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INFLUENCE OF SOME BIOFERTILIZERS AND FOLIAR APPLICATION WITH AMINO GREEN AND YEAST ON SOME BOTANICAL CHARACTERS OF SNAP BEAN UNDER SANDY SOIL CONDITIONS

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ABSTRACT: Two field experiments were carried out during two successive summer seasons of 2007 and 2008 at the Experimental Farm, El-Kassasein Research Station, Ismailia Governorate, to investigate the effect of two sources of biofertilizers (Biogen and Nitrobein) in addition to the control (without), foliar application with amino green compound (1, 2 and 4 cm/l), active dry yeast (1, 2 and 4g/l) and their interactions on plant growth, dry weight, leaf pigments, yield and chemical constituents of snap bean (*Phaseolus vulgaris* L.) cv. Paulista. The anatomical structure of leaf was also studied. Inoculation of snap bean seeds with biofertilizers (Biogen or Nitrobein) recorded maximum values of plant height, number of leaves/plant, leaf area,Total dry weight of leaves and branches/plant, number of pods/plant, yield/plant and total yield/fed. as well as protein content in the pods as compared to control in both seasons, and increased the values of all anatomical characters.

Significant increases in the plant height, number of leaves /plant, leaf area, total dry weight of leaves and branches/plant, chlorophyll a, total chlorophyll (a+b) as well as carotenoides in leaf, number of pods /plant, yield /plant and total yield /fed. as well as protein content in the pods were recorded with foliar application of active dry yeast at the rate of 4g/ l or amino green compound at the rate of 4 cm^3/l or the combination between active dry yeast at the rate of 2g/ l, and amino green compound at the rate of 2 cm^3/l comparing with control plants.

The interaction between biofertilizers and foliar application with amino green compound or active dry yeast generally had significant effect on most of vegetative parameters, photosynthetic pigments, yield and its components as well as protein content in the pods at both seasons and all anatomical characters. The best treatments were the interaction between nitrobein biofertilizers and foliar spray with active dry yeast at rate 4g/l or by the combination between amino green (2cm^3/l) and active dry yeast (2g/l).

Key words: Botanical studies, common bean, biofertilizers, active dry yeast and amino green compound.

INTRODUCTION

Snap bean (*Phaseolus vulgaris* L.) is one of the most important vegetable crops grown in Egypt for both local consumption and exportation. Such importance comes from the fact that legumes are very rich in protein content which is essential for human nutrition rather than the role of such crops in improving soil fertility (Kerlous, 1997). Uses of mineral fertilizers (NPK) without rationalization may cause environmental pollution as well contaminate the underground water. For these reasons, there was a great attention to use biofertilizers in production of snap bean in order to reduce plant and soil contamination with different elements decline the usage of mineral fertilizers, produce clean crop and also to improve the soil properties. Biofertilizers (microbial inoculation), which contain efficient strains of nitrogen fixing, could be used partially instead of chemical fertilizers. Moreover, these bacterial cells increase the availability of nutrients in form that can be easily assimilated or to make them absorbable by plants (Subba Rao, 1993).

Yeast is considered as a natural source of Bs vitamins and most of the essential elements (Nagodawithana, 1991). In addition, yeast extract is the natural component that contains many of the nutrient elements and cytokininis, which is safe and non-pollutant. It has a considerable amount of amino acids (Abou Zaid. 1984).

Foliar application technique as a practical way to supply macro and micronutrients leads to considerable yield response. This is mainly due to the fact that foliar

nutrient application easily overcome limiting soil physiochemical conditions for root nutrient uptake and because nutrients are directly applied to foliage at times when demand is particularly high and rapid responses may be desired (Alexander, 1987).

Fertilization of pea plants with mixture of biofertilizers (rizobactrein + okadein + phosphorein) gave the highest values of stem length, number of leaves, branches and nodules/plant, total dry weight/plant, maximum values of chlorophyll a, b and (a+b) as well as carotenoides in leaf tissues, number of pods/plant, number of seeds/pod, yield/plant and total yield/fed. and total uptake of N, P and K/ plant (El-Beheidi *et al.,* 2005). Inoculation of garlic cloves with 3kg nitrobein recorded maximum dry weight of roots, bulb and leaves as well as total uptake of NPK (Bardisi *et al.,* 2004). Hewedy *et al.* (2003) indicated that inoculation of bean seeds with Nitrobein + Phosphorine and fertilization the plants with nitrogen fertilizer at 30Kg N + P_2O_5 at 30Kg/fed. induced significant increases in plant height and number of branches/ plant comparing with the treatment received mineral fertilizer alone at a rate of 40 Kg from either N or P_2O_5. Shams (2003) working on sweet pepper showed that inoculation with Nitrobein + Phosphorine significantly increased chlorophyll a and total chlorophyll over the control treatments. Nodules number and yield of snap bean were promoted with inoculation of seeds with rhizobial (Shibru and Mitiku 2000).

Many investigators studied the effect of Amino acids as foliar application on plant growth, yield and chemical constituents. Awad *et al.* (2007) indicated that the best growth parameters and the highest total tuber yield of potato were recorded with foliar addition of glycine plus lysine each at 100ppm. El-Shabasi *et al.*(2005) reported that foliar spraying of garlic plants with mixture of glycine, alanine, cysteine and arginine (each at 100 ppm) gave the highest values of plant height, leaf blade area, neck and bulb diameter, fresh weight of leaves and markedly produced higher yield and amino acid as well as crude protein. Kamar and Omar 1987 found that spraying cucumber plants with amino acid solution significantly increased

early and total yield, average number of fruits/ plant, also, they found that the same treatment increased total yield of two potato cultivars.

The effect of foliar application with active dry yeast on the physiological processes inside plants were studied by many investigators. El-Desuki and El-Gereadly (2006) on pea indicated that the vegetative growth of pea, photosynthetic pigments of leaves, pods yield and pod quality were improved by spraying pea plants with yeast extract as compared to the control. Mohamed, (2005) found that active dry yeast as foliar application had a beneficial effect on growth, yield and chemical constituents of bean plants especially at the highest rate (1.5g/l). Similar trend was observed by many investigators on different plants (Fathy and Farid (1996); Mekhemar and Al-Kahal (2001); Amer (2004), on bean plants) and Tartoura (2001) on pea.

This investigation aimed to study the effect of two biofertilizers and foliar application with amino green and active dry yeast on vegetative growth, anatomical traits, yield and chemical constituents of snap bean plants (*Phaseolus vulgaris* L.) cv. Paulista grown under sandy soil conditions.

MATERIALS AND METHODS

The present work was carried out during two successive summer seasons of 2007 and 2008 at the Experimental Farm, El Kassasein Research Station, Agriculture Research Center, Ismailia Governorate, to study the effect of two sources of biofertilizers; i.e., biogen, nitrobein as well as control, amino green compound and active dry yeast on vegetative growth, anatomical traits, yield and chemical constituents of snap bean plants (*Phaseolus vulgaris* L.) c.v. Paulista grown under sandy soil conditions. The physical and chemical properties of the experimental soil are given in Table 1.

This experiment included 24 treatments, which were the combinations between three biofertilizers treatments and eight foliar application of amino green and active dry yeast. Treatments were arranged in a split plot design with three replicates, biofertilizers treatments were assigned at random in the main plots, while sub-plots were devoted to amino green compound and active dry yeast treatments.

Seeds of snap bean c.v. Paulista were obtained from Horticultural Research Institute, Agriculture Research Center, Giza, Egypt and sown on March 4th and 5th in 2007 and 2008, respectively. The area of experimental plot was $9m^2$ (5 rows x 0.6m width x 3m length). Seeds were sown in hills 20 cm apart on one side of ridges and two seeds per hill. All plants received 50% of recommended fertilization rates; i.e., 120 kg/ fed. Ammonium nitrate (33.5%N) in two equal doses at 30 and 45 days after sowing, the normal cultural practices were followed according to Agriculture Ministry recommendations for snap bean.

Each biofertilizer was mixed with wet seeds by adding Arabic gum solution before sowing and the treated seeds were, directly, sown in the same day. The biofertilizers used were Biogen (contains *Azotobacter chroococcum* as nitrogen fixing bacteria) and Nitrobein (contains *Azotobacter* sp. and *Azospirillum lipoferum* as nitrogen fixing bacteria). The source of biogen and nitrobein was the General Organization for Agriculture Equalization Foundation (GOAEF), Ministry of Agriculture, Egypt.

Amino green compound is a foliar fertilizer containing several amino acids alanine, glycine,

Table 1. The physical and chemical properties of the used soil during 2007and 2008 seasons

Physical properties			Chemical properties		
	2007	2008		2007	2008
Sand (%)	96.5	95.6	**Organic matter (%)**	0.03	0.08
Silt (%)	1.7	1.6	**Available K (ppm)**	52	64
Clay (%)	1.8	2.8	**Available P (ppm)**	5.5	6.2
FC (%)	6.5	6.8	**Available N (ppm)**	5.4	6.9
WP (%)	2.4	2.5	**Calcium carbonate (%)**	0.18	0.26
Available water	4.5	4.5	**pH**	8.1	8.1
Water holding capacity (%)	13.8	14.5			

valine, leucine, thereonine, proline, aspartic acid, methionine, lysine, histidine, treptophan, cystine and asparagines produced by Dishner Company.

Active dry yeast (*Saccharomyces cerevisiae)* was dissolved in warm water (38°C) followed by adding sugar at a ratio 1:1 to activate growth and reproduction of yeast and left stand for two hours before spraying.

The foliar application treatments were sprayed twice during the growth period of plant at 30 and 45 days after sowing.

The treatments carried out in this study were as follows:

-Main plots (biofertilizers)

1. Control (without).
2. Biogein. (*Azotobacter chroococcum*) 1k.g / fed.
3. Nitrobein. (*Azotobacter* sp., *Azospirillum lipoferum*) 1k.g / fed.

- Sub-plots (foliar application)

1. Control (tab water) .
2. Active dry yeast 1g/l.
3. Active dry yeast 2g/l.
4. Active dry yeast 4g/l.
5. Amino green compound $1cm^3$/l.
6. Amino green compound $2cm^3$/l.
7. Amino green compound $4cm^3$/l.
8. Amino green compound $2cm^3$/l. + Active dry yeast 2g/l.

Data Recorded

Vegetative parameters

A random sample of three plants was taken from each plot at 60 days after sowing (beginning of fruiting stage) in both seasons of study for measuring the vegetative characters of snap bean plant expressed as follows: plant height (cm), number of both leaves and branches/plant and total dry weight (leaves + branches)/plant (g), the samples were dried in an electric oven at 70°C till constant weight.

Yield and its components

At harvesting stage (aged 70 days for both seasons) 15 bean plants from each treatment were randomly taken to study the yield and its components including: average number of pods/plant, average weight of green pods/plant (g), average pod weight (g), green pod yield/fed. (ton) and dry matter of pods %.

Leaf pigments

Disk samples from the fourth upper leaf on the main stem were taken at 60 days after sowing to determine chlorophyll a, b and

total chlorophyll (a+b) as well as carotenoids according to Wettestein (1957).

Pod chemical constituents

Dried pods were finely ground separately and digested with sulfuric acid and percholoric acid (3:1). Nitrogen%, phosophorus% and potassium % were determined according to the method described by Kock and Mc-Meekin (1924), Murphy and Riley (1962) and Brown and Lilliland (1946), respectively.

Total crude protein %

The previously determined nitrogen of dry pods was used for calculating total crude protein by multiplying N- values by 6.25 (A.O.A.C., 1980).

Anatomical Study

Specimens of treatments at the age of 50 days from sowing during second season, specimens from the blade of the terminal leaflet of the 5th upper on the main stem were taken from various treatments of snap bean plant leaflet were sections as described by Willey (1971). The sections were photographed by using light microscope (Olympus) with digital camera (Canon power shot S80) connected to computer; the photographs were taken by Zoom Browser Ex Program. The dimensions of leaflet sections were measured by using Corel Draw program ver.11.

Statistical Analysis

The obtained data were subjected to the analysis of variance according to Snedecor and Cochran (1980). Duncan`s multiple range test was used for the comparison among treatments (Duncan, 1955).

RESULTS AND DISCUSSION

Vegetative Characters

Effect of biofertilizers and foliar application with amino green compound and dry yeast

The effect of biofertilizers (Biogen, Nitrobein and control) and foliar application with amino green compound and active dry yeast on vegetative characters of snap bean plants are shown in Table 2. It is obvious from the data that biofertilizers enhanced all studied vegetative characters as compared to control and significantly increased plant height in the first season and total dry weight as well as leaf area in the second season. Such effect of the above mentioned treatment could be attributed to the activity of bacteria in the absorption

Table 2. Effect of biofertilizers, amino green compound and yeast on vegetative characters and dry weight of snap bean plants during 2007 and 2008 seasons

Treatments	Vegetative characters / plant									
	Season 2007					Season 2008				
Biofertilizers	Plant height (cm)	Leaves No.	Branches No.	Total dry weigh (g)	Leaf area (cm^2)	Plant height (cm)	Leaves No.	Branches No.	Total dry weigh (g)	Leaf area (cm^2)
Control (Without)	34.63 c	10.38a	3.29a	6.42a	396.6a	42.63a	12.63a	4.167a	8.141b	484.2b
Biogen	37.05b	11.75a	3.42a	6.94a	420.5a	46.00a	13.33a	4.250a	9.021ab	539.6a
Nitrobein	39.21a	11.29a	3.29a	6.80a	410.4a	47.38a	14.04a	4.250a	9.688a	575.2a
Amino green& Yeast / l.										
Control (Without)	34.07d	8.67b	2.89a	5.64d	355.8c	40.78b	10.78c	3.889a	7.580c	448.5c
Amino green1cm^3	36.23c	10.56ab	3.44a	6.71bc	424.8ab	43.56ab	12.00bc	4.000a	8.340bc	500.1bc
Amino green2cm^3	36.30bc	11.22a	3.44a	7.00abc	424.4ab	45.56ab	13.22ab	4.222a	8.660bc	512.9abc
Amino green4cm^3	36.16ab	12.00a	3.67a	7.52a	458.1a	47.67a	14.00ab	4.222a	9.440ab	559.9ab
Yeast 1 g	37.22abc	10.67a	3.11a	6.64bc	388.2bc	44.22ab	13.44ab	4.556a	8.783b	533.8abc
Yeast 2 g	37.41abc	11.89a	3.44a	7.10ab	432.4ab	46.56a	14.11ab	4.111a	9.283ab	546.1abc
Yeast 4 g	38.19a	12.56a	3.33a	6.90abc	411.4abc	48.56a	14.78a	4.556a	10.27a	613.7a
Amino green2cm^3 +Yeast2g	38.14ab	11.56a	3.33a	6.27cd	378.2bc	45.78ab	14.33a	4.222a	9.243ab	548.8abc

Values having the same alphabetical letter (s) did not significantly differ at 0.05 level of significance according to Duncan's multiple range test

zone of plant roots by improving soil fertility and consequently plant development by N_2- fixation and due to releasing of certain other nutrients; i.e., Fe, Zn and Mn (Bhonde *et al.*, 1997) through the break down of organic materials in the soil and make these elements in available forms.

These results are in a harmony with those obtained by many researchers such as Hewedy *et al.* (2003) on common bean, Bardisi *et al.* (2004) on garlic and El-Beheidi *et al.* (2005) on pea plants.

As for the effect of amino green compound and active dry yeast, the results in Table 2 show also that foliar application with amino green compound or active dry yeast had a beneficial effect on vegetative growth; i.e. plant height, number of leaves/plant, leaf area and total dry weight at both seasons as compared to the control which recorded the lowest values. The highest increases, in general, were obtained by the highest rate of amino green compound ($4cm^3/l$) or active dry yeast (4g/l) or the combination between amino green compound ($2cm^3/l$) and active dry yeast (2g/l).

The beneficial effect of active dry yeast application on growth parameters of snap bean plants may be due to that yeast (*Saccharomyces Cerevisiae*) as a natural source for cytokinins had stimulatory effects on cell division and enlargement, protein and nucleic acid synthesis and chlorophylls formation (Spencer *et al.*, 1983). Also yeast was found to contain carbohydrate, amino acids and lipids as well as several vitamins and most nutritional elements; i.e. Na, Ca, Fe, Mg, K, P, S, Zn and Si (Shady, 1978 and Nagodawithana, 1991). Bidwell (1980) stated that amino acids are known as building blocks of proteins in plants. They had number of additional functions in the regulating of metabolism, transport and storage of nitrogen, indicating that continuous protein synthesis was necessary during growth development.

Similar findings with amino acids foliar application were obtained by Kamar and Omar (1987) on cucumber and potato plants, El-Shabasi *et al.* (2005) on garlic and Awad *et al.* (2007) on potato .In addition, the obtained results with active dry yeast foliar nutrition agree with those of Fathy and Farid (1996), Mekhemar and Al-Kahal (2001), Amer (2004) and Mohamed (2005) on bean plants, Tartoura (2001),and El-Desuki and El-Gereadly (2006) on pea.

Effect of interaction between biofertilizers and foliar application with amino green compound and yeast

Illustrated data in Table 3 indicate that the interaction between biofertilizers and foliar applications had promotive effect on all parameters except number of branches as compared with control plants. These results are true in both growing seasons. In general, the interaction between Nitrobein or Biogen and active dry yeast 4g/l gave the highest values of plant height, number of leaves/ plant, total dry weight and leaf area as compared to control which recorded the lowest values in both seasons.

Leaf Pigments

Effect of biofertilizers and foliar application with amino green compound and dry yeast

The results, listed in Table 4 clearly show the effect of inoculation with biogen or nitrobein and foliar application with amino green or active dry yeast on photosynthetic pigments of snap bean plants, the results indicated that treating snap bean plants with biogen or nitrobein exert its promoting effect on photosynthetic pigments as compared to the control in both seasons. On the other hand, it is observed that, the effect treatments were, generally, insignificant. The enhancing effect of biofertilizers on photosynthetic pigments might be due to that N produced from N_2-fixation is a constituent of chlorophyll molecule. Moreover, it is the main constituents of all the amino acids and hence of proteins, acting as a structural components of the chloroplasts. Corresponding, an enhancement of protein synthesis and chloroplasts formation leads to an increase in chlorophyll and carotene (Marschner, 1995). The obtained results were in agreement with those obtained by El-Beheidi *et al.* (2005) on pea plants.

Regarding the effect of amino green compound and active dry yeast, it is clear from the same data Table 4 that application of amino green compound or active dry yeast enhanced photosynthetic pigments; i.e., chlorophyll a. b. and total chlorophyll (a +b) as well as carotenoids, at two successive seasons, while significantly increased chlorophyll a and total chlorophyll in first season and carotenoids in the second season as compared to the control. The highest increases were obtained by active dry yeast treatments and amino green compound treatments with no significant differences among their effects.

Table 3. Effect of interaction between biofertilizers, amino green compound and yeast on vegetative characters and dry weight of snap bean plants during 2007 and 2008 seasons

Treatments		Vegetative characters / plant									
		Season 2007					Season 2008				
Biofertilizer	Amino green& Yeast /l.	Plant height (cm)	Leaves No.	Branches No.	Total dry weigh (g)	Leaf area (cm^2)	Plant height (cm)	Leaves No.	Branches No.	Total dry weigh (g)	Leaf area (cm^2)
Without	Control (Without)	32.0k	7.67h	2.667a	5.24h	328j	38.7i	9. 7g	3.667a	6.94j	405h
	Amino green1cm^3	33.9ij	9.67e-g	2.333a	7.17b-e	472ab	41.7ghi	11.7defg	4.000a	7.96g-j	487e-h
	Amino green2cm^3	32.6jk	10.33d-g	3.667a	6.98b-e	440a-f	42.7efghi	12.3bcdef	4.000a	8.29f-i	497d-h
	Amino green4cm^3	37.7d-g	11.67a-d	3.667a	7.33bc	458a-d	43.3defghi	1abcd3.7	4.333a	8.69e-h	508d-g
	Yeast 1 g	34.7i	10.00d-g	3.000a	5.90gh	348ij	42.3fghi	12.0cdef	4.667a	7.89h-j	477f-h
	Yeast 2 g	33.9ij	11.33b-e	3.667a	6.37fg	383f-g	44.0defgh	13.7abcd	4.000a	8.21f-i	494d-h
	Yeast 4 g	35.4hi	11.67a-d	3.333a	6.48e-g	391f-i	44.7cdefgh	14.3ab	4.667a	8.77e-h	511d-g
	Amino green2cm^3 +Yeast2g	36.9gh	10.67c-g	3.000a	5.85gh	353ij	43.7defghi	13.7abcd	4.000a	8.38f-i	496d-h
Biogen	Control (Without)	33.8ij	9.00gh	3.000a	5.79gh	368h-j	40.3hi	10.3fg	4.000a	7.50ij	442gh
	Amino green1cm^3	35.3hi	11.00b-f	3.333a	6.31fg	391f-i	43.7defghi	11.3efg	4.000a	8.07ghi	484e-h
	Amino green2cm^3	37.0f-h	11.67a-d	3.667a	6.84b-f	396e-i	46.0abcdefg	13.0abcde	4.333a	8.50f-i	505d-g
	Amino green4cm^3	37.5efg	12.67ab	3.667a	8.09a	488a	49.7abc	13.7abcd	4.333a	8.84e-h	513d-g
	Yeast 1 g	37.7d-g	11.33b-e	3.333a	7.22b-d	423 b-h	43.3defghi	13.7abcd	4.667a	9.20d-f	578b-e
	Yeast 2 g	38.8a-e	12.67ab	3.333a	7.47ab	463a-c	48.0abcd	14.7a	4.333a	10.00b-d	587b-d
	Yeast 4 g	38.7bc-f	13.33a	3.333a	7.32bc	439a-f	50.3ab	15.0a	4.333a	10.47bc	629a-c
	Amino green2cm^3 +Yeast2g	37.8c-g	12.33a-c	3.667a	6.50d-g	396e-i	46.7abcdefg	15.0a	4.000a	9.59c-e	579b-e
Nitrobein	Control (Without)	36.4gh	9.33f-h	3.000a	5.87gh	372g-j	43.3defghi	12.3bcdef	4.000a	8.30f-i	499d-h
	Amino green1cm^3	39.5a-c	11.00b-f	3.667a	6.65cd-f	411c-h	45.3bcdefgh	13.0abcde	4.000a	8.99d-g	530d-g
	Amino green2cm^3	39.3a-d	11.67a-d	3.000a	7.17b-e	438a-f	48.0abcd	14.3ab	4.333a	9.19d-f	536c-g
	Amino green4cm^3	39.3a-d	11.67a-d	3.667a	7.15b-e	428b-g	50.0ab	14.7a	4.000a	10.79ab	659ab
	Yeast 1 g	39.3a-d	10.67c-g	3.000a	6.80b-f	394f-i	47.0abcdef	14.7a	4.333a	9.26d-f	547c-f
	Yeast 2 g	39.6ab	11.67a-d	3.333a	7.45ab	451a-e	47.7abcde	14.0abc	4.000a	9.62c-e	558c-f
	Yeast 4 g	40.5a	12.67ab	3.333a	6.89b-f	405d-i	50.7a	15.0a	4.667a	11.57a	701a
	Amino green2cm^3 +Yeast2g	39.8ab	11.67a-d	3.333a	6.45e-g	385f-i	47.0abcdef	14.3ab	4.667a	9.76b-e	572b-f

Table 4. Effect of biofertilizers, amino green compound and yeast on photosynthetic pigments of snap bean leaves during 2007 and 2008 seasons

Treatments	Photosynthetic pigments							
	Season 2007				Season 2008			
Biofertilizers	Chl.a mg/g D.W.	Chl.b mg/g D.W.	Total(a+b) mg/g D.W.	Carotenoids mg/g D.W.	Chl.a mg/g D.W.	Chl.b mg/g D.W.	Total(a+b) mg/g D.W.	Carotenoids mg/g D.W.
Control (Without)	1.304a	1.962a	3.265a	1.616a	1.554a	1.724a	3.270a	1.882a
Biogen	1.454a	2.210a	3.664a	1.619a	1.704a	1.860a	3.550a	2.125a
Nitrobein	1.355a	2.155a	3.510a	1.676a	1.449a	1.815a	3.264a	2.115a
Amino green& Yeast / l.								
Control (Without)	1.250b	1.963a	3.213b	1.580a	1.493a	1.797a	3.290a	1.850b
Amino green1cm^3	1.393ab	2.170a	3.563ab	1.643a	1.603a	1.797a	3.363a	2.313a
Amino green2cm^3	1.373ab	2.113a	3.487ab	1.663a	1.490a	1.850a	3.341a	2.117ab
Amino green4cm^3	1.387ab	2.053a	3.440ab	1.630a	1.553a	1.843a	3.397a	1.820b
Yeast 1 g	1.460a	2.237a	3.697a	1.633a	1.547a	1.843a	3.390a	2.097ab
Yeast 2 g	1.381ab	2.043a	3.424ab	1.630a	1.667a	1.693a	3.350a	2.073ab
Yeast 4 g	1.387ab	2.077a	3.463ab	1.687a	1.553a	1.823a	3.367a	1.943b
Amino green2cm^3 +Yeast2g	1.337ab	2.216a	3.50ab	1.630a	1.643a	1.750a	3.393a	2.113ab

Values having the same alphabetical letter (s) did not significantly differ at 0.05 level of significance according to Duncan's multiple range test

The stimulative effect of yeast on the chlorophyll content might be due to that yeast acts as a source of cytokinins (Skoog and Miller, 1957), delaying the degradation of chlorophyll via the inhibition of chlorophyllase (Ben, 1986). Similar findings with active dry yeast foliar application were obtained by Amer (2004) and Mohamed (2005) on bean plants.

Effect of interaction between biofertilizers and foliar application with amino green compound and yeast

The effect of interaction between biofertilizers and foliar application on photosynthetic pigments concentration of snap bean is shown in Table 5. It is evident from these results that such interaction treatments generally had a promotive effect on chlorophyll a, b and total chlorophyll in both seasons. On the other hand, carotenoids were not significantly affected in first season. The inoculation with Biogen and foliar application of amino green at 4cm/l or active dry yeast at 1g/l resulted in the maximum values of the above mentioned leaf pigments parameters as compared to other treatments.

Yield and Its Components

Effect of biofertilizers and foliar application with amino green compound and dry yeast

Results in Table 6 illustrate the effect of biofertilizers on yield and its components; i.e., number of pods / plant, average pod weight, green pod yield/ plant, green pod yield / fed. and dry matter (%) of pods. It is obvious from the data that there were significant differences among most of the treatments in number of pods/plant, green pod yield / plant and per feddan. It is also clear that Nitrobein treatment recorded higher values of those characters as compared to biogen and control treatments in the two growing seasons. This may be attributed to the results obtained previously Table 2 in which Nitrobein treatments generally recorded higher growth parameters and total dry weight than biogen or control treatments.

Biofertilizers enhance crop productivity through N_2- fixation, plant hormone production and / or stimulate of disease resistance (Pathak *et al.*, 1977; Hedega *et al.*, 1999). Obtained results are agreeable with those reported by Shibru and Mitiku (2000) and Hewedy *et al.* (2003) on common

Table 5. Effect of interaction between biofertilizers, amino green compound and yeast on photosynthetic pigments of snap bean leaves during 2007 and 2008 seasons

Treatments		Photosynthetic pigments							
		Season 2007				Season 2008			
Biofertilizer	Amino green& Yeast / l.	Chl.a (mg/g D.W.	Chl.b (mg/g D.W.)	Total (a+b) (mg/g D.W.)	Carotenoids (mg/g D.W.)	Chl.a (mg/g D.W.)	Chl.b (mg/g D.W.)	Total (a+b) (mg/g D.W.)	Carotenoids (mg/g D.W.)
Without	Control (Without)	1.23d	1.89de	3.12g	1.60a	1.50d-g	1.69e-g	3.19gh	1.92e-h
	Amino green1cm^3	1.22d	1.93c-e	3.15fg	1.64a	1.62b-f	1.75c-g	3.37b-h	2.33a-c
	Amino green2cm^3	1.25d	1.84e	3.09g	1.63a	1.52d-g	1.73d-g	3.25e-h	1.94e-h
	Amino green4cm^3	1.33b-d	1.94c-e	3.27d-g	1.61a	1.44g	1.74c-g	3.18h	1.49j
	Yeast 1 g	1.41b-d	2.13a-e	3.54b-e	1.62a	1.41g	1.95ab	3.36c-h	1.59ij
	Yeast 2 g	1.37b-d	2.07b-e	3.44c-g	1.57a	1.65a-d	1.62g	3.24e-h	1.81g-i
	Yeast 4 g	1.33b-d	1.85e	3.18e-g	1.66a	1.59b-g	1.66fg	3.22e-h	2.05c-g
	Amino green2cm^3 +Yeast2g	1.29cd	2.04b-e	3.33d-g	1.60a	1.70a-c	1.65fg	3.35d-h	1.93e-h
Biogen	Control (Without)	1.23d	1.89de	3.12g	1.52a	1.56c-g	1.88a-d	3.44b-g	1.70h-j
	Amino green1cm^3	1.51ab	2.32ab	3.83ab	1.63a	1.74ab	1.83a-f	3.46b-f	2.33a-c
	Amino green2cm^3	1.51ab	2.35ab	3.86ab	1.65a	1.51d-g	1.96a	3.47b-e	2.40ab
	Amino green4cm^3	1.47a-c	2.07b-e	3.54b-e	1.57a	1.80a	1.94ab	3.74a	1.86f-i
	Yeast 1 g	1.61a	2.43a	4.04a	1.57a	1.76ab	1.77b-g	3.53a-d	2.53a
	Yeast 2 g	1.47a-c	2.10a-e	3.57b-d	1.70a	1.81a	1.80a-f	3.61a-c	2.27abcd
	Yeast 4 g	1.47a-c	2.15a-e	3.62b-d	1.71a	1.64a-e	1.89a-d	3.53a-d	1.70hij
	Amino green2cm^3 +Yeast2g	1.36b-d	2.37ab	3.73a-c	1.60a	1.81a	1.81a-f	3.62ab	2.21b-e
Nitrobein	Control (Without)	1.29cd	2.11a-e	3.40c-g	1.62a	1.42g	1.82a-f	3.24e-h	1.93e-h
	Amino green1cm^3	1.45a-c	2.26a-c	3.71a-c	1.66a	1.45fg	1.81a-f	3.26e-h	2.28a-d
	Amino green2cm^3	1.36b-d	2.15a-e	3.51b-f	1.71a	1.44g	1.86a-e	3.30d-h	2.01d-g
	Amino green4cm^3	1.36b-d	2.15a-e	3.51b-f	1.71a	1.42g	1.85a-e	3.27e-h	2.11b-f
	Yeast 1 g	1.36b-d	2.15a-e	3.51b-f	1.71a	1.47e-g	1.81a-f	3.28d-h	2.17b-e
	Yeast 2 g	1.30cd	1.96c-e	3.26d-g	1.62a	1.54c-g	1.66fg	3.20gh	2.14b-f
	Yeast 4 g	1.36b-d	2.23a-d	3.59b-d	1.69a	1.43g	1.92a-c	3.25d-h	2.08c-g
	Amino green2cm^3 +Yeast2g	1.36b-d	2.23a-d	3.59b-d	1.69a	1.42g	1.79a-g	3.21f-h	2.20b-e

Table 6. Effect of biofertilizers, amino green compound and yeast on yield and its components of snap bean plants during 2007 and 2008 seasons

Treatments	Yield and its components									
	Season 2007					Season 2008				
	No. of pods/plant	Avr. pod Wt.(gm)	Green pods yield gm / plant	Green pods yield tons /fed.	Dry matter of pods (%)	No. of pods/plant	Avr. pod Wt.(gm)	Green pods yield gm / plant	Green pods yield tons /fed.	Dry matter of pods(%)
Biofertilizers										
Control (Without)	13.21b	3.219a	42.42b	2.545b	4.915a	12.92b	3.620a	46.89a	2.813a	5.544b
Biogen	16.71a	3.132a	52.19a	3.133ab	5.120a	15.79ab	3.828a	60.15a	3.609a	6.345a
Nitrobein	17.96a	3.174a	56.65a	3.399a	5.841a	17.13a	3.762a	64.58a	3.875a	6.556a
Amino green& Yeast /l.										
Control (Without)	11.44e	3.088a	35.33e	2.123e	4.677a	11.67d	3.458a	40.32b	2.419b	5.36d
Amino green1cm^3	13.22de	3.164a	41.35d	2.481d	4.813a	13.33cd	3.877a	51.72ab	3.103ab	5.49cd
Amino green2cm^3	15.33c	3.133a	47.83c	2.870c	5.480a	14.56bc	3.937a	57.29a	3.438a	5.99abcd
Amino green4cm^3	16.56bc	3.314a	54.93b	3.296b	5.543a	15.89ab	3.803a	60.65a	3.639a	6.20abcd
Yeast 1 g	14.56cd	3.311a	48.13c	2.888c	5.173a	15.11bc	3.697a	56.12ab	3.367ab	5.88bcd
Yeast 2 g	18.11ab	3.113a	56.06b	3.364b	5.640a	16.33ab	3.857a	63.15a	3.789a	6.55abc
Yeast 4 g	20.00a	3.118a	61.70a	3.702a	5.883a	17.78a	3.667a	65.45a	3.927a	7.01a
Amino green2cm^3 +Yeast2g	18.44ab	3.157a	58.03ab	3.482ab	5.127a	17.56a	3.600a	62.94a	3.777a	6.69ab

Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of significance according to Duncan's multiple range test.

bean, Bardisi, et *al.* (2004) on garlic and El-Beheidi *et al.* (2005) on pea plants.

As for the effect of foliar application with amino green compound and active dry yeast on yield and its components, the results in Table 6 suggest that foliar spray with active dry yeast at the rate of (4g/l) and the combination between amino green compound (2cm/l) and active dry yeast (2g/l), in general, were the most favorable treatments for enhancing number of pods / plant, green pod yield / plant as well as total green pod yield / fed. in both seasons.

The enhancing effect of active dry yeast on snap bean yield and its components may be due to that yeast via its cytokinins content and the high content of vit. B and nutrient elements as well as organic compounds (Nagodawithana, 1991), might play a role in distribution and translocation of metabolites from leaves towards the reproductive organs which lead to the improvement of snap bean yield.

These results are in harmony with those obtained by Fathy and Farid (1996), Mekhemar and Al-Kahal (2001), Amer (2004) and Mohamed (2005) on bean plants, Tartoura (2001) and El-Desuki and El-Gereadly (2006) on pea.

Effect of interaction between biofertilizers and foliar application with amino green compound and yeast

Presented data in Table 7 indicate the effect of interaction between biofertilizers and foliar application with amino green compound or active dry yeast on yield and its components. The results revealed that most of interaction treatments between biofertilizers and foliar application with amino green compound or active dry yeast had significant effect on yield and its components as compared with control, these results are true in both growing seasons. The highest values of number of pods / plant, green pod yield / plant, total green pod yield / fed. and dry matter (%) of pod were recorded by the interaction between Nitrobein biofertilizer and foliar spray with active dry yeast at rate 4g/l or by the combination between amino green (2cm/l) and active dry yeast (2g/l), while the control gave the lowest values of all the above mentioned characters of yield and its components when compared with all other treatments.

Table 7. Effect of interaction between biofertilizers, amino green compound and yeast on yield and its components of snap bean plants during 2007 and 2008 seasons

Treatments		Yield and its components									
		Season 2007					Season 2008				
				Green pods yield					Green pods yield		
Biofertilizer	Amino green& Yeast/l.	No. of pods/plant	Avr. pod Wt.(gm)	gm / plant	tons /fed.	Dry matter of pods (%)	No. of pods/plant	Avr. pod Wt.(gm)	gm / plant	tons /fed.	Dry matter of pods (%)
Without	Control (Without)	10.3m	3.07a-c	31.72i	1.903i	4.32g	10.3m	3.30b	34.12k	2.047k	5.15e
	Amino green1cm^3	11.3lm	3.17a-c	34.80i	2.088i	4.38fg	11.7lm	3.74ab	43.61ijk	2.616ijk	5.34de
	Amino green2cm^3	13.0i-l	3.12a-c	40.47h	2.428h	5.38cd-g	12.7kl	3.78ab	47.96ghijk	2.878ghijk	5.79cde
	Amino green4cm^3	14.3h-j	3.24a-c	46.42fg	2.785fg	4.83c-g	14.0h-k	3.69ab	52.06defghi	3.124defghij	5.50de
	Yeast 1 g	12.3kl	3.36ab	41.41h	2.484h	4.93c-g	12.7kl	3.55ab	45.19hijk	2.711hijk	5.45de
	Yeast 2 g	14.3h-j	3.25a-c	46.53fg	2.792fg	5.34c-g	13.7ijk	3.60ab	49.10efghijk	2.946efghijk	5.36de
	Yeast 4 g	15.3gh	3.32a-c	50.68d-f	3.041d-f	5.03c-g	14.0h-k	3.48ab	48.47fghijk	2.908fghijk	5.82cde
	Amino green2cm^3 +Yeast2g	14.7hi	3.23a-c	47.31f	2.840f	5.11c-g	14.3h-k	3.80ab	54.64cdefghij	3.278cdefghij	5.94cde
Biogen	Control (Without)	11.3lm	3.07a-c	34.65i	2.089i	4.65e-g	11.7lm	3.55ab	41.25jk	2.475jk	5.54de
	Amino green1cm^3	14.0h-k	3.04bc	42.43gh	2.545gh	4.78d-g	13.7i-k	4.13ab	56.42bcdefghij	3.385bcdefghij	5.56de
	Amino green2cm^3	15.7f-h	3.16a-c	48.84ef	2.931ef	5.11c-g	14.3h-k	4.19a	59.98bcdefgh	3.599bcdefgh	5.85cde
	Amino green4cm^3	16.7fg	3.32a-c	5.27cd	3.316cd	5.97a-d	15.7f-h	4.17a	65.57abcd	3.934abcd	6.37bcd
	Yeast 1 g	15.7f-h	3.22a-c	50.45d-f	3.027d-f	4.95c-g	15.3g-i	3.79ab	58.35bcdefghi	3.501bcdefghi	5.81cde
	Yeast 2 g	19.0de	3.04bc	57.80c	3.468c	4.80c-g	17.7c-e	3.84ab	67.84abcd	4.070abcd	6.80abc
	Yeast 4 g	21.7ab	3.03bc	65.66ab	3.940ab	5.99a-c	19.3a-c	3.48ab	66.99abcd	4.020abcd	7.71a
	Amino green2cm^3 +Yeast2g	19.7cd	3.18a-c	62.43b	3.746b	4.71e-g	18.7a-d	3.45ab	64.78bcde	3.887bcde	7.12ab
Nitrobein	Control (Without)	12.7j-l	3.13a-c	39.61h	2.377h	5.06c-g	13.0j-l	3.52ab	45.58hijk	2.735hijk	5.40de
	Amino green1cm^3	14.3h-j	3.28a-c	46.81fg	2.809fg	5.28c-g	14.7h-j	3.75ab	55.13cdefghij	3.308cdefghij	5.57de
	Amino green2cm^3	17.3ef	3.13a-c	54.19cd	3.251cd	5.95a-d	16.7e-g	3.83ab	63.93bcdefg	3.836bcdefg	6.35bcd
	Amino green4cm^3	18.7de	3.39a	63.10b	3.786b	5.83a-e	18.0b-e	3.54ab	64.34bcdef	3.860bcdef	6.74abc
	Yeast 1 g	15.7f-h	3.36ab	52.53de	3.152de	5.64a-e	17.3d-f	3.74ab	46.84bcde	3.890bcde	6.38bcd
	Yeast 2 g	21.0bc	3.04bc	63.86b	3.831b	6.78a	17.7c-e	4.12ab	72.51ab	4.351ab	7.42a
	Yeast 4 g	23.0a	3.00c	68.76a	4.126a	6.63ab	20.0a	4.03ab	80.88a	4.853a	7.51a
	Amino green2cm^3 +Yeast2g/ L	21.0bc	3.07a-c	64.35ab	3.861ab	5.56b-f	19.7ab	3.54ab	69.41abc	4.156abc	7.02ab

Chemical Constituents of Pods

Effect of biofertilizers and foliar application with amino green compound and dry yeast

Statistical analysis of data in Table 8 clear that, inoculation of snap bean seeds with nitrobein significantly increased N% and total crude protein (%) as compared to biogen or control; this was true in the two seasons. On the other hand, phosphorus and potassium concentration in snap bean pods were not significantly affected in both seasons. The favorable effect of biofertilizers on chemical constituents of snap bean pods may be due to the fact that non-symbiotic bacteria have the ability to supply the plants with N and thereby increase chemical contents in different plant tissues (Bashan and Holguin, 1997). These results are in agreement with those reported by Shibru and Mitiku (2000) and Hewedy *et al.* (2003) on common bean, Bardisi *et al.* (2004) on garlic and El-Beheidi *et al.* (2005) on pea plants.

Regarding the effect of amino green compound and active dry yeast, it is clear from the same Table that spraying snap bean plants with amino green compound or active dry yeast had no significant effect on chemical constituents of pods, these results are true in the two growing seasons.

The increases of chemical constituents by increasing rates of active dry yeast might be attributed to that macro and micronutrients increases in the capacity of plant to absorb nutrients by the increase of root surface per unit of soil volume, as well as, the high capacity of the plants supplied with macro and micronutrients in building up plant metabolites, which in turn contributes much to the increase of nutrients uptake (Mandour *et al.*, 1986).

Effect of interaction between biofertilizers and foliar application with amino green compound and yeast:

The results listed in Table 9 clearly show the effect of interaction between biofertilizers and foliar application with amino green and active dry yeast on pods chemical constituents of snap bean; i.e. N, P, K and protein. It is obvious from such data that the interaction between biofertilizers (Biogen and Nitrobein) and foliar application with amino green compound or active dry yeast significantly increased N% and

Table 8. Effect of biofertilizers, amino green compound and yeast on chemical constituents %of snap bean pods during 2007 and 2008 seasons

Treatments	Chemical constituents (%)							
	Season 2007				Season 2008			
Biofertilizers	N	P	K	Protein	N	P	K	Protein
Control (Without)	3.25b	0.394a	2.539a	20.33b	2.87b	0.417a	2.780a	17.91b
Biogen	3.19b	0.371a	2.370a	19.59b	2.84b	0.396a	2.655a	17.70b
Nitrobein	3.78a	0.392a	2.379a	23.64a	3.87a	0.402a	2.681a	24.06a
Amino green& Yeast / l.								
Control (Without)	3.02a	0.411a	2.650a	20.01a	2.96a	0.416a	2.773a	18.49a
Amino green1cm^3	3.15a	0.385a	2.463a	19.66a	3.14a	0.400a	2.669a	19.63a
Amino green2cm^3	3.69a	0.379a	2.370a	23.07a	3.47a	0.403a	2.683a	21.70a
Amino green4cm^3	3.53a	0.377a	2.320a	22.05a	3.29a	0.394a	2.623a	20.58a
Yeast 1 g	3.54a	0.352a	2.470a	22.15a	3.31a	0.403a	2.787a	20.68a
Yeast 2 g	3.30a	0.374a	2.343a	20.63a	3.03a	0.406a	2.653a	18.94a
Yeast 4 g	3.51a	0.386a	2.400a	21.92a	3.23a	0.408a	2.720a	20.18a
Amino green2cm^3 +Yeast2g	3.36a	0.387a	2.417a	20.97a	3.05a	0.410a	2.733a	18.92a

Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of significance according to Duncan's multiple range test.

Table 9. Effect of interaction between biofertilizers, amino green compound and yeast on chemical constituents of snap bean plants during 2007 and 2008 seasons

Treatments		Chemical constituents (%)							
		Season 2007				Season 2008			
Biofertilizer	Amino green& Yeast/l.	N	P	K	Protein	N	P	K	Protein
Without	Control (Without)	2.97gh	0.419ab	2.70ab	18.58gh	2.57f	0.402abcd	2.68abcd	16.06f
	Amino green1cm^3	2.97gh	0.434a	2.80a	18.58gh	2.64ef	0.423ab	2.82abcd	16.48ef
	Amino green2cm^3	3.63a-f	0.359ab	2.31a-c	22.67a-f	3.15c-f	0.390abcd	2.60bcd	19.71c-f
	Amino green4cm^3	3.62a-f	0.411ab	2.65a-c	22.65a-f	3.20c-e	0.447a	2.98ab	20.02c-e
	Yeast 1 g	3.34b-h	0.365ab	2.35a-c	20.88b-h	2.94d-f	0.399abcd	2.66abcd	18.38d-f
	Yeast 2 g	3.07f-h	0.388ab	2.50a-c	19.21f-h	2.69ef	0.426ab	2.84abcd	16.79ef
	Yeast 4 g	3.34b-h	0.380ab	2.45a-c	20.87b-h	3.02d-f	0.416abcd	2.77abcd	18.90d-f
	Amino green2cm^3 +Yeast2g	3.07f-h	0.395ab	2.5a-c	19.21f-h	2.70ef	0.434ab	2.89abc	16.90ef
Biogen	Control (Without)	3.27c-h	0.411ab	2.65a-c	20.44c-h	2.88d-f	0.426ab	2.84abcd	18.04d-f
	Amino green1cm^3	2.87h	0.333b	2.09c	17.96h	2.68ef	0.353d	2.35d	16.73ef
	Amino green2cm^3	3.62a-f	0.373ab	2.40a-c	22.65a-f	3.19c-f	0.405abcd	2.70abcd	19.92c-f
	Amino green4cm^3	3.17d-h	0.334b	2.09c	19.81d-h	2.79ef	0.359cd	2.39cd	17.42ef
	Yeast 1 g	3.34b-h	0.434a	2.80a	22.88b-h	2.99d-f	0.428ab	3.15a	18.67d-f
	Yeast 2 g	3.07f-h	0.341b	2.18bc	19.19f-h	2.74ef	0.390abcd	2.45cd	17.16ef
	Yeast 4 g	3.12e-h	0.372ab	2.40a-c	19.52e-h	2.69ef	0.405abcd	2.70abcd	16.81ef
	Amino green2cm^3 +Yeast2g	3.07f-h	0.369ab	2.35a-c	19.19f-h	2.76ef	0.399abcd	2.66abcd	16.89ef
Nitrobein	Control (Without)	3.36b-h	0.403ab	2.60a-c	21.02b-h	3.42b-d	0.420abc	2.80abcd	21.37b-d
	Amino green1cm^3	3.59a-g	0.388ab	2.50a-c	22.44a-g	4.11a	0.426ab	2.84abcd	25.67a
	Amino green2cm^3	3.82a-c	0.404ab	2.40a-c	23.90a-c	4.07a	0.413abcd	2.75abcd	25.46a
	Amino green4cm^3	3.79a-d	0.385ab	2.22bc	23.69a-d	3.89ab	0.375bcd	2.50bcd	24.30ab
	Yeast 1 g	3.95ab	0.357ab	2.26a-c	24.69ab	4.00ab	0.383bcd	2.55bcd	25.00ab
	Yeast 2 g	3.76a-e	0.395ab	2.35a-c	23.48a-e	3.66a-c	0.401abcd	2.67abcd	22.86a-c
	Yeast 4 g	4.06a	0.405ab	2.35a-c	25.35a	3.97ab	0.404abcd	2.69abcd	24.83ab
	Amino green2cm^3 +Yeast2g	3.92ab	0.398ab	2.35a-c	24.52ab	6.67a-c	0.398abcd	2.65abcd	22.96a-c

Values having the same alphabetical letter (s) did not significantly differ at 0.05 level of significance according to Duncan's multiple range test.

protein concentrations as compared to the control in both seasons. The highest increases were obtained by the interaction between nitrobein and amino green at rate $2cm^3/l$ and active dry yeast at rate 4g/l.

These results are in a harmony with those obtained by Fathy and Farid (1996), Mekhemar and Al-Kahal (2001), Amer (2004) and Mohamed (2005) on bean plants, Tartoura (2001), and El-Desuki and El-Gereadly (2006) on pea.

Anatomical Study

Effect of biofertilizers and foliar application with amino green compound and dry yeast

Data in Table 10 and Fig. 1 show the effect of inoculation with Biogen or Nitrobein and foliar application with amino green compound or active dry yeast on leaflet blade anatomy of snap bean plant at 50 days from sowing. It is quite clear that Nitrobein biofertilizer treatment recorded the highest values of all anatomical characters; i.e., midrib width, midrib thickness, midvein bundle thickness xylem thickness, phloem thickness, vessel diameter, blade thickness and palisade tissue thickness and spongy tissue thickness as compared with control or Biogen treatments.

As for the effect of foliar application with amino green compound and active dry yeast, the results in Table 10 suggest that foliar spray with active dry yeast at rate (4g /l) gave the best values of all anatomical characters as compared with control and Amino green compound treatments. The presented results coincide with those reported by Mohamed 2005 on common bean plants.

Effect of interaction between biofertilizers and foliar application with amino green compound and dry yeast

Results in Table 11 and Fig.1 illustrate the effect of interaction between biofertilizers and foliar application with amino green compound or active dry yeast on blade anatomy of snap bean plants. Generally, the results revealed that, interaction between Nitrobein biofertilizer and foliar spray with active dry yeast at rate (4g / l) recorded the highest values of all anatomical characters under study, as compared with the other treatments.

Recommendation

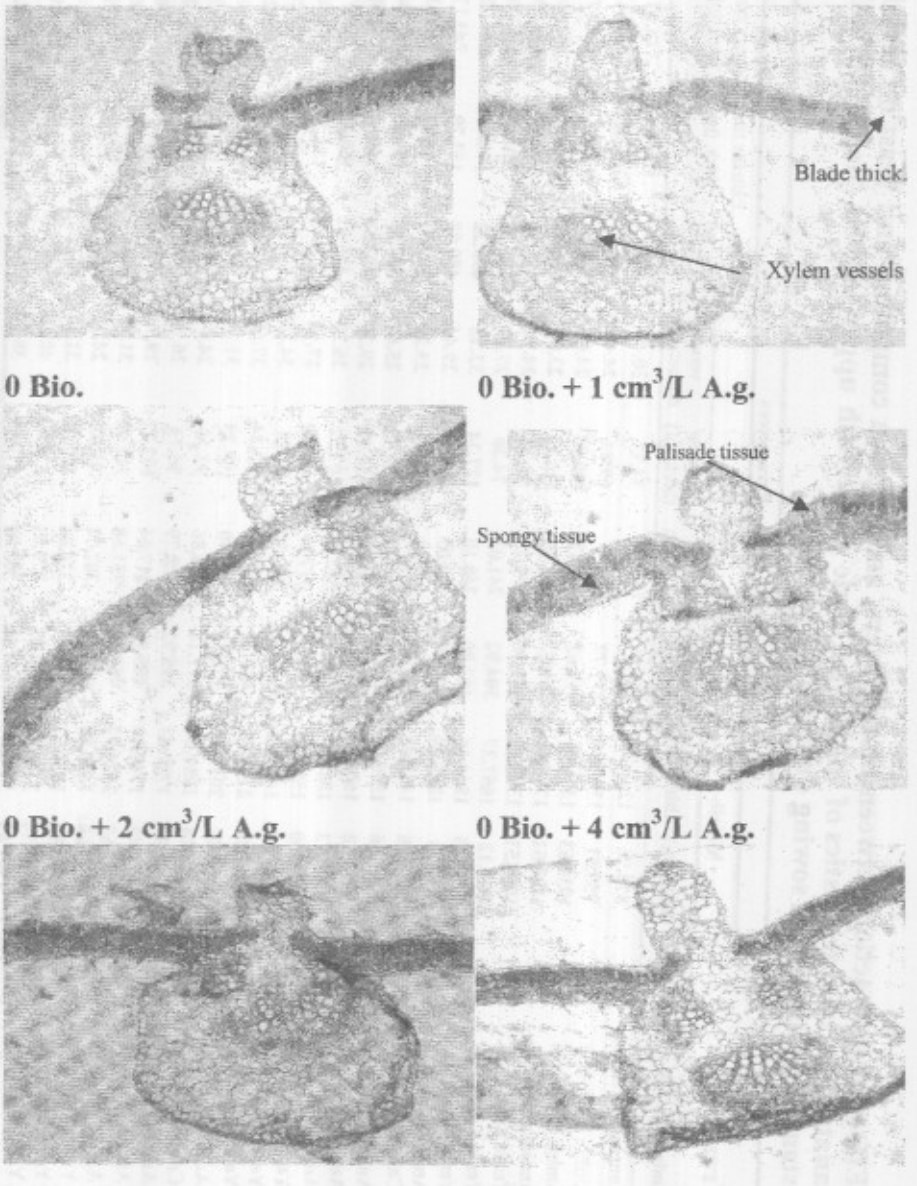
From the previous results of this investigation, it could be recommend that inoculation snap bean plants grown under sandy soil conditions with nitrobein

Table 10. Effect of biofertilizers, amino green compound and yeast on certain anatomical characteristics of the leaflet blade of the fifth upper leaf on snap bean main stem at 50 days from sowing during 2008 season

Treatments	Parameters								
	Midrib		Midvein				Blade thick. (µ)	Palisade tissue thick. (µ)	Spongy tissue thick. (µ)
Biofertilizers	width (µ)	thick. (µ)	bundle thick. (µ)	Xylem thick. (µ)	Phloem thick. (µ)	vessel diameter (µ)			
Control (Without)	1036.56	1560.53	333.64	255.60	84.12	25.71	394.45	143.95	205.67
Biogen	1344.14	1741.71	394.55	306.28	99.38	29.41	444.29	158.74	234.19
Nitrobein	1455.13	1884.90	424.17	331.41	106.14	30.93	478.22	179.64	257.89
Amino green& Yeast / l.									
Control (Without)	1110.75	1447.84	299.00	232.85	74.74	22.81	324.69	115.06	165.03
Amino green1cm	1183.39	1566.68	363.01	281.77	90.03	25.43	368.81	138.75	186.93
Amino green2cm	1283.75	1575.71	418.52	320.20	104.94	27.74	472.92	176.26	247.70
Amino green4cm	1386.09	1935.90	441.09	340.83	110.85	27.05	456.32	164.33	245.39
Yeast 1 gm	1172.00	1527.27	286.13	226.59	71.21	25.24	372.44	145.03	191.87
Yeast 2 gm	1328.96	1731.70	364.40	286.54	90.01	31.51	507.96	183.96	276.93
Yeast 4 gm	1430.52	2049.43	470.68	359.24	122.07	36.70	516.13	187.42	278.67
Amino green2cm +Yeast2g	1333.41	1997.85	430.14	334.08	108.51	32.96	492.65	175.39	268.16

Table 11. Effect of interaction between biofertilizers, amino green compound and yeast on certain anatomical characteristics of the leaflet blade of the fifth upper leaf on snap bean main stem at 50 days from sowing during 2008 season

Treatments		Parameters								
		Midrib		Midvein				Blade thick. (µ)	Palisade tissue thick. (µ)	Spongy tissue thick. (µ)
Biofertilizer	Amino green& Yeast / l.	width (µ)	thick. (µ)	bundle thick. (µ)	Xylem thick. (µ)	Phloem thick. (µ)	vessel diameter (µ)			
Without	Control (Without)	873.76	1249.37	138.65	106.03	34.73	20.42	302.73	105.57	156.03
	Amino green1cm	950.51	1397.56	277.72	218.98	69.83	24.43	295.29	102.98	149.55
	Amino green2cm	1038.63	1371.75	412.62	306.42	100.95	24.08	374.60	153.35	187.87
	Amino green4cm	1200.51	1796.31	449.57	338.40	112.11	23.01	406.64	166.64	198.46
	Yeast 1 gm	1008.51	1302.30	198.36	159.75	50.20	24.14	343.51	126.89	183.35
	Yeast 2 gm	999.12	1657.27	304.92	241.03	74.20	27.97	482.75	168.02	260.20
	Yeast 4 gm	1221.75	1864.16	482.80	360.10	127.34	32.15	499.22	174.41	266.72
	Amino green2cm +Yeast2g	999.70	1845.49	404.50	314.07	103.59	29.44	450.88	153.70	243.17
Biogen	Control (Without)	1180.26	1412.48	387.21	291.66	96.13	23.29	327.51	116.18	162.03
	Amino green1cm	1287.66	1595.05	415.38	317.55	105.52	25.67	382.38	153.65	188.04
	Amino green2cm	1393.18	1606.47	437.45	336.53	111.11	29.39	493.56	163.57	261.59
	Amino green4cm	1396.12	1886.67	422.96	332.42	107.52	26.20	476.21	158.22	261.07
	Yeast 1 gm	1221.60	1588.70	272.57	217.29	66.46	27.19	375.75	153.77	186.35
	Yeast 2 gm	1423.17	1687.22	350.30	282.54	86.78	34.70	501.34	175.63	274.20
	Yeast 4 gm	1442.28	2140.05	439.10	337.86	113.24	37.60	500.99	174.33	268.25
	Amino green2cm +Yeast2g	1408.87	2017.07	431.41	334.40	108.25	31.21	496.59	174.59	272.01
Nitrobein	Control (Without)	1278.24	1681.67	371.14	300.86	93.35	24.71	343.83	123.44	177.03
	Amino green1cm	1312.01	1707.43	395.92	308.79	94.74	26.20	428.75	159.63	223.20
	Amino green2cm	1419.45	1748.89	405.50	317.64	102.77	29.74	550.61	211.87	293.64
	Amino green4cm	1561.65	2124.72	450.73	351.68	112.92	31.93	486.12	168.14	276.64
	Yeast 1 gm	1285.88	1690.81	387.47	302.74	96.98	24.38	398.05	154.42	205.90
	Yeast 2 gm	1564.59	1850.61	437.97	336.04	109.06	31.86	539.78	208.23	296.40
	Yeast 4 gm	1627.54	2144.08	490.15	379.75	125.62	40.36	548.17	213.51	301.03
	Amino green2cm +Yeast2g/ L	1591.65	2130.97	454.50	353.77	113.69	38.24	530.47	197.87	289.31



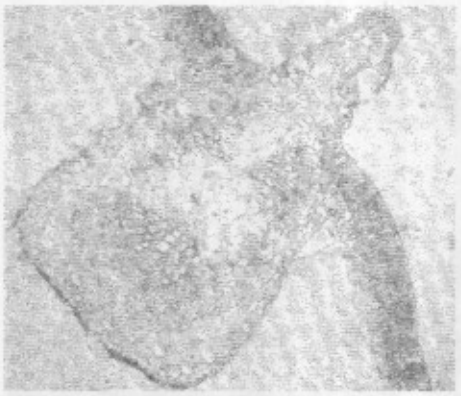
0 Bio. 0 Bio. + 1 cm^3/L A.g.

0 Bio. + 2 cm^3/L A.g. 0 Bio. + 4 cm^3/L A.g.

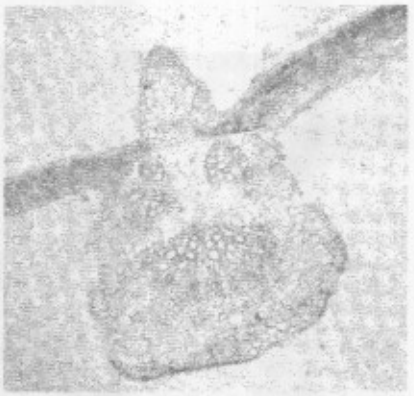
0 Bio. + 1 gm/L Y. 0 Bio. + 2 gm/L Y.

Fig. 1. Transactions of snap bean leaflet blade at 50 days from sowing during second season as affected by biofertilizers, amino green compound, yeast and their interactions (X80)

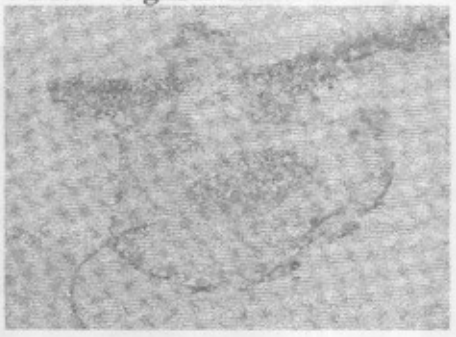
Bio. :Biofertilizers A.g.: Amino green Y.: Active dry yeast



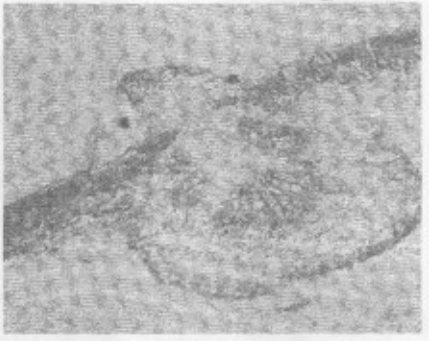
0 Bio. + 4 gm/L Y.



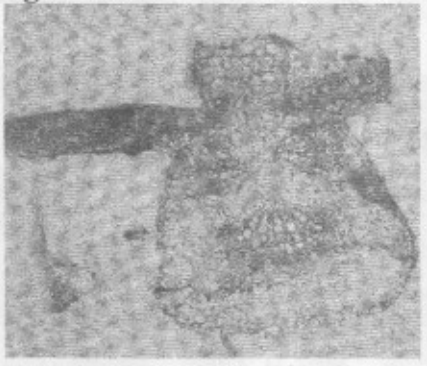
0 Bio. + 2 cm^3/L A.G. + 2 gm/L Y.



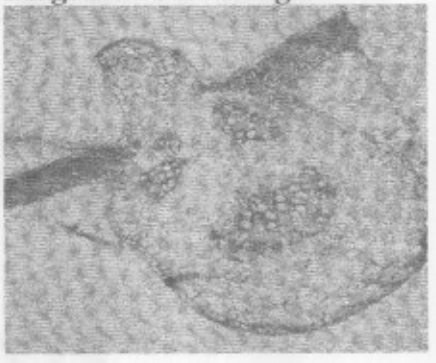
Biogen



Biogen + 1 cm^3/L A.g.

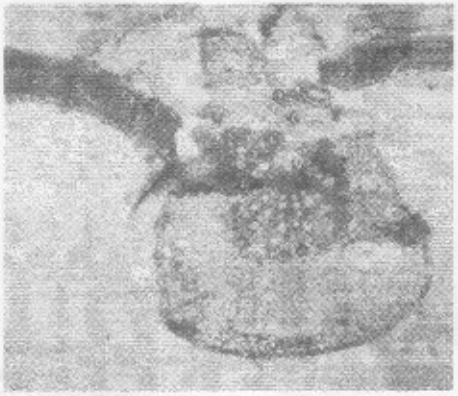


Biogen + 2 cm^3/L A.g.



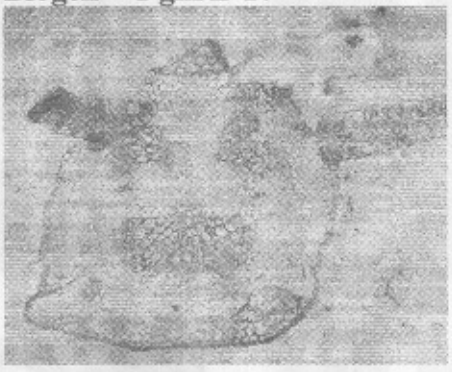
Biogen + 4 cm^3/L A.g.

Fig. 1. Cont.

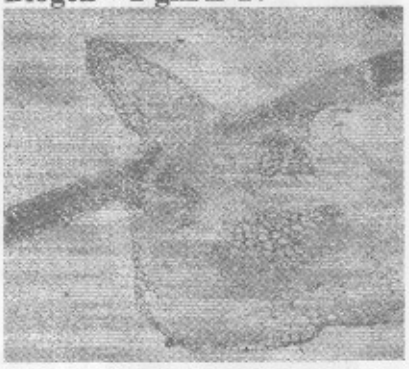


Biogen + 1 gm/L Y.

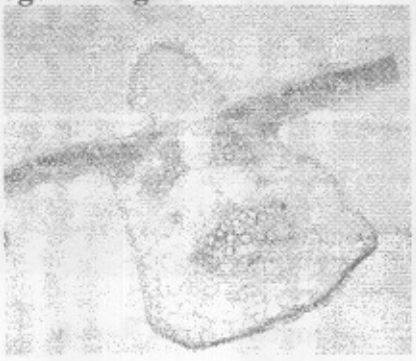
Biogen + 2 gm/L Y.



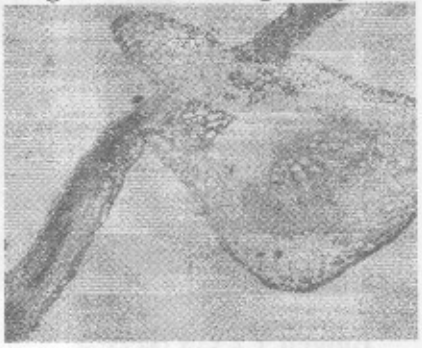
Biogen + 4 gm/L Y.



Biogen + 2 cm^3/L A.g. + 2 gm/L Y.

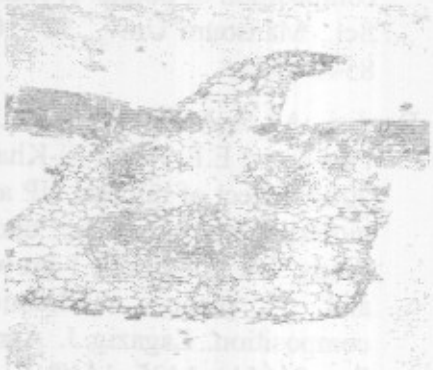


Nitrobein

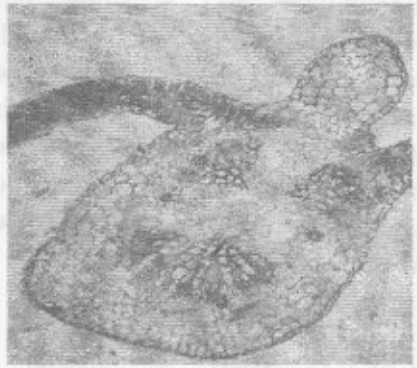


Nitrobein + 1 cm^3/L A.g.

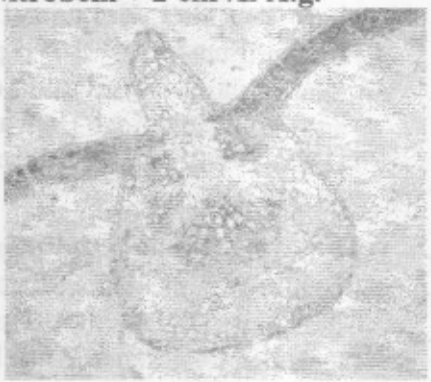
Fig. 1. Cont.



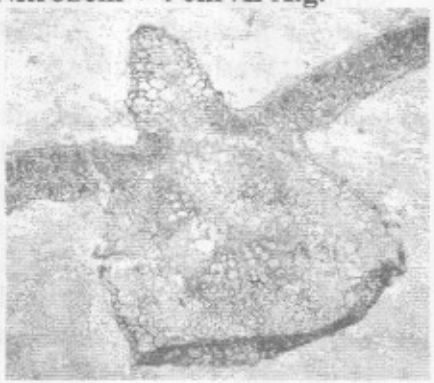
Nitrobein + 2 cm^3/L A.g.



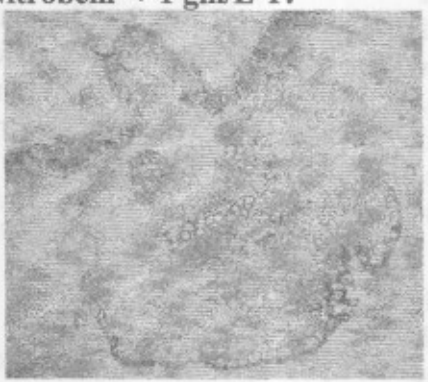
Nitrobein + 4 cm^3/L A.g.



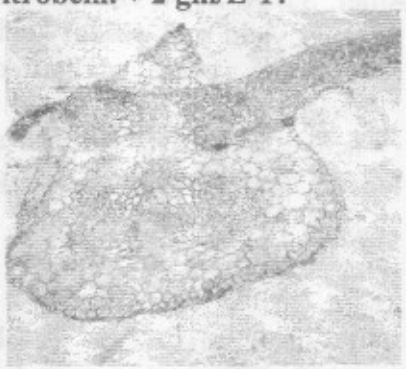
Nitrobein + 1 gm/L Y.



Nitrobein. + 2 gm/L Y.



Nitrobein + 4 gm/L Y.



Nitrobein + 2 cm^3/L A.g. + 2 gm/L Y.

Fig. 1. Cont.

biofertilizer and spraying with (4g/l) active dry yeast or the combination between amino green compound ($2cm^3/l$) and active dry yeast (2g/l) significantly enhanced plant growth, leaf pigments, pod yield and yield components as well as promotive anatomical traits.

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تأثير بعض المخصبات الحيوية والرش الورقى بمركب أمينو جرين والخميرة على بعض الصفات النباتية فى الفاصوليا تحت ظروف الأراضى الرملية

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أجريت تجربتان حقليتان خلال موسمى صيف ٢٠٠٧ و ٢٠٠٨ فى مزرعة التجارب البحثية بمحطة بحوث البساتين بالقصاصين، محافظة الإسماعيلية، لدراسة تأثير مصدرين من المخصبات الحيوية (البيوجين، النيتروبين) بالإضافة إلى الكنترول والرش الورقى بمركب أمينو جرين بمعدل ١، ٢، ٤ سم^3/ لتر والخميرة الجافة بمعدل ١، ٢، ٤ جم/لتر وخليط من أمينو جرين ٢سم^3/لتر + الخميرة ٢جم/لتر بالإضافة إلى الرش بماء الصنبور والتفاعل بينهما، على صفات النمو والوزن الجاف والصبغات النباتية والمحصول والمحتوى الكيماوى والتركيب التشريحى لنباتات الفاصوليا صنف بوليستا.

أعطت نباتات الفاصوليا المعاملة بالبيوجين أو النيتروبين أعلى القيم بالنسبة لارتفاع النبات، عدد الأوراق/نبات، الوزن الجاف الكلى للنبات، عدد القرون/نبات والمحصول الكلى للفدان هذا بالإضافة إلى محتوى القرون من البروتين وكذلك الصفات التشريحية، كما أعطى الرش الورقى لنباتات الفاصوليا بمركب أمينو جرين بتركيز ٤ سم^3/لتر، و الخميرة الجافة بتركيز ٤جم/ لتر، ومعاملة الخلط بين أمينو جرين بتركيز ٢ سم^3 + الخميرة بتركيز ٢جم/لتر أعلى القيم لكل من ارتفاع النبات، عدد الأوراق/نبات، مساحة الورقة، الوزن الجاف الكلى/نبات، محتوى الأوراق من الكلوروفيلات، عدد القرون/نبات، محصول القرون/نبات والمحصول الكلى للفدان والصفات التشريحية وكذلك المحتوى الكلى للقرون من البروتين، وسجلت معاملات التفاعل بين النيتروبين والرش بالخميرة بمعدل ٤جم/لتر أو الخلط بين أمينو جرين ٢سم^3/ لتر + الخميرة ٢جم/لتر أعلى القيم بالنسبة لقياسات النمو الخضرى، ومحتوى الأوراق من الكلوروفيلات والمحصول الكلى ومكوناته، ومحتوى القرون من البروتين مع زيادة كل الصفات التشريحية.