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EFFICIENCY OF SEED INOCULATION WITH N-FIXING BACTERIA IN DECREASING THE MINERAL N REQUIREMENTS FOR EARLY AND LATE SOWN COTTON PLANTINGS

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ABSTRACT

The hypothesis that seed inoculation with the N-fixing bacteria: *Azotobacter chroococcum* and *Azospirillum brasilense* could reduce the meniral N requirements for early and late sown cotton plantings was tested at the experimental farm of Mallawi Agric. Res. Station, Agric. Res. Center, Minia, Egypt, during 2002 and 2003 Seasons, using Giza 83 cotton cultivar. Seed bacterial inoculation was combined with five graded rates of chemical N; 0, 15, 30, 45 and 60 kgN/fed., while the control treatment was 60 kgN/fed. without bacterial inoculation. The obtained results from that study could be summarized as follow :

Delaying cotton sowing tended to give taller plants with longer internodes, but it markedy reduced most of yield components and seed cotton yield/fed. While sowing date had no effect on leaves content of chlorophyll.

Across planting dates, reducing the chemical N rate to be 0 or 15 kgN/fed. at early sowing, even with seed bacterial inoculation, significantly reduced leaves content of chlorophyll, most of growth parameters and yield components, and seed cotton yield/fed. However, with seed inoculation with N-fixing bacteria, leaves content of chlrophyll a, b and total chlorophylls as well as seed cotton yield per fed. were not significantly reduced with decreasing the meniral N rate to 45 kgN/fad., and all studied growth parameters and yield components were not significantly reduced with reducing the mineral N rate to 30 kgN/fad. at late sowing.

The interaction of planting date X N had significant effects on leaves content of total chlorophyll, number of open bolls/plant, and seed cotton yield/fad. as the reduction in these traits due to reducing the meniral N rate under early planting date was higher than under late one.

It could be concluded from this study that due to inoculation of cotton seed with N-fixing bacteria, the chemical N rate could be decreased to 45 N/fad. for early planting and to 30kgN/fad. for late planting without significant reduction in seed cotton yield, saving at least 15 kg/fad. from the recommended mineral N rate, reducing the costs of meniral N fertilizers and environmental pollution at the same time.

INTRODUCTION

Nitrogen is the limiting element for cotton under local conditions. Cotton plant responds favourably to N application and its growth and productivity are markedly suppressed with reducing N supply (Hamissa and Abdel-Salam, 1999). Thus, the application of chemical N fertilizers exhibits much significance for maintaining high cotton yield. However, the chemical N fertilizers are not only a costly input, but also a pollunating to the agroecosystem. Sustainable agroecosytem is essential for agricultural development. Production of the environment with the sustainability of the soil and agroecosystem should gain as much concern as maintaince of high yield. Therefore, there is a currrent trend, at the local as well as the global scale, to reduce the use of mineral N fertilizers with keeping high crop productivity at the same time (El-Aggory *et al.*, 1996). On the way to achieve such valuable goal, biofertilizers represent a promising approach through serving as a safe, effective, and economical source of nitrogen (Bohlool *et al.*, 1992; Afify & Ashour, 1993; Omar, 1995 and Bastia, 2001). The practical application of biofertilizers is important for sustainable agriculture, economically by reducing the cost of using N fertilizers and, ecologically by reducing nitrate pollution and other harmful impacts on environment (El-Aggory *et al.*, 2001; Bohlool *et al.*, 1992; and Ashour *et al.*, 1993). Biological N fixation has been shown to supply many non-legumes field crops, including cotton, with a reasonable portion of their N requirements (Saber, 1993; El-Aggory *et al.*, 1996, and Singh *et al.*, 2001).

Among a few microorganisms capable of fixing N, are the free-living bacteria: Azotobacter and Azospirillum which exhibit high capacity in fixing elemental N non-sympiotically (Rao, 1982; and Kennedy and Tchan, 1992). In cotton, several workers obtained increases in cotton yield and yield components using the inoculation with Azotobacter and/or Azospirillum under supplemental merniral N rates lower than the recommended ones for cotton (Chitrir and Wangikar, 1986; Shende *et al.*, 1988; Khune *et al.*, 1989; Basu, 1992; and Mannukaer, 1993). Afify & Ashour (1993) and Ashour *et al.* (1993) reported that soil inoculation with Azotobacter improved both growth and productivity of cotton plant to be equal to or better than those obtained by the application of 30 kgN/fad. They recommended that mineral N fertilizers must be substituted by biological N fixation as an effective solution of environmental pollution. Besides, the beneficial effects of Azotobacter are related not only to its N-fixing proficiency but also to its ability to produce antibacterial and antifungal compounds, growth regulators, and vitamins (Rao, 1982; and Pandey and Kumar, 1989). On the other hand, Dahatonde (1996) and Wankhade *et al.* (2001) reported that seed cotton yield was not increased by soil or seed inoculation with Azotobacter and/or Azospirillum.

In the light of these results, the present study was performed to evaluate the efficiency of seed inoculation with the N-fixing bacteria *Azotobacter chroococcum* and *Azospirillum brasilense* in decreasing the mineral N requirements for early and late sown cotton plantings.

MATERIALES AND METHODS

Two field experiments were conducted at Mallawi Agric. Res. Station, Minia govrtnorate, Egypt, during 2002 and 2003 seasons, to study the effect of cotton seed inoculation with mixture of two N-fixing bacteria namely *Azotobacter chroococcum* and *Azospirillum brasilense* with graded levels of chemicals N fertilizer on growth and yield of cotton cultivar Giza-83 under early sowing date (in the last week of March) and late sowing one (in the last week of April).

The layout of the two experiments were laid in a split-plot design with four replicates. The main-plots were assigned to planting date while the sub-plots were occupied by six treatments of the combination between biological and chemical N as follows :

1- 60 Kg N/fad. without bacterial inoculation (control).
2- 60 Kg N/fad. + seed bacterial inoculation.
3- 45 Kg N/fad. + seed bacterial inoculation.
4- 30 Kg N/fad. + seed bacterial inoculation.
5- 15 Kg N/fad. + seed bacterial inoculation.
6- 00 Kg N/fad. + seed bacterial inoculation.

Local isolates of *Azotobacter chroococcum* and *Azospirillum brasilense* were supplied from Agric. Microbial. Dept., Soil, Water and Environm. Instit., ARC. Two bacterial cultures containing 1 x 10^8 colony forming unit (CFU)/ml from each of Azospirillum and Azotobacter were prepared in individually, then they were mixed in equal portions and then loaded up on carrier material composed from 90% vermculite and 10% peat moss to made bacterial inoculant. Inoculation was done immediately before sowing by coating of cotton seeds with bacterial inoculant at rate of (400 g inoculant/40 kg seed) using Arabic gum as adhesive material.

Each sub-plot was 12 m^2 in area, including 5 ridges; 4 m long and 60 cm a part. The chemical N fertilizer was applied to the soil in the form of ammonium nitrate (33.5% N) in two equal portions, immediately before the 2^{nd} and the 3^{th} irrigations. Other cultural practices were done as recommended for common cotton production. Some chemical and physical properties of the soil of the two experimental sites are presented in Table 1.

For determining the effects of different treatments the following characters were estimated :

1- Leaves content of chlorophyll; a sample of leaves was collected at the peak of flowering in 2003 season only to determine leaves content of chlorophyll a, b and total chlorophylls following the method described by Arnon (1949).
2- Plant growth parameters : a sample of six plants was used at harvest to measure the growth parameters; plant height, number of main stem nodes, internode length, and nuumber of fruiting branches (sympodia) plant.
3- Yield and Yield components : number of open bolls/plant, boll weight (gm), earliness%, lint% and seed index (gm), while seed cotton yield/fad. Was calculated from yield/plot.

All collected data were subjected to the statistical analysis according to Gomez and Gomez (1984).

Table 1 : Some chemical and physical properties of the experimental soil in 2002 and 2003 seasons.

Soil properties	2002	2003
Texture	Clayloam	Clayloam
Organic mater (%)	1.42	1.64
PH (1/2.5)	8.2	8.1
E.C. (m. moh)	0.35	0.33
N (p.p.m)	35	42
P (p.p.m)	8	10
K (meq/100 g soil)	0.9	0.8

RESULTS AND DISCUSSION

1- Leaves content of chlorophyll :

1.1- Effect of planting date :

Results shown in Table 2 reveal that planting date had no significant effect on the leaves content of chlorophylls; chlorophyll a, b and total chlrorophyll.

1.2- Effect of N fertilizer level and N_2-fixers :

It is obvious from Table 2 that there were significant differences among N treatments in relation to leaves content of chlorophyll a, b and total chlorophylls. In general, there was a gradual reduction in chlorophyll level with reducing the mineral N rate but such chlorophyll reduction did not reach the significant level except with decreasing mineral N rate to 30 kg N/fad. and lower. There were no significant differences in chlorophyll level among the control treatment (60 kg N/fad.) and the bacterial inoculation with 60 or 45 kgN/fad. however, reducing the chemical N rate up to 0-30 kgN/fad, even with seed bacterial inoculation, resulted in significant reduction in leaves content of chlorophyll. In this connection, Loawlor *et al.* (2001) stated that deficient N supply negatively affects number and size of chloroplasts and chlorophyll level as N is a fundamental component of chlorophyll. On the other hand, the obtained results reveal that bacterial inoculation improved leaves content of chlorophyll of plants that received 45 kgN/fad. only to be insignificantly different from that of plants given 60 kgN/fad., but it failed to improve chlorophyll level under chemical N rates lower than 45 kgN/fad. Such beneficial effect of bacterial inoculation on chlorophyll level could be due to the enhancing effect of N-fixing bacteria on N uptake and subsequent increase in N level in cotton plant leaves Rao, (1982); and Ashour *et al.*, (1993).

1.3- Effect of the interaction :

Results presented in Table 2 indicate that the interaction of planting date X N application did not significantly affect chlorophyll a and b but it significantly affected total chlorophyll in leaves revealing different responses of chlorophyll level to N treatments under the two planting dates. In comparison with the two controls of early and late planting dates, the significant reduction in chlorophylls level of early plants was reached with

Table (2) :Effect of seed inoculation (SI) with N_2-fixers under graded levels of meniral N on leaves content of chlorophyll (as mg/g dry weight) under early and late planting dates in 2003 season.

N treatments (B)		Chlorophyll a			Chlorophyll b			Total chlorophylls		
		Planting date(A)								
		Early	Late	Mean	Early	Late	Mean	Early	Late	Mean
60 Kg N/fad. (control)		4.720	4.442	4.581	3.080	2.913	2.996	7.800	7.355	7.577
60 Kg N/fad. + SI with N_2- fixers		4.767	4.535	4.651	3.070	2.968	3.019	7.838	7.502	7.670
45 Kg N/fad. + SI with N_2- fixers		4.627	4.383	4.505	2.995	2.740	2.868	7.622	7.123	7.373
30 Kg N/fad. + SI with N_2- fixers		3.988	4.232	4.110	2.815	2.757	2.786	6.803	6.989	6.896
15 Kg N/fad. + SI with N_2- fixers		3.517	3.692	3.604	2.630	2.525	2.578	6.147	6.217	6.182
00 Kg N/fad. + SI with N_2- fixers		3.137	3.282	3.210	2.248	2.402	2.325	5.385	5.685	5.535
Average		4.126	4.094	4.110	2.806	2.718	2.762	6.932	6.812	6.872
L.S.D 5%	A	N.S.			N.S.			N.S.		
	B	0.289			0.221			0.311		
	AB	N.S.			N.S.			0.439		

reducing chemical N rate to 30 kgN/fad. only, while it was not achieved except with reducing N rate to 15 kgN/fad. This may indicate that bacterial inoculation was more profitable for late sown cotton probably due to the relatively lower N requirement for late sown cotton as compared with those for early one.

2- Growth parameters :

2.1- Effect of planting date :

With regard to the effect of planting date on plant growth, Table 3 shows that planting date significantly affected internode length in both seasons and plant height in 2003 season only, but it had no significant effects on number of main stem nodes and number of sympodia/plant. In general, late sown cotton plants were taller with longer internode length as compared with early sown ones. This could be attributed to the relatively higher temperature prevailing during plant growth under late sowing conditions.

2.2- Effect of N fertilizer level and N_2-fixers :

It is clear from Table 3 that there were significant differences among N treatments in all studied growth parameters in 2002 season, and in plant height and internode length in 2003 season. In general, plant growth was suppressed as mineral N rate was reduced from 60 kgN/fad. to 0-15 kgN/fad. However, in comparison with the control (60 kgN/fad.), the application of 60, 45, or 30 kgN/fad. when combined with bacterial inoculation did not reduce plant growth parameters. Reduction in plant growth with reducing chemical N rate to 0-15 kgN/fad. indicate that bacterial inoculation failed to compensate the reduction in mineral N rate under such lower N rate . Lawlor *et al.* (2001) reported that N has a profound effect on plant growth through its structural and enzymatic roles in the synthesis of all metabolic intermediates, cellular structure components, and storage components which constitute the plant body and are required for the growth of cells and organs. The beneficial effect of N-fixing bacteria under as low chemical N rates as 30-45 kgN/fad. could be due to, in addiation to their ability in N fixation, their capability to produce growth promoting substances; auxins, cytokinens, gibberellins and gibberellin-like compounds (Rao, 1982; Pandey & Kumar, 1989 and Shriram & Prasad, 2001).

2.3- Effect of the interaction :

Results presented in Table 3 reveal that the interaction between planting date and N application had no significant effect on all studied growth traits in both seasons.

3- Yield and yield components :

3.1- Effect of planting date :

Data shown in Table (4) indicate that planting date significantly affected number of open bolls/plants, boll weight, and seed cotton yield in both seasons, lint % in 2002 season, and seed index in 2003 season, but it had no significant effect on earliness% in the two studied seasons. Results clearly emphasized that early cotton sowing markedly enhanced cotton yield

Table (3) :Effect of seed inoculation (SI) with N_2-fixers under graded levels of meniral N on some growth parameters of early and late sown cotton in 2002 and 2003 seasons.

N treatments (B)		Plant height (cm)			No. of main stem nodes			Internode length (cm)			No. of sympodia/plant		
		Planting date (A)											
		Early	Late	Mean	Early	Late	Mean	Early	Late	Mean	Early	Late	Mean
		2002 season											
60 Kg N/fad. (control)		103.9	104.6	104.2	25.1	24.4	24.7	4.15	4.28	4.21	15.58	14.85	15.21
60 Kg N/fad. + SI with N_2- fixers		104.3	106.3	105.3	25.1	25.1	25.1	4.15	4.24	4.19	15.70	14.95	15.33
45 Kg N/fad. + SI with N_2- fixers		100.4	104.3	102.3	24.8	24.5	24.7	4.05	4.25	4.15	15.15	14.65	14.90
30 Kg N/fad. + SI with N_2- fixers		101.6	100.4	101.0	24.8	23.8	24.3	4.10	4.23	4.17	15.03	14.35	14.69
15 Kg N/fad. + SI with N_2- fixers		91.0	94.2	92.6	23.6	23.8	23.7	3.86	3.97	3.91	13.68	14.00	13.84
00 Kg N/fad. + SI with N_2- fixers		92.2	92.1	92.2	23.7	23.3	23.5	3.89	3.96	3.93	13.90	13.38	13.64
Average		**98.9**	**100.3**	**99.6**	**24.5**	**24.1**	**24.3**	**4.03**	**4.15**	**4.09**	**14.84**	**14.30**	**14.57**
L.S.D 5%	A		N.S.			N.S.			0.10			N.S.	
	B		3.5			0.7			0.11			0.61	
	AB		N.S.			N.S.			N.S.			N.S.	
		2003 season											
60 Kg N/fad. (control)		104.3	115.8	110.1	24.3	25.0	24.7	4.29	4.64	4.46	16.20	16.48	16.34
60 Kg N/fad. + SI with N_2- fixers		104.8	117.6	111.2	24.6	25.2	24.9	4.26	4.67	4.47	16.23	16.55	16.39
45 Kg N/fad. + SI with N_2- fixers		103.9	113.3	108.6	24.4	25.0	24.7	4.26	4.57	4.41	16.23	16.13	16.18
30 Kg N/fad. + SI with N_2- fixers		103.1	112.9	108.0	24.1	25.2	24.6	4.30	4.49	4.39	15.45	15.90	15.68
15 Kg N/fad. + SI with N_2- fixers		95.8	108.2	102.0	23.6	24.7	24.1	4.07	4.39	4.23	15.18	15.68	15.43
00 Kg N/fad. + SI with N_2- fixers		96.5	104.6	100.5	23.6	23.9	23.8	4.08	4.38	4.23	14.73	15.20	14.96
Average		**101.4**	**112.1**	**106.7**	**24.1**	**24.8**	**24.5**	**4.21**	**4.52**	**4.36**	**15.67**	**15.99**	**15.83**
L.S.D 5%	A		4.6			N.S.			0.19			N.S.	
	B		4.8			N.S.			0.11			N.S.	
	AB		N.S.			N.S.			N.S.			N.S.	

Table (4) :Effect of seed inoculation (SI) with N_2-fixers under graded rates of meniral N on yield and some yield components of early and late sown cotton in 2002 and 2003 seasons.

N treatments (B)	No. of open Bolls/plant			Boll weight (gm)			Earliness %			Seed cotton yield Kentar/fad.			Lint %			Seed index (gm)		
	Planting (A)																	
	Early	Late	Mean	Early	Late	Mean	Early	Late	Mean	Early	Late	Mean	Early	Late	Mean	Early	Late	Mean
2002 season																		
60 Kg N/fad. (control)	16.58	13.33	14.95	2.56	2.39	2.48	66.1	67.9	67.0	12.88	10.83	11.86	40.85	39.66	40.25	11.25	11.15	11.20
60 Kg N/fad. + SI with N_2- fixers	16.18	12.90	14.54	2.59	2.36	2.48	66.9	68.4	67.6	12.49	10.53	11.51	40.04	37.57	40.30	11.23	11.10	11.16
45 Kg N/fad. + SI with N_2- fixers	15.70	13.80	14.75	2.58	2.44	2.51	64.3	68.8	66.6	12.58	10.90	11.74	40.87	39.70	40.28	11.10	10.95	11.03
30 Kg N/fad. + SI with N_2- fixers	14.75	13.70	14.23	2.51	2.39	2.45	66.5	68.2	67.8	12.31	10.62	11.46	40.64	39.76	40.20	11.23	11.23	11.23
15 Kg N/fad. + SI with N_2- fixers	12.33	12.83	12.58	2.38	2.32	2.35	65.1	67.5	66.7	10.49	9.97	10.23	41.20	40.16	40.59	11.10	10.60	10.85
00 Kg N/fad. + SI with N_2- fixers	12.83	11.65	12.24	2.37	2.22	2.35	65.3	68.6	67.4	10.55	9.51	10.03	44.20	40.17	40.69	10.48	10.73	10.60
Average	**14.73**	**13.03**	**13.88**	**2.50**	**2.36**	**2.43**	**65.7**	**68.2**	**67.0**	**11.88**	**10.39**	**11.14**	**40.94**	**39.83**	**40.38**	**11.06**	**10.96**	**11.01**
L.S.D 5% A		1.60			0.14			N.S.			0.41			0.60			N.S.	
L.S.D 5% B		1.29			0.08			N.S.			0.51			N.S.			0.32	
L.S.D 5% AB		1.82			N.S.			N.S.			0.72			N.S.			N.S.	
2003 season																		
60 Kg N/fad. (control)	14.40	10.33	12.36	2.47	2.32	2.39	66.42	68.42	67.42	11.91	8.18	10.04	38.75	38.81	38.78	10.95	10.47	10.71
60 Kg N/fad. + SI with N_2- fixers	14.78	10.08	12.43	2.52	2.26	2.39	68.29	67.48	67.89	12.19	7.89	10.04	39.64	38.64	39.14	11.30	10.73	11.01
45 Kg N/fad. + SI with N_2- fixers	14.20	11.80	13.00	2.48	2.32	2.40	65.13	69.89	67.51	11.67	8.37	10.02	38.81	39.69	39.25	10.78	10.35	10.56
30 Kg N/fad. + SI with N_2- fixers	13.33	11.05	12.19	2.29	2.28	2.28	65.44	69.07	67.26	10.95	7.91	9.43	39.26	38.61	38.93	10.95	10.50	10.73
15 Kg N/fad. + SI with N_2- fixers	12.65	9.80	11.23	2.25	2.19	2.27	71.11	69.25	70.18	10.19	7.28	8.73	39.88	39.30	39.59	10.58	9.95	10.62
00 Kg N/fad. + SI with N_2- fixers	11.70	9.35	10.53	2.27	2.18	2.22	70.74	70.53	70.63	9.66	7.18	8.42	39.71	38.73	39.22	10.58	10.50	10.54
Average	**13.51**	**10.40**	**11.95**	**2.38**	**2.26**	**2.32**	**67.85**	**69.11**	**68.48**	**11.09**	**7.80**	**9.45**	**39.34**	**38.96**	**39.15**	**10.85**	**10.42**	**10.64**
L.S.D 5% A		1.72			0.10			N.S.			0.64			N.S.			0.30	
L.S.D 5% B		1.27			0.11			N.S.			0.49			N.S.			0.50	
L.S.D 5% AB		N.S.			N.S.			N.S.			0.69			N.S.			N.S.	

and yield components; number of open bolls/plant, boll weight, lint %, seed index, and seed cotton yield/fad. This appears reasonable based on the fact that early planting date provides a favourable in-season sequence of field conditions that quite synchronized with optimal climatic requirements for different successive stages of plant growth which insures better crop development resulting in higher yields. Similar results were reported by Namich *et al.* (2003).

3.2- Effect of N fertilizer level and N_2-fixers :

With concern to the responses of yield and its compounds to N application, it appears from Table 4 that number of open bolls/plant, boll weight, seed index, and seed cotton yield were significantly affected by N application in both seasons, while earliness % and lint % were not significantly affected by N application in both seasons. Results reveal that there was a steedy reduction in yield and yield components with decreasing chemical N rate. This could be a reflection of the adverse effects for reducing N rate on chlorophyll level and plant growth since poor N supply negatively influences all biochemical and physiological processes at the subcellular, cellular, and whole plant levels resulting in lower yields (Lawlor *et al.*, 2001). On the other hand, seed treatment with N-fixing bacteria as combined with 15 kg N/fad. was enough to keep number of open bolls/plant and seed index to not be reduced significantly. While bacterial inoculation + 30 kg N/fad. in 2002 season, and + 45 kg N/fad. in 2003 season improved boll weight and seed cotton yield to be statistically equal to those of the control treatment (60 kg N/fad.). It could be concluded that, across planting dates, bacterial inoculation needed to be supplemented with at least 30 kg N/fad. in 2002 season, but with 45 kg N/fad. in 2003 season to maintain cotton yield signifiantly unreduced. In this respect, Rao (1982), Pandey & Kumar (1989), and Kennedy & Tchan (1992) reported that the ability to fix elemental N is a vital physiological characteristic of Azotobacter and Azosprillum. In addition, the beneficial effect these bacteria are related not only to their N-fixing proficiency but also to their ability to synthesize and secrete antibacterial and growth regulators antifungal compounds, and vitamins in the plant rhizosphare. Several researcher obtained cotton yield increases with the inoculation with Azotobacter and/or Azospirillum as a supplemental source of N for decreased chemical N rate (Shende *et al.*, 1988; Khune *et al.*, 1989; Afify & Ashour, 1993; Basu, 1992; Ashour *et al.*, 1993; Bastia, 2001; and Singh *et al.*, 2001).

3.3- Effect of the interaction :

The interaction between planting date and N application significantly affected seed cotton yield in both seasons and number of open bolls/plant in 2002 season only Table 4, indicating that both traits responded differentially to N treatments under the two planting dates. Both treats responded to N treatments under each of the two planting dates following the same above-discussed trend across planting dates however, the magnitude of reduction in both traits was greater under early planting date than under late one. In comparison with the controls of early and late planting dates, bacterial inoculation under early planting date needed to be supplemented with higher rate of chemical N than that needed under late planting date to keep both characters significantly unreduced. Bacterial inoculation with only 30 kg N/fad. was adequate to achieve to be combined with 45 kg N/fad. to insure unreduced yield of early sown plantings. This could be owing to the lower N requirements for late sown cotton plantings as compared with early sown ones.

It could be concluded from this study that cotton seed inoculation with the N-fixing bacteria exhibits some economical and ecological adventages under early and late planting dates. Bacterial inoculation of cotton seed could be supplemented with 45-30 kg mineral N/fad. to maintain higher yields of early and late plantings, respectively, saving at least 15 kg N/fad. of the recommended mineral N rate without significant yield reduction, reducing the costs of mineral N fertilizers, and decreasing the environmental pollution.

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فاعلية معاملة البذور بالبكتيريا المثبتة للنيتروجين فى خفض الاحتياجات السمادية النيتروجينية المعدنية للقطن فى الزراعات المبكرة والمتأخرة

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يؤدى الاستعمال المتوالى والمتزايد للأسمدة النيتروجينية المعدنية إلى زيادة التلوث البيئى وكذلك زيادة تكلفة الإنتاج بينما تمثل الأسمدة الحيوية مصدرا للنيتروجين المنخفض التكلفة والأمن على البيئة فى نفس الوقت ولذلك أجرى هذا البحث بمحطة البحوث الزراعية بملوى،محافظة المنيا، خلال موسمى الزراعة ٢٠٠٢، ٢٠٠٣، بهدف دراسة مدى الاستفادة من معاملة البذور ببكتيريا الازوتوباكتر والأزوسبيريللم فى تقليل احتياجات القطن من الأسمدة الآزوتية المعدنية تحت ظروف الزراعة المبكرة (خلال الأسبوع الأخير من مارس) والزراعة المتأخرة (خلال الأسبوع الأخير من أبريل) باستخدام صنف القطن جيزة ٨٣ . كانت المعاملات المستخدمة هى : معاملة المقارنة (٦٠ كجم آزوت/فدان بدون تلقيح بكتيرى للبذور) بالإضافة إلى خمسة معاملات للتلقيح البكتيرى كمصدر مكمل للآزوت لمستويات متدرجة من الآزوت المعدنى (صفر، ١٥، ٣٠، ٤٥، ٦٠ كجم آزوت/ف) ويمكن تلخيص نتائج هذه الدراسة فيما يلى :

أدى التأخير فى الزراعة بصفة عامة إلى زيادة طول النبات وزيادة طول السلامية ولكنه أدى إلى نقص جوهرى فى معظم مكونات المحصول وكذلك محصول القطن الزهر للفدان بينما لم يتأثر محتوى الأوراق من الكلوروفيل بميعاد الزراعة .

أدى نقص المعدل الآزوتى المعدنى إلى صفر – ١٥ كجم آزوت/فدان إلى نقص معنوى فى محتوى الأوراق من الكلوروفيل ومعظم صفات النمو ومكونات المحصول وكذلك محصول القطن الزهر/فدان. بينما أدى استخدام المخصب الحيوى فى معاملة البذور إلى عدم حدوث نقص معنوى فى محتوى الأوراق من الكلورفيل أو محصول القطن الزهر للفدان مع نقص المعدل الآزوتى المعدنى إلى ٤٥ كجم آزوت/ف. فى الزراعة المبكرة. كما أدى التلقيح البكتيرى إلى عدم حدوث نقص معنوى فى صفات النمو ومكونات المحصول بنقص المعدل الآزوتى المعدنى إلى ٣٠ كجم آزوت/ف. فى الزراعة المتأخرة.

أظهر التفاعل بين ميعاد الزراعة ومعاملات النيتروجين تأثير معنوى على محتوى الوراق من الكلوروفيل الكلى وعدد اللوز المتفتح/نبات ومحصول القطن الزهر/ف حيث كان النقص فى هذه الصفات الناتج عن نقص المعدل السمادى الآزوتى تحت ظروف الزراعة المبكرة أكبر منه تحت ظروف الزراعة المتأخرة .

ويمكن أن نستخلص من هذه الدراسة أنه عند استخدام البكتيريا المثبتة للأزوت الجوى فى تلقيح بذورالقطن يمكن تقليل المعدل الآزوتى المعدنى إلى ٤٥ كجم آزوت/ف للزراعات المبكرة وإلى ٣٠ كجم آزوت/ف للزراعات المتأخرة دون حدوث نقص معنوى فى المحصول أى يمكن توفير ١٥ كجم ازوت/ف على الأقل من الأسمدة الآزوتية المعدنية وبالتالى تقليل التلوث البيئى ونقص تكلفة الإنتاج فى نفس الوقت .