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EFFECT OF BIOFERTILIZATION AND NITROGEN FERTILIZER LEVELS ON GROWTH, YIELD AND QUALITY OF ONION PLANTS

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ABSTRACT: ***Two field experiments were carried out during the two successive winter seasons of 2007 / 2008 and 2008/ 2009 at El-Makrany village, Yousef El-Sadeek district, El-Fayoum Governorate to study the main effect of four N fertilizer levels (0, 30, 60 and 90 kg N/ fed.) and biofertilizer treatments Azospirillum as a single biofertilizer and Microbein (a mixture of Azotobacter, Azospirillum, Pesudomonas, Rhizobium and Bacillus) as well as their interaction on vegetative growth characters, leaf chlorophyll contents, minerals content, some biochemical compounds, yield, quality and storability of onion (Allium cepa L.) cv. Giza 20.***

The obtained results indicated that application of mineral N particularly at the highest two rates (60 and 90 kg N/fed) significantly increased plant length, plant fresh and dry weight, number of leaves and leaf chlorophyll contents over the untreated plants

- Treatments showed significant increments with the inoculated plants comparing with untreated ones.

- Inoculation of onion seedling with mixed biofertilizer (Microbein) was more effective for all studied characters than the single biofertilizer (Azospirillum).

- Interaction between N levels and biofertilizer treatments exerted significant effects for most of the studied characters and revealed that application of N at 90 kg N/fed combined with mixed biofertilizer gave the best results, however the most economic treatment was N application at 60 kg N/fed with mixed biofertiizer (Micobein), which can reduce N-fertilizer used without reducing of production or increasing of environmental pollution.

Key words: ***Nitrogen Fertilizer, Biofertilization, Azospirillum, Microbein Fertilization, Onion Plants.***

INTRODUCTION

Onion (Allium cepa L.) is one of the oldest vegetable crops. It is one of the most important vegetables due to high income and its great consumption popularity. It has enormous nutritional and medical values because of its contents of carbohydrates, proteins, vitamins, minerals and antioxidant substances (Paul and Southgate, 1987).

Nitrogen is an element required for plant growth. It is a fertilizer in a balance and rational way to keep high and stable yield in important component of proteins, enzymes and vitamins in plant and it is a central part

of the chlorophyll, the essential photosynthetic molecule. Application of high rates of N to the shallow rooted onion crop is a common practice by onion growers to insure high yields and bulb quality (Randle, 2000). The excessive application of chemical fertilizers led to increase production cost. The residual of chemical fertilizers has seriously affected the quality of agricultural products people's health and caused environmental pollution. Therefore a great interest has been generated to apply bio-organic and inorganic fertilizers to establish a good ecoenvironment.

The biofertilizers (microbial inoculants) in many plants have been established, which effectively supplement the need of nitrogen and reduce the cost of production and environmental pollution via reducing the rates of mineral –N fertilizers used (Ouda, 2000). Several researchers reported that the inoculation of some plants with biofertilizers (singly combinations with mineral fertilizers) improved plant growth, yield and chemical composition (Abd El-Fattah and Sorial, 2000; Abou-Hussein *et al*., 2001 and Abdel-Mouty *et al*., 2002). The combination of biofertilizers with suitable rate of mineral N-fertilizers could help to increase the efficiency of these fertilizers and to reduce the extensive use of mineral-N fertilization (Gadallah *et al*., 2004). Thus the present investigation was conducted to study the effects of biofertilizers under different nitrogen levels on growth, chemical composition, yield and its components of onion plants.

MATERIALS AND METHODS

Two field experiments were carried out at El-Makrany village, Yousef El-Sadeek district, El-Fayoum Governorate during the two winter seasons of 2007/ 2008 and 2008/ 2009 to study the effects of biofertilizers under different nitrogen levels on growth, chemical composition, yield and its components of onion (Allium cepa L.) cv. Giza 20 in order to estimate the efficiency of single biofertilizer as well as mixed biofertilizers in saving inorganic N-fertilizer.

Physical and chemical analysis of the experimental soil shown in Table (1) were carried out before planting according to the methods of Black (1965).

The experimental treatments and design:

Azospirillum brazlense, a local isolate, which was supplied by the Department of Microbiology, Soil, Water and Environ. Res. Institute, Agriculture Resarch Center (ARC), Giza, Egypt, was used as the single biofertilizer. Microbein (a biofertilizer) contains a mixture of growth promoting N-fixing bacteria of genera (Azotobacter, Azospirillum Pseudomonas, Rhizobium and Bacillus), was obtained from Agricultural Research Center, Ministry of Agriculture, Egypt, and used as mixed biofertilizers.

Table (1): Some physical and chemical analysis of the experimental soil

Soil properties	Value
<u>Particle size distribution %</u>	
Coarse sand	7.2
Fine sand	21.12
Silt	23.95
clay	47.73
Soil textural class	Clay
Soil $CaCO_3$ %	12.58
Soil organic matter %	1.85
Soil pH (1:2.5 soil water suspension)	8.25
EC_e (dSm^{-1}) in soil paste extract	3.16
<u>Soluble ions in soil paste extract (meq/l):</u>	
$CO_3^{=}$	0.00
HCO_3^-	2.75
Cl^-	20.87
$SO_4^{=}$	8.11
Ca^{2+}	8.42
Mg^{++}	4.28
Na^+	18.53
K^+	0.50
<u>Available nutrients in soil (mg/kg):</u>	
N	17.40
P	4.65
Fe	3.25
Mn	0.76
Zn	0.43\

The experiments included 12 treatments which were all combinations of four N levels (0, 30, 60 and 90 kg N/fed.) and three biofertilizer treatments, which were:

1- **uninoculated control (with no bacterial cells)**
2- ***Azospirillum brasilense* as the single biofertilizer.**
3- **Microbein**

Seedling roots 60 days old were immersed in heavy cell suspension of each culture treatment for 15 minutes before transplanting. The inoculation process was achieved just before transplanting by dipping the roots in the single or mixed biofertilizer. Seedling of the uninoculated control were dipped in distilled water.

The experimental design was a split-plot system in randomized complete blocks with three replications. The main plots were allocated for N levels, whereas, the sub-plots were occupied by the biofertilizer treatments.

Nitrogen fertilizer in form of ammonium sulphate (20.6%N) was directly applied as soil application treatment in two equal portions at 30 and 60 days after transplanting. The experimental units (10.5 m^2) were fertilized with equal amounts of calcium superphosphate (15.5% P_2O_5) at rate of 200 kg/fed. applied to the soil before planting and potassium sulphate (48% K_2O) at rate of 50 kg /fed.

Data recorded:

a) **Growth characters:** A random sample of five onion plants was taken from each sub plot, 90 days after transplanting, to determine the following estimates: plant height (cm), number of leaves//plant, fresh and dry weight of leaves and bulb as well as the total fresh and dry weight of whole plant. Also, diameter of bulb and neck of sample time (90 days after transplanting)were measured.

b) **Chemical analysis:** The same sample was used for determination of: leaf chlorophyll a, b and total chlorophyll (mg/g fresh weight of leaf), according to the method of Witham *et al*.(1971), as well as Total nitrogen content in dry leaves using the micro-kjeldahl method as described by Ling(1963). Protein content was calculated by multiplication N% x 6.25 Phosphorus and potassium were determined in dried leaves as described by Chapman and Pratt(1961).

c) **Yield and bulb characteristics:** These were determined at the harvesting time (150 days from transplanting) including the following:

- Total yield of bulb (Ton/fed.)
- Bulb diameter (cm)
- Average bulb weight (g)
- In fresh bulbs (juice), the total soluble solids (TSS) were estimated using handle refractometer (A.O.A.C 1990)
- N, P and K in bulb were determined according to Page *et al*., (1982)
- Total carbohydrates content in onion bulbs was determined according to the method of Dubois *et al*., (1956).
- Total, reducing and non reducing sugars contents in onion bulbs were determined according to Somogy (1952).

Storability: after curing, random samples (5 kg sound bulbs/pot)were taken and stored at room temperature and total weight loss was recorded monthly for five months after harvesting.

The obtained data were statistically analyzed according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Effect of mineral nitrogen:

Data presented in Table (2), generally, indicate significant increments in all studied growth characters of onion plants due to N application e.g., plant length, number of leaves/plant, fresh and dry weight of leaves and bulb as well as the total fresh and dry weight of whole plant and diameter of bulb and neck, which were corresponded to increased N levels. Application of N at 90 kg /fed gave significantly higher mean values for all studied growth characters, compared with those of the control or other N levels. The increase in plant growth may be attributed to the beneficial effects of N on stimulating the meristmatic activity for producing more tissues and organs, since N plays major roles in the synthesis of structural proteins and other several macro molecules, in addition to its vital contribution in several biochemical processes in the plant related to growth (Marchner,1986). Similar findings were supported by several researchers as El-Gamili(1996); and Abd El-Maksoud and El-Swaff (2000).

Effect of biofertilization:-

Concerning the effect of biofertilizer inoculation, data in Table (2) show that inoculation of onion seedling with single (Azospirillum) or mixed (microbein) biofertilizer was responsible for the significant increments of onion plants, over the control. Meanwhile, the mixed biofertilizer was more pronounced and associated with the highest mean values for all previously mentioned vegetative growth characters followed by the effect of single biofertilizer. Our findings agree generally with those of Ali and Selim (1996), Barakat and Gaber(1998) and El-Zeiny *et al*.,(2001) on tomato; Ghoneim and Abd El-Razik (1999) on potato; Shibob (2000) on common bean; Ishaq (2002) and Solieman *et al*.,(2003) on pea. The enhancing effect of the biofertilizers application have been attributed to several mechanisms, including biological nitrogen fixation, dissolving immobilized P and producing plant growth promoting substances (Okon and Itzigsohn 1995 and Okan and Labandera-Gonzalez 1994).

Fallik *et al*., (1994) indicated that the non-symbiotic N_2-fixing bacteria of genera Azospirillum produced adequate amounts of IAA and cytokinins which increased the number of lateral roots and root hairs causing absorption of sufficient nutrients and foster luxurianty.

With respect to the interactive effect between N levels and biofertilizer application, data in Table (2), also, indicate that onion plants received 90 kg N/fed and inoculated either with Azospirillum or Microbein had the highest mean values for all vegetative growth characters, compared with the control and other combined treatments. However, it appears from the results that inoculation with Microbein (mixed biofertilizer) had enhanced all growth characters of onion when no N was applied, compared with uninoculated

Table 2

plants or inoculated with Azospirillum (single biofertilizer). Similar results were obtained by El-Gamal (1996) on potatoes and Barakat and Gabr (1998) on tomatoes which seemed to confirm these results.

Chemical composition of onion leaves:-

a) Photosynthetic pigments

There were significant increases in chlorophyll a, b and total chlorophyll contents of onion leaves with increasing N levels (Table 3). This trend was similar to those obtained by vegetative growth characters as affected by N levels. This can be attributed to the sufficient N uptake, enhanced onion plants to absorb more N and in turn to build more chlorophyll molecules, whereas N is considered as the backbone of chlorophyll structure, this results is confirmed by that recorded by El-Beheidi *et al*.(1996) and Tartoura and El-Saeid(2001). On the other hand, data presented in Table (3), also, show that inoculation of onion seedling, with either single or mixed biofertilizer, resulted in significant increments of leaf chlorophyll, a, b and total chlorophyll contents. The highest values of phytosynthetic pigments content were obtained using Microbein inoculation. Similar finding was gained by Barakat and Gabr (1998) on tomatoes, who found that the single and mixed biofertilizers significantly increased leaf chlorophyll content and net assimilation rate over the control and the mixed biofertilizer exerted a remarkable influence than the single biofertilizers.

The interaction effects between N fertilizer rates and biofertilizers on chlorophyll a, b and the total chlorophyll content of leaves in Table (3) reveal that, at higher N rates 60 and 90 kg N/fed the inoculation of onion seedling attained the highest chlorophyll content of leaves. These results are in line with those of Dawa *et al*., (2000). El-Zeiny *et al*., (2001), working on tomato and Gabr *et al*., (2001) working on sweet pepper.

b) Mineral contents in tubular blades and bulbs:-

Data presented in Table (3) clearly show that, the concentration of N, P and K in both tubular blades and bulbs at 90 days from transplanting were increased by increasing N levels. Data in Table (3) also show that inoculation with either single or mixed biofertilizers increased the concentration of N, P and K in both tubular blades and bulbs than the control plants.

It is also obvious that the highest concentration of N and K was obtained in the tubular blades as compared to that in the bulb of onion plants, while an opposite trend was observed for the P concentration. Similar results were obtained by Abd El-Maksoud and El-Swaff (2000).

The data in Table (3) indicate that inoculation of onion seedling with biofertilizer in combination with mineral N fertilizer at rates 60 and 90 kg N/fed increased N, P and K concentration in both tubular blades and bulbs at 90 days from transplanting. In this respect, Hanafy Ahmed *et al*., (1997)

Table 3

suggested that addition of biofertilizers increases the ability to convert N_2 to NH_4 and thus make it available to plant. Also, the data show that onion seedlings inoculated with biofertilizers and received either 60 or 90 kg N/fed contained higher P concentration than plants fertilized with the mineral N-fertilizer only. The enhancing effect of biofertilizer on increasing P concentration in both tubular blades and bulbs could be attributed to the beneficial effects of bacteria on reducing soil pH by secreting organic acids (e.g. acetic, propionic, fumaric and succinic) , which brought about the dissolution of bounds forms of P and render them available for growing plants. These results are in agreement with those reported by Hewedy (1999), Ouda (2000) on tomato and Gad -allah *et al*.(2004)on spinach. The interaction between N levels and biofertilizer treatments was similar to those obtained with respect to chlorophyll content.

Yield and its components:-

Total bulb yield, bulb diameter, average bulb weight, bulb dry matter content and T.S.S. percentage reflected significant differences among the different nitrogen levels used (Table 4). Fertilizing onion plants significantly increased bulb yield and its components in comparison with the unfertilized treatment. In addition, increasing nitrogen levels caused a significant increase in bulbs yield and its component up to 90 kgN/fed These increments may be related to the role of N enhancing vegetative growth, which lead to produce more photosynthetic material required for bulb production. These results are in agreement with those of El-Gamili *et al*., (2000) and Abd El-Maksoud and Swaff (2000).

Data in Table (4), also, reveal that treatment of the single as well as mixed biofertilizer inoculation, significantly exceeded the comparable control treatment concerning bulbs yield and its components. However, the mixed biofertilizer (Microbein) exerted significant increases in this respect than the single biofertilizer. The beneficial effect of biofertilizers was due to improving N nutrition (Lazarovit and Nowak 1997). Producing phytohormones are responsible for root hair branching and an eventual increase in nutrient uptake, (Noel *et al*., 1996) and /or biocontrol of plant disease through production of antibiotics, antibacterial and antifungal compounds. These results agree to a great extent with those reported by Barakat and Gabr(1998) and Gaber *et al*., (2001).

The effects of different interactions among the various levels of the nitrogen and different biofertilizers type on yield ability of onion plants are shown in Table (4). The results revealed that the highest mean values for total bulbs yield diameter average bulb weight, dry matter content and total soluble solids were obtained from the plants that were previously inoculated with the biofertilizer Microbein and given either 60 or 90 kg N/fed. These results might be explained on the basis that the interactive effects of two studied factors were additive. A large number of reports emphasized the

beneficial effects of the interaction between mineral N fertilizer and inoculation with biofertilizer on productivity of different vegetable crops as Ashour *et al*., (1997), Barakat and Gaber (1998), Abd El-Mouty (2000) and ElKhatib (2003).

Table (4): Total yield and quality characteristics of onion bulbs as affected by different nitrogen levels and biofertilizer treatments and their interaction (combined analysis of two seasons)

Treatments		Total yield of bulb (Ton/fed)	Bulb diameter (cm)	Average bulb weight (g)	Dry matter content (%)	Total soluble solids (%)
N levels kg/fed	Biofertilizer type					
0	Uninoculated	4.300	4.50	97.82	10.37	12.32
	Azospirillum	5.150	4.81	101.60	10.55	12.54
	Microbein	6.00	5.41	107.30	11.72	12.77
	Mean	5.15	4.91	102.24	10.88	12.54
30	Uninoculated	7.967	5.91	112.29	12.21	13.21
	Azospirillum	8.083	6.36	115.53	13.63	13.56
	Microbein	9.420	6.67	121.42	14.31	13.74
	Mean	8.489	6.31	116.41	13.38	13.50
60	Uninoculated	12.530	6.40	127.55	13.89	13.81
	Azospirillum	13.160	6.72	134.65	14.25	14.20
	Microbein	13.320	7.37	142.39	15.46	14.51
	Mean	13.003	6.83	134.86	14.53	14.17
90	Uninoculated	13.660	6.79	145.38	14.42	14.57
	Azospirillum	14.540	7.52	152.27	15.55	14.68
	Microbein	14.690	7.80	164.70	16.82	14.77
	Mean	14.297	7.37	154.12	15.60	14.67
Mean of biofertilizer	Uninoculated	9.614	5.90	120.76	12.72	13.48
	Azospirillum	10.230	6.35	126.01	13.50	13.75
	Microbein	10.858	6.81	133.95	14.58	13.95
l.S.D of 5%						
N		0.319	0.292	5.143	0.275	0.071
Bio		0.345	0.381	2.437	0.155	0.095
N x Bio		n.s	n.s	n.s	0.340	0.100

N-uptake and biochemical compounds:-

N-uptake, protein content, total, reducing and non reducing sugars of onion bulbs were increased by increasing N levels (Table 5). Nitrogen

application at rate 60 and 90 kg N/fed recorded the highest N-uptake and some biochemical compounds of onion bulbs compared with the control and other levels of nitrogen fertilizer. Similar finding for increases onion bulb quality due to N-application were obtained by Midan (1995) and Abd El-Fattah and Sorial (1998) who mentioned that mineral N-fertilizer might promote metabolic processes within the plant, which in turn could reflect a positive effect on chemical composition of plant.

Table (5): N-uptake and some biochemical estimates of onion bulbs as affected by different nitrogen levels and biofertilizer treatments and their interaction (combined analysis of two seasons)

Treatments		N-uptake (kg/fed)	Total proteins (%)	Reducing sugar (%)	Non reducing sugar(%)	Total Sugar (%)
N levels kg/fed	Biofertilizer type					
0	Uninoculated	69.66	10.13	2.95	13.24	16.19
	Azospirillum	89.61	10.88	3.23	13.67	16.90
	Microbein	108.00	11.25	3.42	14.92	18.34
	Mean	89.09	10.75	3.20	13.94	17.14
30	Uninoculated	135.44	10.63	3.27	13.72	16.99
	Azospirillum	148.67	11.50	3.46	14.57	18.03
	Microbein	180.86	12.00	4.13	16.09	20.22
	Mean	154.99	11.38	3.62	14.79	18.41
60	Uninoculated	229.30	11.44	3.54	14.42	17.96
	Azospirillum	271.10	12.88	3.65	15.18	18.83
	Microbein	298.37	14.00	4.38	16.48	20.86
	Mean	266.26	12.77	3.86	15.36	19.22
90	Uninoculated	292.32	13.38	4.29	14.75	19.04
	Azospirillum	324.24	13.94	4.48	15.77	20.25
	Microbein	334.93	14.25	4.67	16.98	21.65
	Mean	317.16	13.86	4.48	15.83	20.31
Mean of biofertilizer	Uninoculated	181.68	11.40	3.51	14.03	17.55
	Azospirillum	208.41	12.30	3.71	14.80	18.50
	Microbein	230.54	12.88	4.15	16.12	20.27
l.S.D of 5%						
N		3.480	0.424	0.172	0.072	0.072
Bio		4.973	0.073	0.148	0.062	0.064
N x Bio		5.543	0.069	0.227	0.107	0.106

Data in Table (5) further show, also, that inoculation with either single or mixed biofertilizers significantly increased some biochemical compounds of onion bulbs than the control plants. These results might be due to the increase in vegetative growth characters, as well as the increase in bulbs size, average bulb weight and bulb dry matter content, since nitrogen is an important constituent of chlorophyll which increases photosynthesis, resulting in assimilation of more total, reducing and non reducing sugars. Moreover, bulb quality increases might be due to the fact that Azospirillum or mixed biofertilizer (Microbein) stimulates root growth, changes root morphology and enhances uptake of minerals. It is also possible due to the invotvement in phytohormones production which all together might cause promotion of vegetative growth characters and induction of some biochemical compounds.

Concerning the effects of N-levels and biofertilizer inoculation on onion bulb quality, data in Table (5), indicate that both factors had significant and positive effects on onion bulb quality. Similar results were obtained by El-Gamal (1996).

Storability:

Data presented in Table (6) clearly show that all the treatments under consideration tended to increase the weight loss from the first to the last month during the storage period (5 months). In this respect, the amount of monthly water loss from bulbs was increased by increasing N application rate, which may be attributed to more viscosity of plant cells induced by higher application rate of nitrogen. This attained the bulbs keeping higher amount of water. This trend is in accordance with of Leilah and Mostafa (1993) who found that, keeping quality was markedly deteriorated with raising N-level. The highest values of weight loss were obtained from the treatment of the highest N-fertilizer. In general, the present results are in conformity with those found by El-Sheekh and Hegazi (1998) and Mohamed (2006).

The highest total loss in weight percent was produced under 90 kg N/fed followed by 60 and 30 kg N/fed On the other hand, the lowest total loss in weight was produced under 0 nitrogen (control). Also, the total loss in weight increased with increasing the storage period (five months).

Regarding to the effect of biofertilizer on weight loss of bulb%., data also in Table (6) show that, the biofertilizer decreased the loss of bulb weight, might be due to one or more from the following mechanisms; production of plant growth promoting substances or organic acids, enhancing nutrient uptake or protection against plant pathogens (El-Haddad *et al*. 1993).

Concerning the effects of N-levels and biofertilizer inoculation on weight loss of bulb%, data in Table (5) indicate that both factors had significant and positive effects on improving the storability of onion bulbs.

Table (6): Weight loss percentage of onion bulbs during storage period as affected by different nitrogen levels and biofertilizer treatments and their interaction (combined analysis of two seasons)

Treatments		Weight loss %				
N levels kg/fed	Biofertilizer type	Storage period (days)				
		30	60	90	120	150
0	Uninoculated	4.65	5.72	7.58	9.47	11.53
	Azospirillum	4.52	4.97	6.87	9.22	11.32
	Microbein	3.42	4.56	6.62	8.18	11.19
	Mean	4.20	5.08	7.02	8.96	11.35
30	Uninoculated	5.72	6.45	8.52	9.66	12.62
	Azospirillum	4.82	6.31	8.24	9.48	12.44
	Microbein	3.87	4.73	7.65	9.34	12.27
	Mean	4.80	5.83	8.14	9.49	12.44
60	Uninoculated	5.89	6.83	8.69	10.65	13.69
	Azospirillum	5.59	6.67	8.37	10.22	13.52
	Microbein	5.40	5.57	7.76	10.02	13.12
	Mean	5.63	6.36	8.27	10.30	13.44
90	Uninoculated	6.37	7.88	9.35	11.59	14.84
	Azospirillum	6.11	7.37	9.29	11.45	14.52
	Microbein	5.82	6.69	9.07	11.22	13.66
	Mean	6.10	7.31	9.24	11.42	14.34
Mean of biofertilizer	Uninoculated	5.66	6.72	8.54	10.34	13.17
	Azospirillum	5.26	6.33	8.19	10.09	12.95
	Microbein	4.63	5.39	7.78	9.69	12.56
I.S.D of 5%						
N		0.163	0.066	0.158	0.058	0.154
Bio		0.141	0.057	0.137	0.050	0.134
N x Bio		0.193	0.089	0.197	0.066	0.199

REFERENCES

A.O.A.C. (1990). "Official Method of Analysis". 15th ed. Association of Official Analytical Chemists, Washington. D. C., USA.

Abd El-Fattah, M. A. and Mervat E. Sorial (1998). Efficiency of biofertilization on responses of the productivity and chemical composition of Lettuce plants grown under different nitrogen levels. Minufiya J. Agric. Res., 23(5):1185-1207.

Abd El-Fattah, M. A. and M. E. Sorial (2000). Sex expression and productivity responses of summer squash to bio fertilizer application under different nitrogen levels. Zagazig J. Agric. Res., 27(2):255

Abd El-Maksoud, M. R. and N. El-Swaff (2000). Effect of soil and foliar application of nitrogen fertilizer on onion plants grown in sandy soils. Minofyia J. Agric. Res., 25: 1323-1333.

Abd El-Mouty, M. M. (2000). Effect of chemical and bio-nitrogen fertilizer on the growth and yield of cowpea plants (vigna sinensis savi) J. Agric. Sci. Mansoura Univ. , 25 (7):4437-4450.

Abdel-Mouty, M. Mona, Nisha H. Ali and Fatma A. Rizk (2002). Potato yield as affected by interaction between bio and organic fertilizers. Egypt, J. Appl. Sci. 16(6): 267-276.

Abou-Hussein, S. D., T.S. El-Oksh and A. M. Goma (2001). Effect of cattle ,manure biofertilizers and reducing mineral fertilizer on nutrient content and yield of potato plant, Egypt. J. Hort., 29(1):99-115.

Ali. F. A. and A. H. Selim (1996). Response of tomato (*Lycopersicon esculentum* L.) c.v. Castle Rock to inoculation with Azotobacter and different levels of phosphorus and potassium fertilization. Minofyia J. Agric. Res., 21(4):795-817

Ashour, S. A., A. E. Abd El-Fattah and A. A. Tawfik (1997). Effect of nitrobien (biofertilizer) and different levels of nitrogen on growth and yield of potato (Solanum tuberosum L.) J. Agric. Sci., Mansoura Univ., 22 (11):3979-3986.

Barakat, M. A. and S.M. Gabr (1998). Effect of different biofertilizer types and nitrogen fertilizer levels on tomato plants. Alex. J. Agric. Res., 43(1): 149-160

Black, C. A. (1965). Methods of Soil Analysis. Amer. Soc. Agron. Madiso-Wis., U.S.A.

Chapman, H. D. and P. F. Pratt (1961). Method of analysis for soil, plant and water. Div. of Agric. Sci., Univ. of California.

Dawa, K. K.; T. M. El-Gazar; H. A. E-Syaed; A. M. Hewedy and A. M. Ouda (2000). Effect of organic and biofertilizers application as compared to chemical fertilizers on vegetative growth and flowering of tomato plants. J. Agric. Sci. Mansoura Univ., 25(7): 4541-4554

Dubois, M.; K. A. Gilles, J. K. Hamilton, P. A. Robers and F. Smith (1956). Colorimetric method for determination of sugars and related substances. Anals Chem., 28: 350-356.

El- Beheidi, M. A., A. A. El-Mansi, A. M. Metwally, A. A. Guirgis and S. A. Swidan (1996). Level and number of application of nitrogen fertilizer and their action on growth and yield of pea plants. Zagazig J. Agric. Res. 23(3): 413-425.

El-Gamal, A. M. (1996). Response of potato in the newly reclaimed areas to mineral nitrogen fertilizer levels and nitrogen fixing biofertilizer HALEX2. J. Agric. Sci., Assiut Univ. 27:89-99.

El-Gamili, A. E. (1996). Productivity of onion (Allium cepa L.) as affected by different transplanting dates and nitrogen fertilization levels. Minofyia J. Agric. Res. 21(6): 1497-1509.

El-Gamili, A.; A. B. Hanna and A. A. Gamei (2000). Effect of transplanting dates and nitrogen rates on Giza 20 onion bulb yield and storability. Minofyia J. Agric. Res., 25(5):1229-1239.

El-Haddad M. E., Y. Z. Ishac and M. I. Mostfa (1993). The role of biofertilizers in reducing agriculture costs, decreasing environmental pollution and raising crop yields. Arab Univ. J. Agric. Sci., (1)147, 195, Egypt.

Elkhatib, H. (2003). Yield response of peas to nitrogen and bio-organic fertilization: a mathematical model. J. Adv. Agric. Res., 8(4):767-783.

El-Sheekh, H. M. and A. M. Hegazy (1998). Effect of organic and mineral fertilizers on growth, yield, quality and storability of onion. J. Agric. Sci., Mansoura Univ., 23(8): 3641-3650.

El-Zeiny, O. A. H., U. A. El-Behairy and M. H. Zaky (2001). Influence of biofertilizer on growth, yield and fruit quality of tomato grown under plastic house. J. Agric. Sci. Mansoura Univ. 26(3):1749-1763.

Fallik , E., S. Sarig and Y. Okan (1994). Morphology and physiology of plant roots associated with Azospirillum pp. 77-86. In T Okon (ed). Azospirillum /plant association. CRC. Press Boca Raton, FL.

Gabr, S. M., I. M. Ghoneim and H. M. F. Hassan (2001). Effects of bio and nitrogen fertilization on growth, flowering, chemical contents, yield and quality of sweet pepper. J. Adv. Agric. Res., 6(4):939-955.

Gadallh, F. M., S. A. Mahfouz and N. A. El-Sawah (2004). Response of spinach plants to biofertilization. Fayoum J. Agric. Res. and Dev., 18(1):177-191.

Ghoneim, I. M. and A. H. Abd El-Razik (1999). Effect of biofertilization under different nitrogen levels on growth, yield and chemical contents of potato plants. Adv. Agric. Res., 4(2): 757-769

Gomez, K. A. and A. A. Gomez (1984). Statistical procedures of Agric. Res. Seconded. Weilly interscience puble., Pp. 357-423.

Hanafy Ahmed, A. H., N. F. Kheir and N. B. Talaat (1997). Physiological studies on reducing the accumulation of nitrate in Jew's mallow(Corchorus olitorius) and radish (Raphanus sativus L.). Bull. Fac. Agric., Cairo., Univ., 48:25-64.

Hewedy, A. M. (1999). Influence of single and multi bacteria fertilizer on the growth and fruit yield of tomato. Egypt. J. Appl. Sci., 14(7): 508-523.

Ishaq, M. S. (2002). Comparisons among the effect of biofertilizer, nitrogen and boron on growth, seed production and seed quality of peas (Pisum staivum L.) Ph.D. Thesis, Fac. Agric. Alex. Univ. Egypt.

Lazarovits, G. and J. Nowak (1997). Rhizobacteria for improvement of plant growth and establishment. Hort. Science 23(2): 188-192.

Leilah, A.A. and A.K.Mostafa (1993). Response to onion cv.Giza 20 to N,P,K fertilizer levels. J. Agric. Sci., Mansoura Univ., 18(3): 628-634.

Ling, E. R. (1963). Determination of total nitrogen by semimicro kjeldahl method. Dairy Chem., 11:23-84.

Marchner, H. (1986). Mineral nutrition in higher plants. Academic press, Harcout. Jovanvish Publisher, Pp 6-74.

Midan, S. A. (1995). Response of some promising pepper genotypes to different culture treatments. M.Sc. thesis, Fac. Agric. Menoufiya Univ. Egypt.

Mohamed, A. B. B. (2006). A comparatives study of nitrogen and micronutrients application and their effect on onion yield and yield components. Ph.D. Thesis Fac. of Agric. Benha Univ. Egypt.

Noel, T.C., C. Sheng, C. K. Yost; R.P. Pharis and M. E. Hynes (1996). Rhizobium legumin osarum as a plant growth promoting rhizobacterium: direct growth promotion of canola and lettuce. Can. Jour. Of Microbiol., 42(3):279-283.

Okan, Y. and C. A. Labandera-Gonzalez (1994). Agronomic applications of Azsopirillum. An evaluation of 20 years world wide field inoculation-Soil Biology and Biochemistry, 26: 1591-1601.

Okon, Y. and R. Itzigsohn(1995). The development of Azospirillum as a commercial inoculants for improving crop yields. Biotechnol. Adv., 13:365- 374.

Ouda, A. M. M. (2000). Physicologicol studies on tomato yield and its components. Ph.D.Thesis, Fac. Sci., Mansoura, Univ., Egypt.

Page, A. L; R. H. Miller and D. R. Keency (1982). Methods of soil analysis. Part 1&2. Amer. Soc. Of Agron., Madison, Wisconsin, USA.

Paul, A. A. and D. A. Southgate (1987). In the composition of foods, 4^{th} ed., McCane and Widdowson, London.

Randle, W. M. (2000). Increasing nitrogen concentration in hydroponics solution affects onion flavor and bulb quality. J. Am. Soc. Hort. Sci., 125:254-259.

Shibob, R. M. (2000). Effects of nitrogen levels and biofertilizer types on growth, yield and quality of common bean (Phaseolus vulgaris L.). M. Sc. Thesis Fac. Agric. Alex. Univ. Egypt.

Solieman, T. H.; H. A. Elkhatib; S. M. El-Araby (2003). Effects of organic manure, mineral nitrogen and biofertilizer application on vegetative growth and chemical composition of pea (Pisum satirum L.). Zagazig J. Agric. Res., 30(3):751-767.

Somogy, S. (1952). Notes of sugar determination. J. Biol. Chem. 195: 19-23.

Tartoura, E. A. and M. A. El-Saeid(2001). Field evaluation of brown algae and two sources of N-fertilizers on pea plants. J. Agric. Sci. Mansoura Univ., 26(7):4593-4605.

Witham, F. H., D. F. Blaydes and P. M. Devlin (1971). Experiments in plant physiology. Pp.55-58, Van Nosland Reinhold Co., New York.

تأثير التسميد الحيوى ومعدلات التسميد النتروجينى على النمو، المحصول وجودته فى نباتات البصل

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الملخص العربي

اجريت تجربتان حقليتان فى الموسمين الشتويين لعامى ٢٠٠٧ /٢٠٠٨ و ٢٠٠٨ /٢٠٠٩ بقرية المقرانى – مركز يوسف الصديق– محافظة الفيوم بهدف دراسة تأثير التسميد بمعدلات مختلفة من السماد الازوتى (صفر، ٣٠، ٦٠، ٩٠ كجم نتروجين/فدان) مع المعاملة بالسماد الحيوى حيث استخدمت بكتيريا الازوسبيريلليم كسماد حيوى منفرد والسماد الحيوى المختلط ميكروبين(Bacillus, Rhizobium, Psedomonas, Azospirillum, Azotobacter) والتداخلات بينهم على صفات النمو الخضرى ومحتوى الاوراق من الكلورفيل ومحتوى العناصر المعدنية يالاضافة الى بعض المواد البيوكميائية مثل السكريات الكلية – المختزلة وغير مختزلة– المواد الصلبة الذائبة والبروتين الكلى والمحصول وجودته والقدرة التخزينية للبصل صنف جيزة ٢٠ ويمكن تلخيص أهم النتائج المتحصل عليها فيمايلى:

- أدت اضافة السماد النتروجينى المعدنى الى زيادة معنوية فى طول النبات والوزن الطازج والجاف للنبات وعدد الاوراق ومحتواها من الكلوروفيل مقارنة بالنباتات الغير معاملة
- أدت اضافة السماد النتروجينى بمعدل ٦٠، ٩٠ كجم نتروجين/فدان الى زيادة معنوية فى كل الصفات موضع الدراسة.
- أظهرت نتائج تلقيح شتلات البصل بأى من الاسمدة الحيوية المستخدمة تفوقا على الشتلات غير الملقحة فى كل صفات النمو الخضرى وكذلك محتوى الاوراق من الكلوروفيل وايضا محتوى الاوراق او الابصال من العناصر.
- تفوق تأثير السماد الحيوى المختلط (ميكروبين) على السماد الحيوى المنفرد (ازوسيبريلليم) بالنسبة لجميع الصفات تحت الدراسة.

- أظهرت النتائج أن هناك تأثيرات معنوية للتداخل بين التسميد النتروجينى المعدنى والحيوى على معظم الصفات المدروسة.
- وقد بينت النتائج أن استخدام التسميد الازوتى بمعدل ٩٠ كجم ن/فدان مع التلقيح بالسماد الحيوى المختلط كانت أكثر المعاملات كفاءة فى التأثير على جميع الصفات.
- تبين أن المعاملة (٦٠ كجم ن/فدان + التلقيح بالسماد الحيوى المختلط) أكثر المعاملات كفاءة من الناحية الاقتصادية حيث انها تؤدى لخفض معدل استخدام السماد الازوتى دون ان تؤدى لتقليل المحصول او زيادة التلوث البيئى.

Table (2): Vegetative growth characters of onion plants as affected by different nitrogen levels and biofertilizer treatments and their interaction after 90 days from transplanting (combined analysis of two seasons).

Treatments		Plant length (cm)	No. of Leaves /plant	Diameter (cm)		Frsh weight (g)			Dry weight (g)		
N levels kg/fed	Biofertilizer type			Bulb	Neck	Leaves	bulb	Whole plant	Leaves	bulb	Whole plant
0	Uninoculated	59.67	6.67	2.23	1.70	23.15	20.31	43.46	2.70	2.90	5.60
	Azospirillum	62.33	7.00	2.55	1.80	31.82	24.65	56.47	3.35	4.17	7.52
	Microbein	66.00	8.00	2.97	2.12	38.45	31.94	70.39	3.42	4.37	7.79
	Mean	62.67	7.22	2.58	1.87	31.14	25.63	56.77	3.16	3.81	6.97
30	Uninoculated	64.67	6.90	2.65	1.90	37.56	29.98	67.54	3.80	4.57	8.37
	Azospirillum	67.33	7.67	3.08	2.23	46.73	36.60	83.33	4.06	4.66	8.72
	Microbein	71.33	8.86	3.29	2.39	53.98	40.47	94.45	4.52	4.72	9.24
	Mean	67.78	7.81	3.01	2.17	46.09	35.68	81.77	4.13	4.65	8.78
60	Uninoculated	70.0	8.33	3.18	2.33	43.83	39.39	83.22	3.88	4.60	8.48
	Azospirillum	72.33	9.33	3.61	2.44	57.60	45.85	103.45	4.64	4.72	9.36
	Microbein	75.33	9.67	4.24	2.49	64.36	52.62	116.98	4.95	5.75	10.70
	Mean	72.55	9.11	3.68	2.42	55.26	45.95	101.22	4.49	5.02	9.51
90	Uninoculated	73.00	9.00	3.82	2.39	59.73	48.72	108.45	4.18	4.90	9.08
	Azospirillum	76.00	10.33	4.45	2.55	65.80	60.10	125.9	4.82	6.44	11.26
	Microbein	78.67	11.33	4.77	2.76	70.24	65.52	135.76	5.09	6.62	11.71
	Mean	75.89	10.22	4.35	2.57	65.26	58.11	123.37	4.70	5.99	10.68
Mean of biofertilizer	Uninoculated	66.84	7.73	2.97	2.08	41.07	34.60	75.66	3.64	4.24	7.88
	Azospirillum	69.50	8.58	3.42	2.26	50.49	41.80	92.29	4.22	5.00	9.22
	Microbein	72.83	9.47	3.82	2.44	56.76	47.64	104.40	4.50	5.37	9.86
l.S.D of 5%											
N		4.862	1.806	0.315	0.237	5.013	2.580	5.110	0.099	0.267	0.327
Bio		3,931	0.732	0.336	0.192	7.070	3.369	4.765	0.121	0.290	0.152
N x Bio		n.s	n.s	n,s	n.s	n.s	n.s	n.s	0.195	0.475	0.387

Table (3): Photosynthetic pigments and mineral contents of onion plants as affected by different nitrogen levels and biofertilizer treatments and their interaction after 90 days from transplanting (combined analysis of two seasons)

Treatments		Photosynthetic pigments (mg/g F.W)			Tubular blades			Bulbs		
N levels kg/fed	Biofertilizer type	Chlorophyll a	Chlorophyll b	Chlorophyll (a+b)	N %	P %	K %	N %	P %	K %
0	Uninoculated	2.2 0	1.45	3.65	1.80	0.24	1.68	1.17	0.31	1.19
	Azospirillum	2.47	1.66	4.13	2.20	0.26	1.89	1.25	0.34	1.25
	Microbein	2.55	1.73	4.28	2.55	0.31	1.98	1.35	0.36	1.28
	Mean	2.41	1.61	4.02	2.18	0.27	1.85	1.26	0.34	1.24
30	Uninoculated	2.35	1.60	3.95	2.30	0.27	1.88	1.37	0.35	1.25
	Azospirillum	2.58	1.74	4.32	2.95	0.29	2.08	1.45	0.37	1.35
	Microbein	2.65	1.87	4.52	3.25	0.34	2.18	1.58	0.41	1.38
	Mean	2.53	1.74	4.26	2.83	0.30	2.05	1.47	0.38	1.33
60	Uninoculated	2.57	1.72	4.29	3.15	0.31	1.97	1.67	0.39	1.28
	Azospirillum	3.36	1.88	5.24	3.20	0.33	2.23	1.81	0.42	1.39
	Microbein	3.47	1.95	5.42	3.35	0.36	2.35	2.05	0.45	1.45
	Mean	3.13	1.85	4.98	3.23	0.33	2.18	1.84	0.42	1.37
90	Uninoculated	2.85	1.84	4.69	3.40	0.35	2.12	2.13	0.42	1.35
	Azospirillum	3.48	2.21	5.69	3.55	0.37	2.37	2.20	0.46	1.46
	Microbein	3.63	2.27	5.90	3.70	`0.41	2.44	2.26	0.49	1.55
	Mean	3.32	2.11	5.43	3.55	0.38	2.31	2.20	0.46	1.45
Mean of biofertilizer	Uninoculated	2.49	1.65	4.15	2.66	0.29	1.91	1.59	0.37	1.27
	Azospirillum	2.97	1.87	4.85	2.98	0.31	2.14	1.68	0.40	1.36
	Microbein	3.08	1.96	5.03	3.21	0.355	2.24	1.81	0.43	1.42
l.S.D of 5%										
N		0.062	0.029		0.107	0.021	n.s	0.026	n.s	0.015
Bio		0.047	0.044		0.121	n.s	n.s	0.050	n.s	0.044
N x Bio		0.099	0.069		0.196	n.s	n.s	0.067	n.s	0.049