EFFECT OF MINERAL NITROGEN AND SOME BIO-ORGANIC FERTILIZERS ON GROWTH, YIELD AND SOME CONSTITUENTS OF GIZA 88 COTTON CULTIVAR

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ABSTRACT

Two Field experiments were carried out at Sakha Agric. Res. Station during 2003 and 2004 seasons using cotton Giza 88 cultivar, to study the effect of mineral nitrogen at 30 and 60 kg/fed., either single or combination with Rizobacterein or Nitrobein (biofertilizer produced by the Egyptian Ministry of Agriculture, containing active bacteria capable of N_2-fixation on growth, earliness, yield and its components, fiber properties as well as chemical constituents. The experimental design was complete randomized blocks with four replications. The obtained results could be summarized as follows:

1. Increasing nitrogen fertilizer rates up to 60 kg N/fed. produced maximum values of growth characters i.e. final plant height, numbers of monopodia and sympodia per plant and leaf area/pant, yield and its components and dry weight of plant, while nitrogen fertilizer levels had insignificant effects on number of days to first flower and first cracking boll in the two seasons.
2. Plants that received 30 kg N/fed. in the presence of Rizobacterein gave great values of growth measurement, high yield and its components nearly identical to that produced by 60 kg N/fed. alone.
3. Using 30 kg N/fed. and inoculation of cotton seed with Rizobacterein increased significantly oil, protein percentage in seeds and chemical constituents in leaves except phenols while carotenoids were decreased by this treatment.
4. Lint percentage and fiber properties were not affect by nitrogen levels and biofertilizer treatments.

Therefore, the biofertilizer can be recommended for cotton to improve productively, growth and some chemical composition, beside this, it reduced the need for mineral fertilizer by about 50%, decreased the production cost and environmental pollution.

INTRODUCTION

Nitrogen is the limiting element for cotton production under local condition. Egyptian soils are deficient in organic matter and total soluble nitrogen (Abd El-Hadi *et al.*, 1997). The early recorded results on cotton fertilization under local conditions indicated that nitrogen is one of the most important factors that exerts marked effects on the yield and yield components of cotton (Eid and Hamissa, 1969).

Nowadays, on the way of clear agriculture with minimum pollution effects, the use of biofertilizers is recommended by several investigators to substitute the mineral fertilizes (Saber, 1993 and El-Aggory *et al.*, 1996). Biofertilizers drew the attention as partial good alternative to N fertilizer application. In addition, biofertilizers 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 biofertilizer for cotton was suggested by Hamissa *et al.* (2000) who found that inoculation of cotton seeds with some biofertilizers i.e. Microbein, Rizobacterein and Nitrobein increased significantly plant height at harvest, boll weight, seed cotton yield/plant in both seasons and numbers of open bolls/plant, seed cotton yield/fed. and lint % in one season only as compared with the check. This application increased also net income/fed. in both seasons. He added that inoculation of cotton seeds with Rizobacterein when conjugated with using the high N dose (60 kg N/fed.) produced the highest values of plant height at harvest, number of open bolls/plant and lint %.

Therefore, the present investigation was designed to study the ability of some biofertilizers alone or combined with nitrogen fertilizer for covering N requirements of cotton plants for cotton yield production and to protect the environment against pollution by extra mineral fertilizers application.

MATERIALS AND METHODS

Two field experiments were carried out at Sakha Agricultural Research Station during 2003 and 2004 seasons using the Egyptian cotton cultivar Giza 88 (*G. barbadense* L.) to study the effect of some biofertilizers (Rizobacterein and Nitrobein) alone or combined with two nitrogen levels (30 kg N/fed. half recommended dose) and 60 kg N/fed. (recommended dose) on cotton plant growth, earliness, seed cotton yield and chemical analysis of seeds and leaves of plant. The experiment was designed in complete randomized block with four replicates. The plot size was 18 m^2 including 6 rows (5 m-long and 60 cm width). The treatments were as follows:

1. 30 kg nitrogen (N)/fed. (without inoculation).
2. 30 kg nitrogen (N)/fed. + inoculation with Rizobacterein (200 g/30 kg seeds).
3. 30 kg nitrogen (N)/fed. + inoculation with Nitrobein (400 g/30 kg seeds/fed.).
4. 60 kg nitrogen (N)/fed. (without inoculation).
5. 60 kg nitrogen (N)/fed. + inoculation with Rizobacterein (200 g/30 kg seeds).
6. 60 kg nitrogen (N)/fed. + inoculation with Nitrobein (400 g/30 kg seeds/fed.).
7. Inoculation with Rizobacterein (200 g/30 kg seeds/fed.).
8. Inoculation with Nitrobein (400 g/30 kg seeds/fed.).

Nitrogen fertilizer in the form of ammonium nitrate (33.5% N) was added in bands in two equal doses, the first one was applied after thinning just before the first irrigation and the second part before the second irrigation. Two biofertilizers were used in the present study, i.e. Rizobacterein and Nitrobein, which are a commercial multi-strain of nitrogen fixing bacteria produced by the general organization agricultural of equalization fund, Ministry of Agriculture. The carriers of Rizobacterein and Nitrobein are peatmoss, charcoal and calcium carbonate. Arabic gum was melted in amount of warm water and was added to each of the previous two biofertilizers cotton seeds were added to the mixture of biofertilizer and gum and mixed carefully spread over plastic sheet far from the direct sun effect for short time before sowing. After sowing irrigation was covered immediately. All other cultural practices were done as recommended in cotton production that is involved as basic dose of 150 kg calcium superphosphate (15.5% P_2O_5) at land preparation. Potassium application was in the form of potassium sulphate 48% K_2O. Soil samples were taken in the two seasons before planting cotton to estimate the soil characters using the standard methods as described by Chapman and Parker (1981). The results are shown in Table 1.

Table (1): Mechanical and chemical analysis of the experiment soil in 2003 and 2004 seasons.

Characters		2003	2004
Soil structure		Clay	Clay
pH		8.52	8.29
Organic matter	%	1.68	1.72
TSS	%	0.61	6.20
Bicarbonate	%	1.79	1.81
Chloride		7.90	7.82
Sulfuric	%	5.62	6.20
Ca^{++}	%	1.31	1.42
Mg^{++}	%	1.94	1.89
Na^{+}	%	4.60	4.58
Available N ppm		12.4	11.95
Available P ppm		9.35	9.55
Available K ppm		685.3	684.2

Five representative hills were chosen by random from the four inner rows in order to study the following characters:

A. Growth characters: Final plant height (cm), number of monopodia per plant, number of sympodia per plant and leaf are/plant (dm^2) (the disc method was used according to Johnson (1967). The cross sectional area of the punch used was 1.538 cm^2).

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

B. Earliness measurements: First sympodia position, days to first flower appearance, days to first boll and earliness percentage:

$$\frac{\text{First pick}}{\text{First pick + second pick}} \times 100$$

C. Yield components: Number of open bolls, boll weigh t(g), lint % and seed index (g/100 seeds). seed cotton yield (kentar/feddan) were estimated from picking all plants of the four inner rows of each plot:
D. Total dry weight/plant (g): A random sample of five plants were taken after 120 days from sowing in the two seasons. all plants were carefully uprooted, washed hard then floated in a water bath for final separation from the muddy medium. All plant parts were dried in an air forced oven at 90°C to a constant weight. Oil and protein (in seed) was determined according to A.O.A.C. (1975).
E. Fiber quality: Fiber fineness (micronaire value) and fiber strength (pressley index) were measured at the laboratories of Cotton Research Institute, under the standard condition of test (62 + 2% relative humidity and 70 + 2 F temperature) according to A.S.T.M. (1975).

For chemical analysis, a random sample of the top fourth node leaves were taken 15 days after thinning to determine some chemical constituents, i.e. chlorophyll, carbohydrates, carotenoides and phenols according to (A.O.A.C. 1975). Statistical analysis was performed according to Snedecor and Cochran (1981) and means were compared by L.S.D. at 5% level.

RESULTS AND DISCUSSION

Plant growth and earliness measurement:

In Table (2), it is clear that N fertilizer rate gave significant effect on plant height at harvest, number of monopodia per plant, number of sympodia per plant and leaf area per plant (dm^2) in the two seasons, in favour of the high nitrogen level (60 kg N/fed.). This may be due to that the nitrogen stimulate vegetative cotton plant growth by increasing amino acids and growth hormones formation which in turn acts positively for cell division and elargement and producing new tissues. This result is in harmony with that of Abd El-Malik, 1998. In the same table, it is clear that inoculation of cotton seed with biofertilizer (Rizobacterein or Nitrobein) and fertilization with mineral nitrogen had significant increase in all characters studied of cotton plant growth as

Table (2): Effect of nitrogen fertilizers, biofertilizer and their combination on some cotton plant growth characters and earliness parameters in 2003 and 2004 seasons.

Treatments \ Characters	Seasons	Pant height at harvest (cm)	No. of monopodia/ plant	No. of sympodia/ plant	Leaf area/plant (dm^2)	First sympodial position	Days to first flower appearance	Days to first cracking boll	Earliness %
30 kg N/fed. (without inoculation)	2003	100.20 b	1.20 bcd	12.85 bc	11.25 cd	6.11 f	91.80 a	143.00 a	53.12 a
	2004	102.15 b	1.30 bcd	13.20 bc	12.10 cd	6.10 f	92.54 a	142.21 a	52.70 a
30 kg N/fed. + Rizobacterein	2003	109.25 a	1.70 abcd	15.20 a	13.40 bc	6.70 d	93.75 a	144.20 a	51.80 a
	2004	109.12 a	1.80 abc	15.50 a	14.55 bc	6.40 d	93.60 a	143.35 a	52.85 a
30 kg N/fed. + Nitrobein	2003	108.60 a	1.60 abcd	14.9 ab	12.70 cd	6.60 e	92.80 a	142.80 a	51.00 a
	2004	108.30 a	1.70 abcd	14.86 ab	14.00 bcd	6.30 e	92.90 a	142.85 a	51.90 a
60 kg N/fed. (without inoculation)	2003	109.50 a	1.90 abc	15.50 a	13.75 bc	6.80 c	93.45 a	143.35 a	54.10 a
	2004	110.35 a	2.00 ab	15.70 a	14.60 bc	6.91 b	94.21 a	144.20 a	54.75 a
60 kg N/fed. + Rizobacterein	2003	110.20 a	2.20 a	18.80 a	17.80 a	7.10 a	93.90 a	144.40 a	54.75 a
	2004	111.50 a	2.10 a	15.95 a	18.20 a	6.75 c	94.95 a	144.85 a	53.50 a
60 kg N/fed. + Nitrobein	2003	109.50 a	2.10 ab	14.50 ab	16.50 ab	7.00 b	93.95 a	143.20 a	54.95 a
	2004	110.70 a	2.10 a	14.80 ab	17.00 ab	7.10 a	92.98 a	143.70 a	52.80 a
Inoculation with Rizobacterein	2003	95.60 c	1.00 cd	11.20 c	10.20 d	6.00 g	90.70 a	142.00 a	55.10 a
	2004	96.50 c	1.10 cd	12.10 c	11.10 d	6.10 f	91.20 a	141.75 a	54.10 a
Inoculation with Nitrobein	2003	93.70 c	0.80 d	11.80 c	9.88 d	6.10 f	90.30 a	141.20 a	55.22 a
	2004	94.35 c	0.95 d	12.35 c	11.20 d	6.00 g	90.20 a	141.00 a	53.30 a
F-test		**	*	**	*	*	NS	NS	NS

*, ** and N.S indicate $P < 0.05$, 0.01 and not significant, respectively.
Means designated by the same letter within each column for every season are not significant different at 5% levels according to L.S.D. multiple range test

compared with the uninoculated plants. Using Rizobacterein led to significant increase in most growth characters as compared to Nitrobein.

Data in Table 2 show that the addition of biofertilizers enhanced the effect of the chemical fertilizers, particularly at the low rates of chemical fertilizers (30 kg N/fed.). The effect of such treatment (30 kg N/fed.) with Rizobacterein or Nitrobein was equal to that recorded at 60 kg N/fed. when added alone with biofertilizers. These increases may be due to the great role of biofertilizer bacteria that may enhance plant growth by N_2-fixing in cultivated soils and/or contributing some growth hormones, such as gibberelins, auxins and cytokinins that bacteria could release in the root media and affect its growth and extension positively, (Said, 1998).

Data in Table 2 indicate that the application of chemical fertilizer alone yielded a significantly better effect than that of biofertilizers alone, this may be attributed to the slow release of biofertilizers can not provide the nitrogen requirements of cotton crop alone (Prasad and Prasad, 1995).

Nitrogen fertilizer levels and biofertilizer treatments had insignificant effect on earliness measurements in both seasons (Table 2). It is evident that plants received 30 kg N/fed. in the presence of Rizobacterein achieve great value of growth measurement were nearly identical for that produced by 60 kg N/fed. alone. Similar results were obtained by El-Shazly and Darwish (2001). This means that combination of biofertilizers with suitable doses of chemical fertilizers could help to increase the efficiencies of these fertilizers, protect the environment from pollution, decrease the high chemical fertilizes (saving about 50% of chemical fertilizers) and accordingly producing satisfactory and good seed cotton yield. The results of El-Akabawy *et al.* (2000) confirm these findings.

Yield, yield components and dry weight of plant:

Nitrogen fertilizer rate and biofertilizer treatments had significant effects on number of open bolls/plant, boll weight, seed index, seed cotton yield (kentar/fed.) and total dry weight/plant (g), while, lint percentage was not significantly affected in both seasons (Table 3). The highest mean values of yield, its components and dry

Table (3): Effect of nitrogen fertilizers, biofertilizers and their combination on yield, yield components and dry weight of plant in 2003 and 2004 seasons.

Characters / Treatments	Seasons	Number of open bolls/plant	Boll weight (g)	Seed index (g/100 seeds)	Seed cotton yield kentar/fed.)	Lint percentage	Total dry weight/plant (g)	Fiber properties	
								Micronaire reading	Pressley index
30 kg N/fed. (without inoculation)	2003	12.10 cd	1.80 c	9.11 abc	7.90 de	40.10 a	80.50 bc	4.2 a	9.3 a
	2004	13.20 bc	1.75 d	9.00 b	6.80 b	39.50 a	79.20 b	4.2 a	9.5 a
30 kg N/fed. + Rizobacterein	2003	14.20 bc	2.00 d	9.20 abc	9.15 bcd	40.22 a	87.35 ab	4.4 a	9.7 a
	2004	13.80 b	1.95 bc	9.35 ab	7.50 b	39.95 a	83.00 b	4.5 a	9.6 a
30 kg N/fed. + Nitrobein	2003	13.10 cd	1.95 d	9.18 abc	8.90 cd	40.15 a	85.35 ab	4.3 a	9.4 a
	2004	13.00 bc	1.82 cd	9.21 ab	7.10 b	39.75 a	80.10 b	4.2 a	9.5 a
60 kg N/fed. (without inoculation)	2003	16.40 ab	2.10 c	9.45 abc	10.00 abc	40.42 a	89.20 ab	4.2 a	9.5 a
	2004	17.50 a	1.98 bc	9.60 ab	9.80 a	40.50 a	91.30 a	4.2 a	9.4 a
60 kg N/fed. + Rizobacterein	2003	18.20 a	2.32 a	9.89 a	11.50 a	40.80 a	90.70 ab	4.5 a	9.7 a
	2004	18.70 a	2.35 a	9.95 a	10.95 a	40.75 a	92.50 a	4.4 a	9.8 a
60 kg N/fed. + Nitrobein	2003	17.50 a	2.20 b	9.75 ab	11.00 abc	40.70 a	98.10 a	4.3 a	9.6 a
	2004	18.00 a	2.10 b	9.81 a	10.15 a	40.55 a	90.00 a	4.3 a	9.5 a
Inoculation with Rizobacterein	2003	11.40 d	1.50 f	8.85 bc	6.72 e	39.80 a	65.80 cd	4.2 a	9.3 a
	2004	10.50 c	1.58 e	8.90 b	7.35 b	39.65 a	72.30 c	4.2 a	9.2 a
Inoculation with Nitrobein	2003	10.90 d	1.42 g	8.70 c	6.60 e	39.50 a	60.20 d	4.2 a	9.3 a
	2004	10.20 c	1.48 e	8.95 b	7.20 b	39.35 a	70.25 c	4.2 a	9.3 a
F-test		**	*	*	**	NS	*	NS	NS

*, ** and N.S indicate P < 0.05, 0.01 and not significant, respectively.
Means designated by the same letter within each column for every season are not significant different at 5% levels according to L.S.D. multiple range test

matter of plant were obtained from the combination between the high nitrogen dose (60 kg N/fed.) and inoculation of cotton seeds with Rizobacterein.

It is obvious that all traits of yield and its components increased by increasing nitrogen fertilizer levels from 30 to 60 kg N/fed. at any biofertilizer treatments in the two seasons.

Nitrogen levels and biofertilizer treatments gave a significant effect on total dry weight/plant at 120 days after planting in both seasons in favour of 60 kg nitrogen fertilizer with inoculation of cotton seeds with Rizobacterein (Table 3). It is evident that plants received 30 kg N/fed. in the presence of Rizobacterein achieved great yield nearly identical for that produced by 60 kg N/fed. alone. There were significant increases on important yield components such as number of open bolls and boll weight (g) in both seasons as a result of biofertilizer application with 30 or 60 kg N/fed. comparing with 30 and 60 g/fed. without biofertilizer.

The significant increase in yield and its components due to bio-organic treatments compared to inoculation with biofertilizer treatments could be due to that the role of biofertilizer in increasing the indigenous level of plant phytohormones like IAA, GAS and CKS which promote plant growth, cell division, break the apical dominance, encourage the photosynthesis and assimilates accumulation (Said, 1998). Also, the role of these microorganisms in increasing the nitrogen, phosphorus and potassium uptake which promote plant development through the expected increase in the root extension (Hamissa *et al.*, 2000).

Nitrogen and biofertilizer treatment did not exhibit any significant effect on lint percentage (Table 3). The highest mean values of these traits were obtained when cotton seed was inoculated with Rizobacterein and received 60 kg N/fed. (Hamissa *et al.*, 2000).

The results in Table 3 clear that the application of chemical fertilizer alone yielded a significant better effect than that of biofertilizers alone.

During two seasons, results show that no significant differences were recorded in fiber properties i.e. micronaire reading or Pressely index due to nitrogen levels and biofertilizers. This result is in good agreement with that obtained by Abd El-Magid (2002).

Seed content of oil and protein and some chemical constituents in cotton leaves:

Data in Table (4) indicate that addition of chemical fertilizers and biofertilizers to cotton plants leads generally to an increase in the oil and protein percentage in seeds compared to uninoculated plants. The highest value of seed content of oil and protein was obtained from the plants received the half N dose (30 kg N/fed.) and uninoculation of cotton seeds with Rizobacterein (as a result for the high vegetative growth, a combined by reducing in fruiting growth). These results are in agreement with those obtained by Abd El-Magid (2002).

Data in Table 4 indicate that using biological and mineral fertilization are recommended in increasing all chemical constituents in cotton leaves i.e. total chlorophylls, carbohydrates and phenols in favour of 30 kg N/fed. and inoculation with Rizobacterein . On the other hand, nitrogen and biofertilizer application had a negative effects on carotenoids at all treatments. This reduction may be due to the reduction in essential metabolites needed for carotenoids biosynthesis.

These results may be due to the fact that nitrogen plays a major role in synthesis of these secondary products throughout maximizing enzymatic activity controlling the biosynthesis of energy rich molecules. The obtained results were in line with those of El-Sawy *et al.* (1998).

CONCLUSION

From the present study it could be conclude that the use of biofertilizers such as Rizobacterein (200 g/30 kg seeds/fed.) and Nitrobein (400 g/30 kg seeds/fed.) with low doses of mineral fertilizer i.e. 30 kg N/fed. produce high yield and growth of cotton plants and prevent or at least, decreased the serious pollution of the environment resulting from the excessive use of chemical fertilizers.

Table (4): Effect of nitrogen fertilizers, biofertilizers and their combination on oil and protein contents of the cotton seeds and some chemical constituents in cotton leaves in 2004 season.

Characters / Treatments	Oil %	Protein %	Total chlorophyll	Carotenoids	Carbohydrates			Phenols	
					R.S.	Non R.S.	T.S.S.	Mono	Poly
30 kg N/fed. (without inoculation)	20.20 cd	19.80 bcd	3.00 b	0.89 c	8.30 c	4.31 d	13.10 d	8.20 a	14.3 a
30 kg N/fed. + Rizobacterein	24.50 a	22.20 a	4.80 a	0.75 h	9.75 a	4.95 a	13.95 a	8.70 a	15.6 a
30 kg N/fed. + Nitrobein	21.90 bc	19.95 bc	3.70 b	0.79 e	8.52 bc	4.50 c	13.40 cd	8.35 a	14.4 a
60 kg N/fed. (without inoculation)	23.85 b	21.50 ab	4.50 a	0.80 d	9.10 ab	4.80 b	13.80 bc	8.50 a	15.2 a
60 kg N/fed. + Rizobacterein	24.20 a	22.00 ab	4.75 a	0.76 g	9.50 a	4.85 ad	13.90 b	8.62 a	15.3 a
60 kg N/fed. + Nitrobein	23.82 b	21.75 ab	4.65 a	0.78 f	9.2 ab	4.85 ad	13.82 bc	8.60 a	14.9 a
Inoculation with Rizobacterein	19.80 cd	18.26 cd	3.00 b	0.93 b	7.90 c	4.00 e	13.00 d	8.10 a	14.2 a
Inoculation with Nitrobein	18.20 d	18.00 d	3.20 b	0.95 a	7.82 c	4.10 c	12.95 d	8.00 a	13.9 a
F-test	*	*	*	*	*	*	*	NS	NS

*, ** and N.S indicate $P < 0.05$, 0.01 and not significant, respectively.
Means designated by the same letter within each column for every season are not significant different at 5% levels according to L.S.D. multiple range test

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تأثير التسميد النيتروجينى المعدنى وبعض الاسمدة الحيوية على النمو والمحصول وبعض المكونات الكيميائية لصنف القطن جيزه ٨٨

عزت عبدالسلام السيد ، محمد المنشاوى المنشاوى

أجريت تجربتان حقليتان بمحطة البحوث الزراعية بسخا خلال موسمى ٢٠٠٣ ، ٢٠٠٤م لدراسة تأثير التسميد النيتروجينى عند مستوى ٣٠ و ٦٠كجم للفدان سواء أضيف منفردا أو مع الأسمدة الحيوية (ريزوباكترين أو نيتروبين) وذلك على صنف القطن جيزه ٨٨ على النمو والمحصول وبعض المكونات الكيميائية. وتضمنت كل تجربة المعاملات الآتية: (١- تسميد أرضى نيتروجينى ٣٠كجم/ف ، ٢- تسميد أرضى نيتروجينى ٣٠كجم/ف + خلط البذرة بالريزوباكترين (٢٠٠جرام لكل ٣٠كجم بذرة ، ٣- تسميد أرضى نيتروجينى ٣٠كجم/ف + خلط البذرة بالنيرتوبين ٤٠٠ جرام لكل ٣٠كجم بذرة ، ٤- تسميد أرضى نيتروجينى ٦٠كجم/ف ، ٥- تسميد أرضى نيتروجينى + خلط البذرة بالريزوبلكترين ٢٠٠ جرام لكل ٣٠كجم بذرة ، ٦- تسميد أرضى نيتروجينى + خلط

البذرة بالنيتروبين ٤٠٠ جرام لكل ٣٠كجم بذرة ، ٧- خلط البذرة بـ ٢٠٠جم ريزوباكترين فقط لكل ٣٠ كجم بذرة ، ٨- خلط البذرة بـ ٤٠٠جم نيتروبين فقط لكل ٣٠ كجم بذرة.

ويمكن تلخيص النتائج المتحصل عليها فيما يلي:

١- أدى زيادة مستوى التسميد النيتروجيني وحتى ٦٠كجم للفدان إلى زيادة صفات النمو مثل الطول النهائي للنبات وعدد الأفرع الخضرية والثمرية ودليل مساحة الأوراق وإلى زيادة المحصول ومكوناته والوزن الجاف للنبات بينما لم يؤثر إضافة المستويات المختلفة من التسميد النيتروجيني على عدد الأيام لتفتح أول زهرة وأول لوزة.

٢- أعطت النباتات التي سمدت بالتسميد الأرضي ٣٠كجم نيتروجين للفدان مع خلط البذرة بالسماد الحيوي ريزوباكترين أعلى قيم لصفات النمو والمحصول ومكوناته ويتقارب محصولها مع النباتات التي سمدت بالسماد الأرضي النيتروجيني فقط بمعدل ٦٠كجم للفدان.

٣- أدت إضافة السماد الأرضي بمعدل ٣٠كجم/ف من النتروجين بالإضافة إلى الخلط مع السماد الحيوي ريزوباكترين إلى الزيادة المعنوية لمكونات البذرة في نسبة الزيت والبروتين وبعض المكونات الكيميائية في الأوراق ما عدا الكاروتينات التي نقصت بزيادة النيتروجين ومعاملات التسميد الحيوي.

٤- لم تتأثر صفات النسبة المئوية للشعر وصفات التيلة بمستويات التسميد النيتروجيني والسماد الحيوي.