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RESPONSE OF COTTON TO INOCULATION WITH *Rhizobacterin* AND COMPOST UNDER DIFFERENT LEVEL OF NITROGEN

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ABSTRACT

Two field experiments were conducted at the exp. Res. Stat. Fac. of Agric., Cairo Univ, Giza, Egypt during 2011and 2012seasons to investigate the effect of seed inculcation with *Rizobactrein* and/or organic fertilizer(Compost) computed with control treatment under two level of nitrogen fertilizer on growth, yield productivity, Seed quality ,fiber properties and same chemical constituents of cotton. Results showed, that fertilizer treatment under study had a significant effect on all studied traits where as the best treatment was use of *Rhizobactrein* + Compost and75% N which give the best result in plant height, No. of sympodial branches, No. of open bolls/plant, boll weight, seed index, seed cotton yield per plant and per fedden, lint percentage and Earliness percentage. Oil and protein percentage significantly affected by fertilizer treatment whereas *Rhizobactrein* + Compost and75% N application give the highest values of oil and protein percentage. Fiber length,fiber strength and micronaire reading didn't significantly differ as affected by fertilizer treatment in both seasons. Use of *Rhizobactrein* + Compost and 75% N increased chlorophyll a & b and total, total soluble suger, carotenoid and Net income/ fed. From the present study it could be concluded that, use of biofertilizer, *Rhizabactrein* (200g/30kg seed/fed), and compost with 75% N produce high growth and yield components.

INTRODUCTION

Egypt is one of the main supplies of long and extra long staple cotton which is more suitable to the manufacture of high quality fabrics. Raising cotton productivity and quality is an urgent national goal to meet the consistent demands from this crop. This can be achieved through planting the selected cultivars with optimizing the cultural practices.

Nitrogen is a major limiting nutrient for crop production, it can be applied as chemical or biological source, but chemical nitrogen fertilizer is more expensive. Available information on N requirements of cotton plants showed better response to moderate rate of N application, i.e., 45-60 Kg/N/ fed. (Hamissa *et al*., 2000; El- Beily *et al*., 2001 and Abou –Zaid *et al*., 2002).

Organic fertilizer holds great promise due to their local availability as a source of multiple nutrient and ability to improve soil characteristics. Improvement of fertility and quality of soil especially under low input agricultural systems requires the input of organic materials (Deger *et al.*, 200l; Palm *et al*., 2001; Ouedrago *et al.*, 2001; Soumare *et al*., 2003 and Abdul Khalig *et al.*, 2006).

The various implications of commercial fertilizer particularly in decreasing the soil fertility and productivity and the ever increasing cost of chemical fertilizers compels one to think of the use of organic manures (Gudadhe *et al.*, 2011). Application of mineral fertilizer a long with organic

manures could achieve sustainability in crop yield and soil health (Katkan *et al.*, 2002).

Biofertilizers are products contain living cells of different types of microorganisms, which have an ability to convert nutritionally of important elements from unavailable to available form through biological processes. Abou Zaid *et al*.(2000) and Hamissa *et al.* (2000) found that inoculation of cotton with *Rhizobactrein* with 60kg N/fed gave the highest yield and net income/fed. While, El – Shazly and Darwish (2001) reported that, addition of 30 kg N/fed. with Microbein biofertilizer significantly increased seed cotton yield/ fed. and gave the highest net income/fed.

Studying the effect of bio and/or organic fertilizer under two N. fertilizers levels and their interaction on seed yield, its components, fiber properties , oil & protein percentage and same chemical constituents was the objective of the present study.

MATERIALS AND METHODS

Two field experiments were carried out at Agric. Exp. Sta., Fac.of Agric., Cairo Univ., Giza, Egypt during 2011and 2012 seasons to evaluate the influence of seed inoculation with *Rhizobactrein*, organic fertilizer as well as compost under two level of nitrogen fertilizer compared with control treatment.

Soil mechanical and chemical analyses of the upper 50 cm soil depth in 2011 and 2012 seasons are shown in Table 1.

Arabic gum was melted in amount of warm water and was added to the bio-fertilizer. Seeds of cotton Giza 88 cultivar were added to the mixture of bio-fertilizer and gum and mixed carefully and spread over plastic sheet for a short time before sowing. After sowing, irrigation must be done immediately.

Table 1. Soil mechanical and chemical analyses of the upper 50 cm soil depth in 2011 and 2012 seasons.

Property	Mechanical analysis		Property	Chemical analysis	
	2011	2012		2011	2012
Clay %	42.71	48.29	Available N ppm	22.0	25.31
Silt%	39.23	34.73	Available P ppm	10.1	9.9
Sand	15.23	14.46	Available K ppm	250	240.0
$CaCO_3$%	2.70	2.40	Ph	8.3	8.6
T.SS%	0.13	0.12	Ec mmoh / cm 25c	0.96	0.85
Texture	Clay loam	Caly loam	Organic/matter %	1.75	1.83

The tested ten treatments were as follows.

- **100%N of recommended dose (60kgN/fed.).**
- **75% N + *Rhizobactrein* (200g/30kg seeds/fed.).**
- **50% N +*Rhizobactrein*.**
- **75%N + Compost (4 ton/fed.)**
- **50% N + Compost.**
- **75% N + *Rhizobacterein* + Compost**
- **50% N+ *Rhizobacterein* + Compost**
- **75% N. of recommended dose.**
- **50% N. of recommended dose.**
- ***Rhizobacterin* + Compost.**

The experimental design was randomized complete block design with three replicates. The plot area was 14.4m^2 and consists of 6 ridges 60cm apart. Each ridge was 4 meters long. Seeds of cotton Giza 88 cultivar were seeded in hills spaced 20 cm on 30 March in both seasons. Two plants were left per hill after thinning.

The preceding crop was Egyptian clover in the first season and barely in the second one. Nitrogen in form of ammonium nitrate (33.5%) was split and side dressed before the first and second irrigation. Potassium (24 kg K_2O/fed) in form of potassium sulfate (48%) was also split and side dressed before the first and second irrigation. Phosphorus (30kg P_2O_5/fed.) in form of superphosphate (15.5 %P_2O_5) was broadcasted during land preparation. The recommended agricultural practices were followed throughout the growing seasons.

Ten individual plants were taken at random from each experimental unit to measure: Plant height, number of sympodial branches/ plant, number of open bolls/plant, Boll weight (average of 50 random bolls), seed index (weight of 100 sound seeds), seed cotton yield/ plant, lint percentage, earliness percentage [(yield of 1st pick /total yield) x 100]

Seed cotton yield was calculated from the two inner ridges in each plot and converted into kentar (157.5 Kg) per feddan(4200m^2).

Fiber length 2.5% sp and uniformity ratio were determined by the digital fibrograph, Fiber strength (Pressely index) by using the Pressely testes at zero gague length and recorded (pressely index) values and Fiber fineness (Mic): Measured by Micronaire apparatus in Micronaire units. Fiber study was conducted at Faculty of Agriculutre, Cairo University according to A.S.T.M (1975).

Oil and protein percentage in seeds were determined according to the methods of A.O.A.C. (1975).

After 120 day of planting samples of the fourth upper leaves were taken to estimate chlorophyll a and b (Arnon, 1949), carotenoids (Rolbelen, 1957) and total soluble sugars. A.O.A.C. (1965).

Net income/fed in pounds was determined as follows.

Net income/fed = Total income of seed cotton yield/ fed – fertilization cost/fed.

The data of experiments were subjected to statistical analysis according to Snedecor and Cochran (1981) and the treatments means were compared using L.S.D. at 0.05 level of probability.

RESULTS AND DISCUSSION

1-Yield and yield components attributes .

Data in Table (2) cleared that, all fertilizer treatments significantly affected plant height, No. of sympodial branches, No. of open bolls/ plant, boll weight and seed index in both seasons.75% N + *Rhizoibactrein* + compost treatment compared to the non inoculation treatment was superior in all studied traits followed by 50% N + *Rhizobactreint* + compost. Hamissa *et al*. (2000) found that, plant height significantly increased due to cotton seed

inoculation with biofertilizers. Elayan *et al*. (2008) reported that addition of 30 Kg N/fed. was quite enough to increase plant height, no of sympodial branches / plant, boll weight and seed index/ plant.

Table 2. Mean values of cotton yield components as affected by bio, organic and mineral fertilizers in 2011 and 2012 seasons.

Treatment	Plant height (cm)		Sympodial branches (no)		Open bolls/ plant(no)		Boll weight (g)		Seed Index (g)	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
1- 100% N(cont.)	103.26	110.15	11.20	12.10	15.62	16.35	2.11	2.16	9.18	9.22
2- 75% N+ Rhizo	119.13	122.17	13.89	13.40	16.89	17.92	2.46	2.58	9.47	9.65
3- 50% N + Rhizo	115.62	120.73	14.91	15.10	15.13	15.90	2.35	2.36	9.38	9.56
4- 75% N + Composs	116.71	118.15	12.99	12.81	14.36	15.11	2.21	2.10	8.86	8.91
5- 50% N + Compost	113.35	115.62	13.15	14.32	13.37	12.96	2.19	1.98	8.74	8.60
6- 75% N+ Rhizo + Compost	125.29	130.11	18.11	17.95	18.70	17.98	2.68	2.77	9.98	9.86
7- 50% N + Rhizo + Compost	120.33	122.39	16.73	15.69	17.53	16.46	2.55	2.64	9.75	9.81
8- 75% N	100.17	97.25	12.65	13.19	14.78	15.66	2.25	2.14	9.01	8.99
9- 50% N	95.23	93.92	11.09	10.27	13.15	12.18	2.19	2.17	8.89	8.90
10- Rhizo + Compost	92.76	89.02	10.80	9.97	10.80	10.37	2.00	2.15	8.75	8.93
LSD at 0.05	8.82	6.91	4.20	3.51	3.71	2.89	0.14	0.33	0.40	0.31

Hamissa *et al*. (2000) attributed the increase in plant height obtained by fertilizer treatment to the principle mechanism that, biofertilizer could benefit the plant growth through a fixing molecular nitrogen and its transfer to the plant as direct effect on growth hormones auxins (GAS) and (CKS) that bacteria could release in the root media and affect its growth and extension positively the result could be more absorption of nutrients which reflect more grow activity, nitrogenous compounds assimilation, forming more growth substances, more cell division and enlargement, more forming of tissues and organs and plant elongation could be considered as a resultant for that mentioned processes.

Inoculation of cotton seed with *Rhizobactrein* when conjugated with using the medium dose (45 Kg N/ fed.) produced the highest values of plant height at harvest, no. of open bolls/plant, boll weight and seed index this result is in harmony with that of Abd El- Malik (1998).

Data in Table (3) show that, fertilizer treatments had significant effect on seed cotton yield, per plant, per feddan, lint percentage and Earliness% in both seasons. The highest values of yield and its components obtained from application 75% N+ inoculation seed with Rhizobactrein and compost compared with non inoculation. The significant increase in yield and its components due to bio-organic treatment compared to uninoculation with *Rhizobactrein* treatment could be due to that the role of biofertilizer in increasing the indigenous level of plant phytohormones like IAA, GAS and CKS with promote plant growth, cell divisions, break the a pical dominance, encourage the photosynthesis and assimilates accumulation (Said, 1998). Also, the role of these microorganisms in increasing the nitrogen uptake which promote plant development thought the expected increase in the root

extension (Hamissa *et al*., 2000), the result clear that the application of chemical fertilizer alone yielded a significant better effect than that of biofertilizers alone.

Table 3. Mean values of cotton yield, yield components and seed quality as affected by bio, organic and mineral fertilizers in 2011 and 2012 seasons.

Treatment	Seed cotton yield/plant (g)		Seed cotton yield/fed. (K)		Lint %		Earliness %		Protein %		Oil %	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
1- 100% N(cont.)	33.91	35.31	8.76	8.20	36.48	36.50	56.03	55.29	18.80	18.91	19.80	19.95
2- 75% N+ Rhizo	41.54	40.23	9.50	9.86	39.50	38.92	60.86	60.71	20.22	20.37	21.53	20.98
3- 50% N + Rhizo	36.96	37.52	9.10	9.21	38.41	37.98	59.73	58.74	19.31	19.89	20.61	20.78
4- 75% N + Compost	31.73	31.73	8.62	8.35	36.69	37.53	55.82	56.62	19.15	19.76	19.86	19.75
5- 50% N + Compost	29.28	25.66	7.97	7.59	36.17	36.59	53.45	53.97	18.92	18.79	18.96	19.11
6- 75% N+ Rhizo + Compost	45.11	43.80	10.99	10.83	40.75	40.91	65.56	64.16	23.93	22.67	22.07	22.34
7- 50% N + Rhizo + Compost	44.70	43.45	10.59	10.66	39.87	39.01	63.29	62.71	22.90	21.68	21.75	21.50
8- 75% N	33.25	33.51	8.01	7.98	36.39	36.27	54.11	53.60	18.50	18.70	18.54	18.60
9- 50% N	28.79	26.43	7.29	7.76	36.25	36.11	53.29	52.30	18.29	18.53	18.36	18.71
10- Rhizo + Compost	21.60	22.29	6.53	6.85	35.96	36.00	50.38	51.19	18.01	18.16	18.00	18.26
LSD at 0.05	4.35	5.92	2.03	2.74	1.35	1.29	7.19	6.34	3.81	2.07	3.25	3.11

The highest seed cotton yield was obtained when cotton seed inoculated with *Rhizobactrein* commercial biofertilizer + 75% N+ Compost giving 10.99 and 10.83 Kentar/ fed. in 2011 and 2012 seasons, respectively. This effect may be due to this fertilizer treatment give the highest values of no of sympodial branches per plant, boll weight, seed index and seed cotton yield/ plant.

2- Seed quality

Data in Table (3) show that, use of 75% N+ *Rhizobactrein* + Compost treatment gave the highest values of oil and protein percentage in both seasons while the lowest values caused when used inoculation seed cotton with *Rhizobactrein* and compost alone without any nitrogen fertilizer. (23.13, 22. 67) (22.07 and 22.34). Additional of chemical and biofertilizer to cotton plants leads generally to an increase in the oil and protein percentage of seeds compared to uninoculated plants (Abd El – Magid, 2002 and El – Sayed and El – Menshawi, 2005).

3- Fiber properties

During two seasons, results in Table(4) show that no significant differences were recorded in both seasons in fiber properties i.e fiber length, strength, and micromere reading due to chemical, bio and organic fertilizer. This result is in good agreement with that obtained by Abd El- Magid (2002) and Abou – Zaid *et al*. (2002).

Table 4. Mean values of cotton fiber properties as affected by bio,organic and mineral fertilizers in 2011 and 2012 seasons.

Treatment	Fiber length 2.5% Sp (mm)		Uniformty ratio %		Fiber strength Pressely index.		Fiber fineness micronaire reading	
	2011	2012	2011	2012	2011	2011	2011	2012
1- 100% N(cont.)	32.11	32.28	46.13	46.35	33.02	33.18	4.13	4.42
2- 75% N+ Rhizo	34.65	34.78	47.30	47.41	34.28	34.30	3.73	3.85
3- 50% N + Rhizo	34.25	34.64	47.27	47.58	34.26	34.51	3.82	3.90
4- 75% N + Compost	33.97	33.81	46.87	46.73	33.95	33.98	4.10	4.22
5-50% N + Compost	33.82	33.29	46.57	46.86	33.19	33.72	4.29	4.31
6- 75% N+ Rhizo + Compost	35.72	35.81	49.07	49.53	34.60	34.67	3.50	3.61
7- 50% N + Rhizo + Compost	35.00	34.93	48.77	49.00	34.37	34.60	3.70	3.83
8- 75% N	32.65	31.54	46.67	46.31	33.11	33.18	4.37	4.60
9- 50% N	31.39	31.28	45.50	45.38	31.88	30.99	4.42	4.53
10- Rhizo + Compost	31.00	30.98	45.00	45.87	31.63	31.56	3.98	4.09
LSD at 0.05	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns

4- Chemical constituents in cotton leaves

It is obvious from Table (5) that, there were significant differences among treatments in relation to leaves content of chemical constituents such as chlorophyll a & b and total chlorophylls, total soluble sugar and carotenoids. This may be due to the needed for carotenoids in essential metabolites biosynthesis .In general, there was gradual increasing in chlorophylls, level with reducing N Mineral rate with inoculation with bacterial or/and compost whereas the obtained results reveal that, bacterial inoculation or/and compost improve leaves content of chlorophyll of plant that received 75% N/fed.

Table 5. Effect of bio, organic and nitrogen fertilizes on some of cotton leaves chemical constituents in 2011 and 2012 seasons

Treatments	Chlorophyll (mg/g. d. w.)			Chlorophyll (mg/g. d. w.)			Total soluble suger(mg/g.d. w)		Carotenoids (mg/g. f. w.)	
	a	b	Total	A	b	Total				
	2011			2012			2011	2012	2011	2012
1- 100% N(cont)	3.56	2.22	5.78	3.40	2.04	5.44	13.90	13.40	0.87	0.84
2- 75% N+ Rhizo	4.62	2.78	7.40	4.50	2.61	7.41	16.65	16.50	0.92	0.90
3- 50% N + Rhizo	4.51	2.57	7.08	4.39	2.40	6.79	16.30	15.99	0.89	0.86
4- 75% N + Compost	4.13	2.32	6.45	3.99	2.29	6.28	16.00	16.08	0.82	0.84
5-50% N + Compost	4.09	2.10	6.19	3.85	2.00	5.85	15.73	15.98	0.78	0.75
6- 75% N+ Rhizo + Compost	4.99	3.01	8.00	4.98	3.12	8.10	18.51	17.92	0.95	0.93
7- 50% N + Rhizo + Compost	4.75	2.85	7.60	4.83	2.19	7.02	17.73	15.64	0.85	0.82
8- 75% N	3.81	2.61	6.42	4.32	2.70	6.72	15.32	14.98	0.80	0.79
9- 50% N	3.67	2.24	5.91	3.71	2.30	6.01	15.00	14.76	0.74	0.68
10- Rhizo + Compost	3.13	2.08	5.21	3.29	2.11	5.40	13.95	13.11	0.63	0.70
LSD at 0.05	0.56	0.73	1.20	0.71	0.25	1.17	1.11	0.99	0.02	0.13

The beneficial effect of bacterial inoculation on chlorophyll level could be due to the enhancing effect of N fixed by bacteria on N uptake and subsequent increase in N level in leaves of cotton plant (Kassem and Hassouna, 2004). Nitrogen plays a major role in synthesis of secondary products throughout maximizing enzymatic activity control the biosynthesis of energy rich molecule. The obtained results are in line with those of El – Sawy *et al.*(1998).

5- Net income/fed.

Data in table (6)showed that, combination of 75 % N and inoculation seed cotton with *Rhizobacterein* and putting compost to soil gave the highest wet income value/fed in both seasons as compared with other treatments. The significant increase in net income/fed. due to N fertilizer and / or biofertilizer and compost treatment could be explained on the role of these treatments in increasing seed cotton yield/ fed.

Table (6) Means of cotton net income/fed. as affected by bio, compost and N fertilizer levels during 2011 and 2012

Treatment	Fertilizer costs/fed (pounds)		Income/fed (pounds)		Net Income/fed (pounds)	
	2011	2012	2011	2012	2011	2012
1- 100% N(cont)	129.98	129.98	3942.00	3690.00	3812.02	3560.02
2- 75% N+ Rhizo	64.98	64.98	4275.00	4437.00	4210.02	4372.02
3- 50% N + Rhizo	89.99	89.99	4095.00	4144.50	4005.01	4054.51
4- 75% N + Composs	709.98	709.98	3879.00	3757.50	3169.02	3047.52
5-50% N + Compost	689.99	689.99	3586.50	3415.50	2896.51	2725.51
6- 75% N+ Rhizo + Compost	714.98	714.98	4945.50	4873.50	4230.52	4158.52
7- 50% N + Rhizo + Compost	694.99	694.99	4765.50	4797.00	4070.51	4102.01
8- 75% N	109.98	109.98	3604.50	3591.00	3494.52	3481.02
9- 50% N	89.99	89.99	3280.50	3492.00	3590.51	3402.01
10- Rhizo + Compost	605.00	605.00	2938.50	3082.50	2333.50	2477.50

Price of biofertilizer used per fed = 5 pound
Price of N fertilizer 30 Kg N. /fed = 39.99 pound
45 Kg N/fed = 59.98 pound
60 Kg N/fed = 79.98 pound
Labour fertilization costs = 50 pound / fed.
Price of seed cotton yield (Kenter) = 450 pounds
Price compost 150 pound.
According to Hamissa, *et al* (2000).

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استجابة القطن إلى التسميد الحيوي والعضوي تحت مستويات مختلفة من النيتروجين

أماني محمد عبد الله، جمالات عثمان محمود وسوسن عبد البديع الصادي
كلية الزراعة – جامعة القاهرة – قسم المحاصيل

تم إجراء تجربتان حقليتان فى محطة التجارب و البحوث الزراعية – كلية الزراعة - جامعة القاهرة خلال موسمي ٢٠١١ و ٢٠١٢ لمعرفة تأثير تلقيح بذور القطن بالريزوباكترين والكمبوست تحت مستويين من السماد النيتروجين ٧٥% و ٥٠% من المعدل الموصى به على المحصول ومكوناته ونسبة الزيت والبروتين والصفات التكنولوجية للالياف وكذلك محتوى الأوراق من الكلورفيل والسكر الكلي والكارتينات وكان تصميم التجربة هو القطاعات كاملة العشوائية وكان الصنف المستخدم هو جيزة ٨٨، وكانت أهم النتائج المتحصل عليها فيما يلي:

- أثرت معاملات التسميد تحت الدراسة معنويا على كل الصفات تحت الدراسة وكانت أفضل معاملة هى استخدام ٧٥% نيتروجين + ريزوباكترين + كمبوست حيث أعطت أفضل النتائج فى طول النبات وعدد الأفرع الثمرية، عدد اللوز المتفتح، وزن اللوزة، معدل البذور ومحصول القطن الزهر / نبات والفدان ونسبة التيلة، ونسبة التبكير.
- تأثرت نسبة الزيت والبروتين معنويًا بمعاملات التسميد المستخدمه حيث أن إضافة ٧٥% نيتروجين + ريزوباكترين + كمبوست).يعطى أعلى نسبة زيت وبروتين.
- لم يكن هناك تأثير معنوي لمعاملات التسميد المستخدمه على كل الصفات التكنولوجية تحت الدراسة فى كلا الموسمين فى طول التيلة و متانة ونعومة الالياف .
- أدى نقص معدل الأزوت المعدني إلى ٧٥% نتروجين مع استخدام المخصب الحيوي فى معاملة البذور وإضافة الكومبست إلى حدوث زيادة معنوية فى محتوى الأوراق من الكلورفيل والسكر الكلي والكاروتينات فى كلا الموسمين، وزيادة صافي الدخل للفدان.

توصى الدراسة باستخدام السماد الحيوي الريزوباكترين ٢٠٠جم/ ٣٠كيلو جرام بذرة/ فدان والكمبوست بمعدل ٤طن /للفدان مع إضافة ٧٥% من السماد النتروجينى الموصى به للحصول أعلى محصول فى نباتات القطن مع تقليل التلوث البيئي الناتج عن استخدام المعدل العالي من السماد النيتروجيني تحت ظروف محافظه الجيزه.

قام بتحكيم البحث

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