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PHYSIOLOGICAL RESPONSE OF COTTON (GIZA 89 VARIETY) TO APPLICATION OF NITROGEN AND BIO-FERTILIZER "RHIZOBACTEREIN"

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ABSTRACT

Two field experiments were carried out at Gemmeiza Agricultural Research station, El-Gharbia Governorate during two seasons (2002 and 2005). The main objective of this investigation was to study the effect of bio-fertilizer (Rhizobacterein) as a method to decrease the levels of mineral nitrogen fertilizer of Giza 89 cotton variety using 60 kg/fed. without Rhizobacterein (as control) and using 30, and 45 N/fed. with Rhizobacterein at thinning, squaring and flowering stages On some cotton plant growth traits and attributes, earliness seed cotton yield / fed. and its components and net income. Results can be summarized as follows:

Application of bio-fertilizer (Rhizobacterein)l at treatment (8) [45 kg N/fed. + Rhizo. (2 L./fed. squaring) + 2 L./fed. flowering stage]. Significantly increased plant height, number of fruiting branches / plant, boll weight, number of open bolls / plant, seed cotton yield / fed. and lint percentage in both seasons. Also, applying bio-fertilization significantly increased the net income / fed. as compared with the check treatment. Also, using bio-fertilizers significantly increased dry weight of plant organs during different growth stages and significantly increased leave contents of chlorophyll, carotinoids, nitrogen, oil and protein contents in seeds.

Keywords: Cotton, Bio-fertilizer, Rhizobacterein, Nitrogen, Growth, yield.

INTRODUCTION

Soil in the Delta and the Nile Valley in Egypt are poor in organic matter and accordingly in nitrogen. The content of total and soluble nitrogen vary between 0.07 – 0.11 % and 13 – 25 ppm, respectively. These values are fairly low, (Hamissa and Abdel-Salam, 1999). Furthermore, a major compensation for the low available N was the extensive use of mineral N fertilizer and this causes the following problems, increased the consumption of fertilizer and cost of production. The share of fertilizer in the total variable cost for cotton in Egypt increased from 4 – 8 % in 1987 to 11.2 % in 1992 (Nassar and Salama, 1995). Also, the economic use of fertilizers and its percentage to the total production cost should be now taken into account more seriously than before (Roussopoulos and Angelakis, 1995). For this it is needed to limit mineral fertilization by using Bio-fertilizer with half of the recommended mineral fertilization which reduce the quantities of mineral fertilization and its negative environmental consequence besides, the simplest and cheapest way of mixed the inculum to the cotton seeds.

Inoculation with N-fixing bacteria increasing yield of field crops even in agricultural systems where mineral N supplementation is not a major problem (Mitkess *et al.*, and Said, 1998).

Bio-fertilizers drew the attention as a partial good alternative to N fertilizer application. In addition, bio-fertilizers have many merits i.e., supply part of plant N requirement by 25 %, increase the availability of nutrients, reduce the environmental pollution, control the vegetative growth and improve the yield

potential (Ragab, 1999). The use of bio-fertilizer for cotton was suggested by Hamissa *et al.* (2000) who found that inoculation of cotton seeds with some bio-fertilizers i.e., Microbein, Rhizobacterein or Nitrobein significantly increased plant height at harvest, boll weight, seed cotton yield / plant or per feddan, number of open bolls / plant and lint percentage. This application increased also net income / fed.

With regard to the interaction between mineral N fertilizer rate and bio-fertilizer treatments, Hamissa *et al.* (2000) found that inoculation of cotton seeds with Rhizobacterein when conjugated with using the high N dose 60 kg N / fed. produced the highest values of number of open bolls plant, lint % and net income / fed.

The objective of this study to evaluate the effect of N fertilizer rates, and bio-fertilizer treatments to limit mineral fertilization and answer this respect in cotton.

MATERIALS AND METHODS

Two field experiments were conducted at Gemmeiza Agricultural Two field experiments were conducted at Gemmeiza Agricultural Research station, El-Gharbia Governorate during 2004 and 2005 seasons.

The experimental unit was 14 m^2 (14 x 3.5) including five ridges with a distance of 25 cm between hills and in ridges of 65 cm a part and 10 – 15 seeds per hills, thinned to two seedlings, Egyptian cotton Cv. Giza 89 was used in this investigation and sown on March 24th and 27th for the two seasons, respectively.

A randomized complete blocks design with four replicates was used to study these treatments:

1) Control (60 kg N / fed.).
2) 30 kg N / fed. + Rhizobacterein (seed dressing) at sowing.
3) 30 kg N / fed. + Rhizobacterein (2 liter / fed.) applied with water irrigation after 10 days from thinning + Rhizobacterein (2 liter / fed.) at the beginning of squaring stage.
4) 30 kg N / fed. + Rhizobacterein (2 liter / fed.) applied with water irrigation at the beginning of squaring stage + Rhizobacterein (2 liter / fed.) at the start of flowering.
5) 30 kg N / fed. + Rhizobacterein (2 liter / fed.) applied with water irrigation after 10 days from thinning + Rhizobacterein (2 liter / fed.) at the start of flowering.
6) 45 kg N / fed. + Rhizobacterein (seed dressing) at sowing.
7) 45 kg N / fed. + Rhizobacterein (2 liter / fed.) applied with water irrigation after 10 days from thinning + Rhizobacterein (2 liter / fed.) at the beginning of squaring stage.
8) 45 kg N / fed. + Rhizobacterein (2 liter / fed.) applied with water irrigation at the beginning of squaring stage + Rhizobacterein (2 liter / fed.) at the start of flowering.
9) 45 kg N / fed. + Rhizobacterein (2 liter / fed.) applied with water irrigation after 10 days from thinning + Rhizobacterein (2 liter / fed.) at the start of flowering.

N fertilizer levels in the form of ammonium nitrate (33.5 % N) were applied in two equal splits first after thinning (36 days after planting), and second at the next irrigation.

Phosphorus and potassium fertilizers were added as recommended. Other cultural practices were carried out as recommended, for the conventional cotton planting.

Analyses of the experimental soil were carried out according to the procedures described by Jackson (1960). The results of soil characterization are shown in Table (1).

Table (1): Soil mechanical and chemical analysis of the experimental soil.

Mechanical analysis			Chemical analysis		
	2004	2005		2004	2005
Clay %	55.2	56.4	Available N (PPm)	23.80	22.0
Silt %	27.5	28.3	Available P (PPm)	5.72	6.3
Sand %	13.3	14.5	Available K (PPm)	402	409
$CaCo_3$ %	3.2	4.1	PH	7.8	8.0
Texture	Clay loam	Clay loam	EC (mnohs)/cm/25°C	2.35	2.6
Organic matter %	1.88	1.90			

The Studied characters:

A- Plant growth characters :

Four random plant samples were taken at 90, 120 and 150 days after sowing and were separated into the different organs (leaves, stems, branches, roots, squares, flowers and bolls). The studied characters on cotton plant were as follows:

1- Plant height (cm).

2- Leaf area (L.A.), the disk method was used according to Johnson (1967).

$$LA / plant = \frac{\text{Leaf dry weight / plant x disc area}}{\text{Disc dry weight}} \quad (dm^2)$$

3- Leaf area index (L.A.I.) was calculated as follows :

$$L.A.I. = \frac{\text{Leaf area / plant}}{\text{Plant ground area}}$$

4- Total dry weight / plant (g)

5- Crop growth rate (CGR), was measured by using the equation:

$$CGR = \frac{W_2 - W_1}{t_2 - t_1} \quad (g / m^2 / week)$$

6- Relative growth rate (RGR), was calculated as follows:

$$RGR = \frac{Log_e W_2 - Log_e W_1}{t_2 - t_1} \quad (g / m^2 / week)$$

7- Net assimilation rate (NAR), was calculated as follows:

$$NAR = \frac{(W_2 - W_1)(Log_e A_2 - Log_e A_1)}{(A_2 - A_1)(t_2 - t_1)}$$

B- Yield and yield component:

At harvest, sample of ten plants from the inner ridges of each sub-plot were taken at random to determine the following yield attributes:

Number of fruiting branches / plant, number of open bolls / plant, boll weight (g), earliness percentage, lint percentage, seed index (100 seed weight (g)), seed cotton yield (kentar / fed.), fiber fineness and fiber strength and the net income / fed. in pounds was determined as follow:

Net income / fed. = Total income of seed cotton yield – total costs (all agricultural practices) / fed.

C- Chemical analysis:

1- Leaf chlorophyll content: was determined in leaves according to Arnan (1949).
2- Oil and protein percentage: were determined in the seeds by the method described by A-O-A-C- (1975).
3- Nitrogen content of leaves: was determined by using A-O-A-C (1975).

Statistical analysis:

The data were taken and analyzed as outlined by Snedecor and Cochran (1981) and the means were compared using L.S.D. at 0.05 level of probability.

RESULTS AND DISCUSSION

A- Growth characters:

1- *Plant height (cm)*:

The results presented in Table (2) reveal that using bio-fertilizer namely Rhizobacterein tend to increase plant height in the first season (2004), however, this increase was significant in the second season (2005). Bio-fertilizer treatments gave a significant effect on number of fruiting branches / plant in both seasons (Table 2). In this respect, Hamissa *et al.* (2000), found that cotton plant height at harvest was significantly increased due to seed inoculation with bio-fertilizer, While number of fruiting branches / plant did not respond to bio-fertilizer application.

2- Leaf area (LA / plant) and leaf area index (LAI):

Data in Table (2) show that LA / plant and LAI were significantly higher due to bio-fertilizer (Rhizobacterein) application over the check at the different sampling dates in the two seasons under study. In this concern, Perumal (1999), found that increasing N levels significantly increased Leaves / plant, leaf area and leaf area index.

Generally, the results indicated that leaf area / plant increased gradually, by advancing plant age till reaching its maximum values at 120 days age, then decreased in values at 150 days age, but also with an increase in leaf area / plant by increasing the bio-fertilizer in both seasons. Where, LAI gradually increased to reach its maximum value at 120 days from planting, then decreased in both seasons as a result of shedding the older leaves, which have larger leaf area with the same area of ground.

Table (2) : Effect of bio-fertilizer and Nitrogen fertilization on some growth characters of cotton plants during 2004 and 2005 seasons.

Treatments	Plant height (cm)		Leaf area (L.A.) (dm^2)						Leaf area index (L.A.I.)					
			2004			2005			2004			2005		
	2004	2005	90 days	120 days	150 days	90 days	120 days	150 days	90 days	120 days	150 days	90 days	120 days	150 days
Control (60 kg N /fed.)	155.03	145.63	18.24	32.90	25.13	18.52	32.13	23.61	2.22	4.03	3.05	2.27	3.93	2.90
30 kg N/fed. + Rhiz. (Seed dressing)	156.58	147.50	16.25	31.49	23.39	16.99	31.53	28.10	1.90	3.84	2.84	2.05	3.85	3.43
30 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f-squaring stage).	157.25	150.00	19.11	34.43	25.38	20.65	31.28	23.62	2.33	4.22	3.11	2.52	3.83	2.89
30 kg N/fed. + Rhiz. (2L./f-squaring + 2L./f flowering stage).	158.88	148.13	23.70	38.44	27.39	25.04	38.36	25.99	2.91	4.72	3.36	3.04	4.71	3.15
30 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f- flowering stage).	160.50	150.00	19.83	35.52	25.65	21.23	34.58	24.20	2.40	4.34	3.15	2.60	4.23	2.94
45 kg N/fed. + Rhiz. (Seed dressing)	158.20	147.83	18.22	31.62	23.67	18.52	32.10	23.56	2.21	3.85	2.90	2.25	3.92	2.88
45 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f-squaring stage).	153.60	155.63	19.98	36.80	26.45	21.82	35.21	24.60	2.45	4.52	3.23	2.67	4.32	3.02
45 kg N/fed. + Rhiz. (2L./f-squaring + 2L./f flowering stage).	158.45	157.38	24.64	39.09	29.08	26.96	41.37	28.42	3.06	4.80	3.53	3.17	5.06	3.47
45 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f- flowering stage).	158.23	156.75	22.91	38.36	27.39	22.10	37.11	25.80	2.81	4.71	3.34	2.71	4.55	3.14
L.S.D. at 5%	N.S.	2.82	0.03	0.04	0.05	16.30	0.05	0.11	0.10	0.03	0.05	0.04	0.03	0.04

*** One kentar = 157.5 kg. seed cotton.**

3- Dry weight / plant:

Data presented in Tables (3 and 4) show the effect of bio-fertilizer "Rhizobacterein" on dry weight of the different organs of cotton plant after 90, 120 and 150 days from sowing.

Bio-fertilizer addition gave significant effect on total dry weight / plant at all growth stages in both seasons.

It could be concluded that all treatments of bio-fertilizer significantly increased the dry weight of whole cotton plant and its organs i.e. roots, stem and leaves in both growing seasons.

Theses results may be due to the increases in both number of vegetative and fruiting branches by increasing the bio-fertilizer addition which added more dry weight to stem.

In this respect, El-Shazly and Darwish (2001) found that bio-fertilizer treatments gave significant effects on total dry weight / plant at all growth stages.

4- Crop growth rate (CGR):

Data in Table (5) indicated that using bio-fertilizer (Rhizobacterein) had a significant effect on crop growth rate (CGR) at all growing periods under study i.e., 90 - 120 and 120 – 150 days after sowing in both seasons.

With regard to bio-fertilizer treatments, it is clear from Table (5) that treatment number (8) [45 kg N/fed. + Rhizo. (2 L./fed. squaring) + 2 L./fed. flowering stage) recorded the highest values of CGR at all growth ages in both seasons. This may be due to the increase in plant ability to receive more light energy and consequently more chemical energy formed as dry matter. Similar conclusion was obtained by Mahrous (1977) and El-Shazly and Darwish (2001).

5- Relative growth rate (RGR):

Results presented in Table (5) show that during 2002 and 2005 growing seasons, bio-fertilizer "Rhizobacterein" applications had a significant effect on relative growth rate (RGR) in the first period and later period.

Generally, relative growth rate (RGR) tended to decrease with advancing plant age in both seasons. These results due to the increase in weight of fruits to the total weight of plant.

6- Net assimilation rate (NAR):

Data presented in Table (5) reveal that the bio-fertilizer treatments exhibit a significant effect on NAR in the first period and later period in both seasons. Data revealed that NAR for treatment (8) exceeded the other treatments.

B- Seed cotton yield and its components:

Bio-fertilizer treatments had significantly increased the number of open bolls / plant, boll weight and seed index in both seasons (Table 6). In this respect, Hamissa *et al.* (2000) and El-Shazly and Darwish (2001), found that bio-fertilizer treatments had significant effects on number of open bolls / plant and lint percentage only in one season and on boll weight and seed cotton yield / plant in two seasons. The highest mean values of these traits were obtained when cotton seeds were inoculated with the commercial bio-fertilizer (Rhizobacterein or Microbein) compared with (Nitrobein) or the check, but this addition decreased seed index

Table (3) : Effect of bio-fertilizer and Nitrogen fertilization on some growth characters of cotton plants in 2004 seasons.

Treatments	Dry weight/ plant (gm) (90 days)						Dry weight/ plant (gm) (120 days)						Dry weight/ plant (gm) (150 days)					
	Roots	Stem	Leaves	Total plant	Weight fruit part S + b	Shoot root/ ratio	Roots	Stem	Leaves	Total plant	Weight fruit part S + b	Shoot root/ ratio	Roots	Stem	Leaves	Total plant	Weight fruit part S + b	Shoot root/ ratio
Control (60 kg N /fed.)	6.35	19.79	17.03	43.17	---	5.80	12.49	17.15	26.44	69.08	13.0	4.53	13.23	32.28	20.92	82.50	16.07	5.24
30 kg N/fed. + Rhiz. (Seed dressing)	5.62	19.82	14.47	39.94	---	6.11	13.38	18.81	25.81	70.27	12.28	4.25	13.93	33.75	20.70	83.74	15.36	5.01
30 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f-squaring stage).	6.23	19.50	16.38	42.11	---	5.76	12.66	15.44	33.34	72.67	11.23	4.74	14.17	35.58	22.70	88.07	15.62	5.22
30 kg N/fed. + Rhiz. (2L./f-squaring + 2L./f flowering stage).	4.96	15.11	12.91	42.98	---	7.66	13.84	16.20	29.93	73.24	13.27	4.29	16.00	33.68	22.57	89.21	16.96	4.58
30 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f- flowering stage).	6.46	15.83	18.91	41.20	---	5.38	12.94	17.67	24.47	69.61	12.53	4.38	14.22	30.37	22.63	84.13	16.91	4.92
45 kg N/fed. + Rhiz. (Seed dressing)	6.96	18.06	14.65	39.67	---	4.70	17.26	13.03	27.19	69.88	12.39	3.05	14.50	34.02	21.53	85.63	15.58	4.91
45 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f-squaring stage).	5.01	19.12	14.48	38.61	---	6.71	16.33	15.85	25.08	69.56	12.30	3.26	14.73	32.73	20.31	83.14	15.37	4.61
45 kg N/fed. + Rhiz. (2L./f-squaring + 2L./f flowering stage).	7.40	17.88	18.94	44.22	---	4.98	16.32	16.91	29.64	67.42	13.55	3.68	15.45	38.25	22.40	93.37	17.27	5.04
45 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f- flowering stage).	6.94	18.37	18.76	44.07	---	5.35	16.60	17.67	29.36	76.04	12.41	3.58	14.68	38.52	21.85	91.42	16.37	5.232
L.S.D. at 5%	0.45	0.46	0.59	0.91	---	0.45	0.45	0.42	0.39	1.10	0.32	0.13	0.25	0.68	0.30	0.57	0.36	0.09

Table (4) : Effect of bio-fertilizer and Nitrogen fertilization on some growth characters of cotton plants in 2005 seasons.

Treatments	Dry weight/ plant (gm) (90 days)						Dry weight/ plant (gm) (120 days)						Dry weight/ plant (gm) (150 days)					
	Roots	Stem	Leaves	Total plant	Weight fruit part S + b	Shoot root/ ratio	Roots	Stem	Leaves	Total plant	Weight fruit part S + b	Shoot root/ ratio	Roots	Stem	Leaves	Total plant	Weight fruit part S + b	Shoot root/ ratio
Control (60 kg N /fed.)	7.20	19.89	17.03	44.39	---	5.17	13.50	18.22	24.40	69.42	13.30	4.14	17.33	27.30	21.20	82.01	16.18	3.73
30 kg N/fed. + Rhiz. (Seed dressing)	6.50	19.95	15.08	41.53	---	5.39	14.30	18.90	26.09	71.52	12.23	4.00	17.96	29.85	20.81	84.01	15.39	3.68
30 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f-squaring stage).	6.35	18.00	16.80	41.15	---	5.48	12.79	19.54	28.44	72.10	11.33	4.64	16.28	32.59	22.85	87.42	15.70	4.37
30 kg N/fed. + Rhiz. (2L./f-squaring + 2L./f flowering stage).	6.12	19.61	17.01	42.74	---	5.98	13.90	17.50	29.90	74.67	13.37	4.37	20.30	30.78	22.60	90.67	16.99	3.47
30 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f- flowering stage).	6.96	16.12	18.96	42.04	---	5.04	13.05	17.97	29.50	73.08	12.56	4.60	17.32	29.47	22.65	86.39	16.95	3.99
45 kg N/fed. + Rhiz. (Seed dressing)	5.15	17.50	17.70	41.35	---	5.72	13.66	18.50	27.33	71.98	12.49	4.27	17.60	32.22	21.65	87.15	15.68	3.95
45 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f-squaring stage).	5.18	19.33	17.20	41.71	---	7.05	16.93	16.95	25.80	72.8	12.60	3.27	14.78	36.77	20.61	87.63	15.47	4.93
45 kg N/fed. + Rhiz. (2L./f-squaring + 2L./f flowering stage).	6.90	18.95	18.98	44.83	---	5.50	16.88	19.98	26.66	77.17	13.65	3.57	16.49	38.35	22.51	94.72	17.37	4.74
45 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f- flowering stage).	7.10	17.78	19.20	44.09	---	5.21	16.91	20.77	25.96	76.09	12.45	3.50	15.75	38.59	21.90	92.64	16.40	4.88
L.S.D. at 5%	0.64	0.57	0.72	0.98	---	0.41	0.46	0.46	0.42	0.99	0.40	0.15	0.30	0.63	0.35	0.69	0.45	0.05

Table (5) : Effect of bio-fertilizer and Nitrogen fertilization on physiological growth parameters of cotton plants at different stages during 2004 and 2005 growing seasons.

Treatments	Growth stages (days after sowing) CGR mg/cm²/day				Growth stages (days after sowing) RGR mg/cm²/day				Growth stages (days after sowing) NAR mg/cm²/day			
	2004		2005		2004		2005		2004		2005	
	90-120	120-150	90-120	120-150	90-120	120-150	90-120	120-150	90-120	120-150	90-120	120-150
Control (60 kg N /fed.)	6.48	3.36	6.25	3.15	0.50	0.030	0.053	0.014	0.178	0.118	0.168	0.121
30 kg N/fed. + Rhiz. (Seed dressing)	7.58	3.37	7.50	3.12	0.063	0.023	0.057	0.023	0.221	0.086	0.195	0.118
30 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f-squaring stage).	7.64	3.385	7.74	3.83	0.055	0.033	0.054	0.0.33	0.174	0.0125	0.095	0.095
30 kg N/fed. + Rhiz. (2L./f-squaring + 2L./f flowering stage).	7.81	3.99	7.98	4.000	0.095	0.020	0.065	0.018	0.286	0.064	0.274	0.054
30 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f-flowering stage).	7.10	3.63	7.76	3.33	0.050	0.020	0.052	0.022	0.156	0.083	0.127	0.109
45 kg N/fed. + Rhiz. (Seed dressing)	7.55	3.94	6.77	3.79	0.065	0.030	0.063	0.027	0.209	0.013	0.170	0.122
45 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f-squaring stage).	7.74	3.40	7.64	3.84	0.063	0.030	0.066	0.025	0.215	0.118	0.193	0.134
45 kg N/fed. + Rhiz. (2L./f-squaring + 2L./f flowering stage).	8.05	4.24	8.09	4.39	0.060	0.015	0.059	0.017	0.191	0.055	0.172	0.068
45 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f-flowering stage).	7.99	3.85	8.00	4.14	0.058	0.018	0.056	0.016	0.218	0.070	0.197	0.079
L.S.D. at 5%	0.06	0.05	0.02	0.03	0.01	0.02	0.04	0.04	0.02	0.04	0.04	0.03

Table (6) : Effect of bio-fertilizer and Nitrogen fertilization on yield, yield components and lint quality during 2004 and 2005 growing seasons.

Treatments	Number Fruiting braches		Number of open boll/plant		Boll weight (gm)		Earliness %		Lint %		Seed index (gm)		Seed cotton yield Kent/fed.		Micronaire reading		Pressley index	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Control (60 kg N /fed.)	16.70	16.83	19.14	19.74	3.13	2.75	54.19	50.99	38.75	38.86	10.95	10.09	11.62	11.85	4.48	4.58	10.18	9.73
30 kg N/fed. + Rhiz. (Seed dressing)	16.05	15.60	17.93	17.80	3.09	3.03	51.91	50.14	38.45	38.71	9.57	9.92	11.31	11.55	4.45	4.65	9.65	9.65
30 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f-squaring stage).	17.80	16.90	19.49	18.78	3.16	3.10	52.71	53.43	38.27	38.62	10.26	10.13	11.65	12.09	4.75	4.58	9.75	10.00
30 kg N/fed. + Rhiz. (2L./f-squaring + 2L./f flowering stage).	19.13	18.70	23.56	22.14	3.20	3.17	52.56	50.28	38.31	38.60	10.78	10.74	12.57	12.54	4.55	4.60	10.13	9.08
30 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f- flowering stage).	18.25	17.53	21.54	20.28	3.14	3.08	52.70	51.77	38.33	38.39	9.51	9.24	12.09	12.16	4.28	4.48	9.58	9.90
45 kg N/fed. + Rhiz. (Seed dressing)	17.13	16.52	18.55	18.24	3.35	3.04	52.02	50.99	38.53	39.07	11.34	10.40	11.53	11.74	4.65	4.65	9.85	9.90
45 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f-squaring stage).	18.48	18.00	22.25	21.18	3.30	3.09	52.77	49.54	38.43	39.23	10.98	10.05	12.35	12.24	4.75	4.65	9.90	10.10
45 kg N/fed. + Rhiz. (2L./f-squaring + 2L./f flowering stage).	20.95	19.63	23.94	22.80	3.46	3.31	53.70	52.21	38.65	38.57	11.58	10.34	12.93	12.81	4.60	4.78	10.00	10.20
45 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f- flowering stage).	18.83	18.37	23.18	21.90	3.32	3.07	53.55	49.70	38.73	39.38	10.82	10.05	12.43	12.46	4.60	4.90	9.73	10.00
L.S.D. at 5%	0.58	0.45	0.75	0.69	0.14	0.10	N.S.	N.S.	N.S.	N.S.	0.43	0.26	0.31	0.47	0.17	0.18	N.S.	N.S.

The results obtained in Table (6) show that seed cotton yield / fed. was significantly affected by bio-fertilization in both seasons, where (Rhizobacterein) applications increased seed cotton yield / fed. by treatment number (8) [45 kg N/fed. + Rhizo. (2 L./fed. squaring.) + 2 L./fed flowering stage), it exceeded over the check by 11.3 % and 8.1 %, in 2004 and 2005, respectively. These significant increases due to bio-fertilizer as compared to uninoculation may be due to the excess of the organic matter content of the experimental soil (Table 1). Also, to the role of these microorganisms in increasing the N and K uptake which, promote photosynthesis and plant development and consequently the productivity per unit area.

With regard to lint percentage, it can be found that bio-fertilizer treatments had insignificant effects on this character in both seasons (Table 6).

Bio-fertilizer additions gave significant effects on earliness % in the first season only. However, in the second season insignificant increase was obtained from adding (Rhizobacterein).

Fiber properties:

The results obtained in Table (6), show that lint properties. Micronaire reading was significantly affected by bio-fertilization in both seasons. However, the effect on Pressley index was significant only in 2005 season. The role of bio-fertilizer in increasing the plant phyto-hormons like IAA, GA_S and CK_S, which promote plant growth, cell division, break the apical dominance, encourage the photosynthesis, (Said, 1998).

C- Net income / feddan:

The highest net income values / fed. were obtained from the commercial bio-fertilizer (Rhizobacterein) applications as compared with a check (without bio-fertilizer (Rhizobacterein) application) in both seasons as shown in Table (7). Similar results were obtained by Hamissa *et al.* (2000) and El-Shazly and Darwish (2001).

It can be noticed that using the application of Rhizobacterein as illustrated in treatment (8) [45 kg N/fed. + Rhizo. (2 L./fed. squaring) + 2 L./fed. flowering stage) gave the highest net income value / fed. as compared with the control by an increase about 13.58, 25.66 %, over the check treatment in 2002 and 2005 respectively.

D- Chemical constituents of cotton leaves and seeds:

1- *Total chlorophyll content*:

Results presented in Table (8) show that all treatments led to significant increase in chlorophyll content. It seems that these nutrients have a good effect on the formation of leaf chlorophyll.

2- *Carotinoids (mg / g)*:

Data presented in Table (8) show the effect of bio-fertilizer "Rhizobacterein" on carotinoids. It obvious from data that Rhizobacterein significantly increased carotinoids in all treatments.

3- *Nitrogen content of cotton leaves*:

Data in Table (8) indicate that nitrogen content of cotton leaves significantly increased by hbio-fertilizer "Rhizobacterein" applications as compared with the control, in this respect Haggag and Azzazy (1996) and Hamissa *et al.* (2000) supported these obtained.

Table (7) : Net income / fed. as affected by bio-fertilizer and Nitrogen fertilization during 2004 and 2005 growing seasons.

Treatments	Total costs / fed. (Pounds)	2004			2005		Net income /fed. (Pounds) Net income /fed. (Pounds)
		Seed cotton yield		Net income /fed. (Pounds)	Seed cotton yield		
		Yield (kentars)	Net Income Pounds		2004	2005	
Control (60 kg N /fed.)	1170.00	11.62	6972.00	5802.00	11.85	7702.50	6532.50
30 kg N/fed. + Rhiz. (Seed dressing)	1113.00	11.31	6786.00	5673.00	11.55	7507.50	6394.50
30 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f-squaring stage).	1138.00	11.65	6990.00	5852.00	12.09	7858.50	6720.50
30 kg N/fed. + Rhiz. (2L./f-squaring + 2L./f flowering stage).	1138.00	12.57	7542.00	6404.00	12.54	8151.00	7013.00
30 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f- flowering stage).	1138.00	12.09	7254.00	6116.00	12.16	7904.00	6766.00
45 kg N/fed. + Rhiz. (Seed dressing)	1143.00	11.53	6918.00	5775.00	11.74	7631.00	6488.00
45 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f-squaring stage).	1168.00	12.35	7410.00	6242.00	12.24	7956.00	6788.00
45 kg N/fed. + Rhiz. (2L./f-squaring + 2L./f flowering stage).	1168.00	12.93	7758.00	6590.00	12.81	8326.50	8208.50
45 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f- flowering stage).	1168.00	12.43	7458.00	6290.00	12.46	8099.00	6931.00

Price of bio-fertilizer spray used / fed = 7 Pounds.
Price of bio-fertilizer used / fed = 3 Pounds.
Price of N fertilizer 30 kg N / fed = 60 Pounds.
Price of N fertilizer 45 kg N / fed = 90 Pounds.
Price of N fertilizer 60 kg N / fed = 120 Pounds.

Labour fertilization costs / fed. = 50 Pounds
Other mineral practices costs / fed. = 1000 pounds
Price of seed cotton yield (kentar) in 2002 season = 600 Pounds
Price of seed cotton yield (kentar)in 2005 season = 650 pounds.

Table (8) : Effect of Bio-fertilizer and nitrogen fertilization on some chemical constituents of cotton leaves and seeds in 2005

Treatments	Leaves					Seeds	
	Chlorophyll			Carotinoid (mg / gm)	Nitrogen %	Oil %	Protein %
	a	b	Total				
Control (60 kg N /fed.)	4.18	2.06	6.24	0.567	3.47	18.78	21.67
30 kg N/fed. + Rhiz. (Seed dressing)	4.09	2.33	6.42	0.592	3.50	18.80	21.88
30 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f-squaring stage).	4.76	2.35	7.11	0.651	3.50	20.12	21.88
30 kg N/fed. + Rhiz. (2L./f-squaring + 2L./f flowering stage).	4.88	2.84	7.72	0.926	4.33	20.86	27.08
30 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f- flowering stage).	4.41	2.53	6.94	0.784	3.70	20.18	23.12
45 kg N/fed. + Rhiz. (Seed dressing)	4.24	2.27	6.51	0.620	4.00	20.07	25.00
45 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f-squaring stage).	4.78	2.34	7.12	0.861	3.67	20.25	22.94
45 kg N/fed. + Rhiz. (2L./f-squaring + 2L./f flowering stage).	4.96	2.94	7.90	0.960	4.50	21.30	28.13
45 kg N/fed. + Rhiz. (2L./f – 10 days / thin + 2L./f- flowering stage).	4.65	2.50	7.15	0.876	4.00	20.52	25.00
L.S.d. at 5 %	0.17	0.13	0.17	0.31	0.24	0.51	0.99

4- *Oil and protein percentage*:

Data in Table (8) indicate that bio-fertilizer "Rhizobacterein" lead to significant increase in seed oil and protein percentages. The increase in cotton seeds oil and protein percentages might be due to the promoting effect of these nutrients on the various chemical constituents of the seeds including the oil and protein quantity.

Conclusion

Results obtained herein, clearly indicate a differential response to either mineral or bio-fertilization. As for as seed cotton yield / fed. is concerned, 45 kg N / fed. and applying bio-fertilizers was needed to obtain the highest yield.

Data of growth attributes support the view that certain imbalance was created between the vegetative and fruiting growth as the increase of LAI and caused noticeable decreases in both RGR and NAR by using these treatments, which consequently resulted the highest yield per unit area.

The combination between the recommended N fertilizer rate (45 kg N / fed.) and applying cotton plants with Rhizobacterein gave the highest net income value / fed. as compared with other treatments.

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الأستجابة الفسيولوجية لصنف القطن جيزة ٨٩ للتسميد النيتروجينى والحيوى الريزوباكترين.

سناء جمعه جبالى

معهد بحوث القطن – مركز البحوث الزراعية – جيزة – مصر

أجريت تجربتان حقليتان بمحطة البحوث الزراعية بالجميزه – محافظة الغربية خلال موسمى ٢٠٠٤ – ٢٠٠٥ ، لدراسة تأثير إضافة التسميد الحيوى الريزوباكترين مع خفض معدلات التسميد النيتروجينى إلى ٣٠، ٤٥ كجم نيتروجين / فدان.

وكانت المعاملات (بدون معامله مع إضافة أزوت ٦٠ كجم ن / فدان) ، إضافة المخصب الحيوى مع ٣٠ كجم ن / فدان ، ٤٥ كجم ن / فدان للبذرة عند الزراعة ، وكذلك باستخدام المخصب الحيوى عند الخف، والوسواس وبداية التزهير وتفاعلها على بعض صفات دلائل النمو والتبكير ومحصول القطن الزهر للفدان ومكوناته ، وصافى الدخل للفدان لصنف القطن جيزة ٨٩ ، وكان التصميم الاحصائى المستخدم هو القطاعات الكاملة العشوائية فى أربعة مكررات.

أوضحت الدراسة النتائج الأتية :

أدت إضافة المخصب الحيوى الريزوباكترين بالمعاملة (٨) (٤٥ كجم نيتروجين للفدان + ريزوباكتيرين ٢ لتر/فدان عن الوسواس + ريزوباكتيرين ٢ لتر/فدان عند بداية التزهير) إلى زيادة معنوية فى طول النبات ، وعدد الأفرع الثمرية ، ومتوسط وزن اللوزة ، وعدد اللوز المتفتح / نبات ، ومحصول القطن الزهر للفدان ، والنسبة المئوية للشعر وكذلك تصافى الحليج مقارنة بعدم الإضافة. وقد أدت إضافة السماد الحيوى أيضا إلى زيادة صافى الدخل فى كلا الموسمين ، كما أدى إستخدام المخصب الحيوى الريزوباكترين كملقح للبذرة استعماله خلال مراحل النمو (الخف – الوسواس – بداية التزهير) إلى زيادة معنوية فى الوزن الجاف للنبات عند أعمار ٩٠ ، ١٢٠ ، ١٥٠ يوما من الزراعة فى الموسمين ، وأيضا زيادة المساحة الورقية / نبات ، ودليل المساحة الورقية ومعدل نمو المحصول ومعدل التمثيل الصافى ، وإلى زيادة معنوية فى محتوى الأوراق من الكلوروفيل والكاروتينات والنيتروجين ، وكذلك النسبة المئوية للزيت والبروتين فى البذرة.