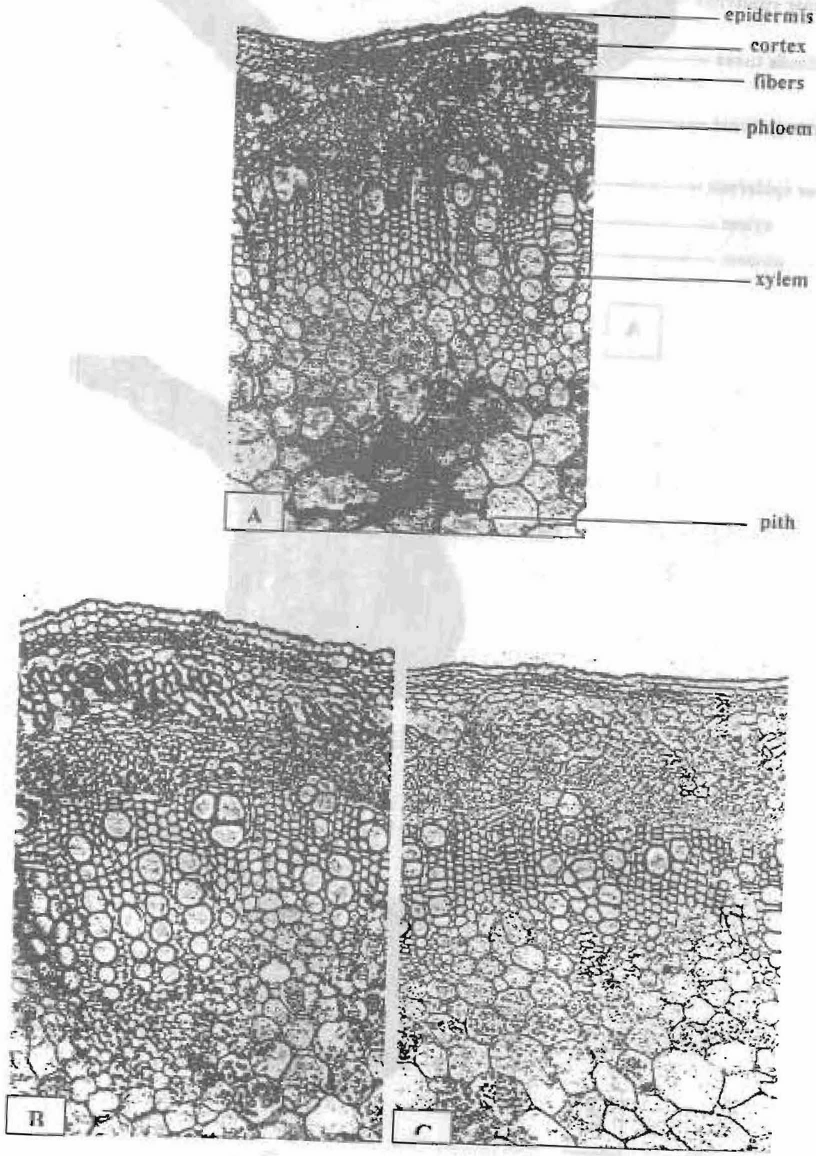

Fig. 1: Transverse sections of middle internode of the main stem of guar plant :
A- Control.
B- Biofertilizer (composite treatment).
C- 6000 ppm salinity level. (100X)

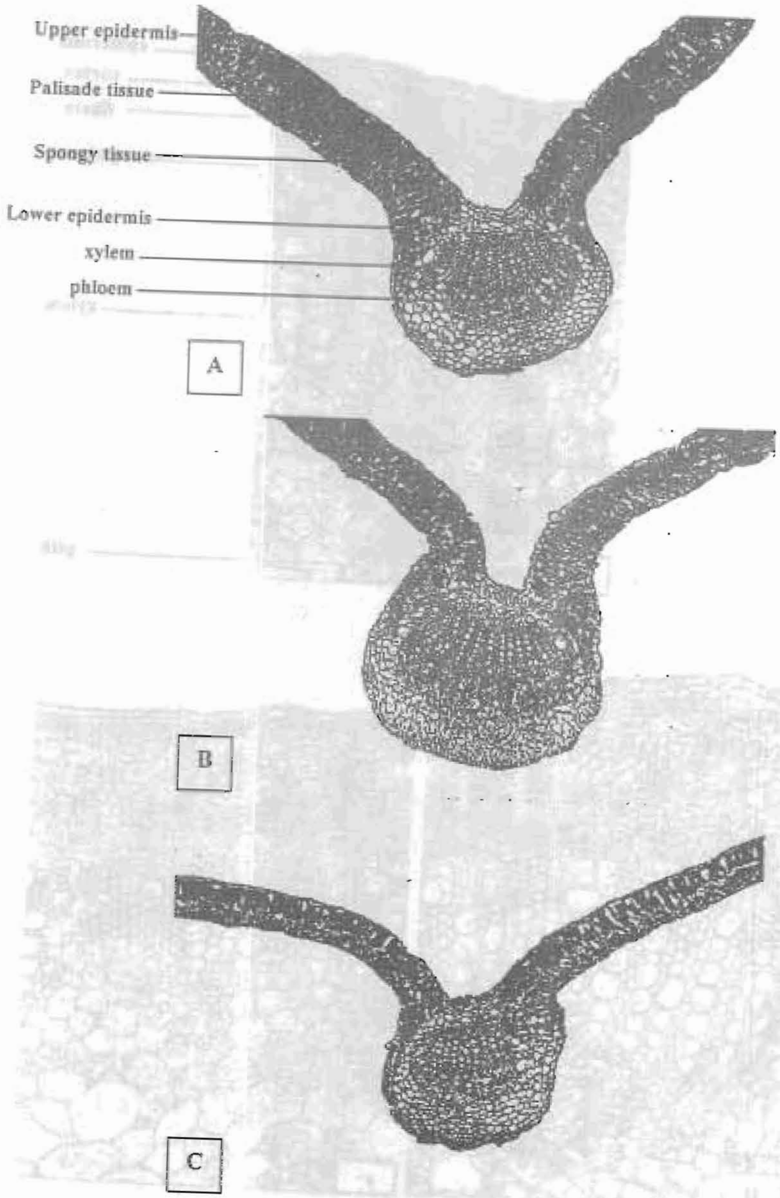

Fig. 2: Transverse sections of leaf blade of guar plant :
A- Control.
B- Biofertilizer (composite treatment).
D- 6000 ppm salinity. (40X)

The midrib thickness was increased in the treated plants (680 µ), while it was 580 (µ) in the control. Moreover, xylem and phloem thickness exhibited a constant increase due to Composite inoculum as compared with the control.

Composite inoculum gave thinner blade than the control by 5.59 % due to thinner palsied and spongy tissues by 5 and 12.97 % . While, midrib thickness, length and width of its bundle were increased by 17.24, 22.72 and 2.56 %, respectively.

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تأثير بعض المخصبات الحيوية على بعض الصفات المورفولوجيــة والتــشريحية لنبات الجوار تحت مستويات مختلفة من الملوحة.

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أجرى هذا البحث لدراسة تأثير بعض المخصبات الحيوية لتحمل نبات الجــوار للملوحــة وزيــادة محصوله الخضرى.

وكانت أهم النتائج هى:

ادت معاملات الملوحة فى كلا الموسمين الى نقص معنوى فى الصفات المورفولوجيــة (طــول النبات- طول الجذر- عدد الاوراق- عدد الافرع- عدد السلاميات- الاوزان الطازجة و الجافة للمجمــوع الخضرى و الجذرى) كذلك مكونات المحصول (عدد القرون- عدد بذور القرن- عدد بذور النبــات- وزن البذور- وزن ١٠٠ بذرة) عند المقارنة بالكنترول. ويزداد معــدل الــنقص بزيــادة مــستويات الملوحــة المستخدمة.حيث يكون اعلى معدل نقص عند ٦٠٠٠ جزء فى المليون.

كما اظهرت كل المعاملات بالتسميد الحيوى زيادة معنوية فى الصفات المدروسة وخاصة المعاملة باللقاح المكون من الفوسفورين بالاضافة الى مثبتات النيتروجين الجوى مقارنة بالكنترول .

أظهرت الدراسة التشريحية ان المعاملة بالتركيز ٦٠٠٠ جزء فى المليــون ادت لحــدوث نقــص ملحوظ فى قطر الساق وانسجة المختلفة (البشرة- القشرة- الاسطوانة الوعائية). وقد حدث نفــس الاتجــاة مع كل انسجة الورقة. وعلى العكس سببت المعاملة بالمركب الحيوى زيادة فى معظم انسجة الساق والورقــة مقارنة بالكنترول.