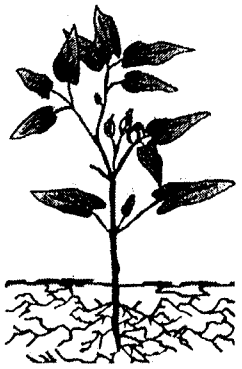

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EFFECT OF SOME BIO AND MINERAL FERTILIZATION LEVELS ON THE GROWTH, PRODUCTIVITY AND STORABILITY OF ONION

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ABSTRACT

Two field experiments were carried out at the Experimental Farm of the Faculty of Agriculture, Tanta University, Egypt, during the winter seasons of 2006/2007 and 2007/2008 to study the effect of some bio-fertilizers such as rhizobacterin, nitrobein, biogein, phosphorein, microbein combined. with different levels of NPK mineral fertilizers on growth, yield, and yield quality and storability of onion bulbs. The obtained results indicated that, applying the rhizobacterin plus phosphorein, nitrobein plus phosphorein and biogein plus phosphorein combined with 75 % of the recommended dose of mineral fertilizers significantly increased plant height, dry weight per plant, bulb weight, total bulb yield and N content of leaves and bulbs. Also, the previous gave the lowest values of bulb weight loss percentage during the storage periods, i.e. 2, 4, 6 and 8 months, in both seasons. There were no significant differences between these treatments and the complete recommended dose of NPK mineral fertilizers in this concern. Biofertilization treatments resulted in the lowest values of nitrate in both leaves and bulbs in the two growing seasons. Applying rhizobacterin plus phosphorein, nitrobein plus phosphorein and biogein plus phosphorein combined with 75 % of the recommended dose of mineral fertilizers were recommended for onion production without reducing productivity. Other benefits of these treatments include reduction the cost of chemical fertilizers, avoiding the risk of nitrate accumulation in the edible portions and the pollution of the environment.

INTRODUCTION

Onion (*Allium cepa*. L) is one of the most important vegetable crops in Egypt. For local markets and export as fresh or dried. The productivity of onion is influenced by several factors, such as NPK-fertilization.

Some investigators reported the beneficial effects of NPK fertilizers on growth and yield of onion **(Ahmad, 2004; Batal, *et al* 1994; Mazrouh and Abo-Waly, 1992; Mazrouh and Ragab, 2000 and Wiedenfeld and Braveman, 1991).** However, the continuous increase in the cost of using chemical NPK fertilizers prevents the producers to use sufficient amount of fertilizers, since the excessive use of NPK-fertilizers represents the major cost in plant production and causes pollution of the agricultural environment. In addition, using of N-fertilizer in excess levels caused significant increment in nitrate accumulation of several vegetable crops **(Brown and Smith, 1966).**

There is a great debate among scientists about the role played by the microorganisms in promoting plant growth. Some investigators stressed their contribution to N_2-fixation, P or K solubilization and cellulose decomposition, while others stressed the production of plant growth modifying substances by such bio-fertilizers. Soil microorganisms, known as phosphate solubilizing bacteria, play a fundamental role in correcting the solubility problems in different soils, by releasing the fixed form of p to

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soluble one to be ready for plant nutrition. The organisms capable of carrying out such process are known as phosphate dissolvers **(El-Sheekh, 1997).**

Microbein, nitrobein and rhizobacterin are commercial bio-fertilizers which gave the same effect of full dose of mineral nitrogen application **(Bedalwi *et al* 1997 and Tawfik, 2008).** Biogein also is a commercial bio-fertilizer which has high amount of symbiotic and non symbiotic bacteria responsible for atmospheric nitrogen fixation. Biofertilizer application enhances the resistance of plant to root disease and reduces the environmental pollution from chemical fertilizer application **(Rizk and Shafeek, 2000)**. Phosphorein partially overcomes the phosphate fixation problem in calcareous soil as found by **Han and Lee (2007)**. Applying of biofertilizers gave the positive responses for storability of onion bulbs **(El-Sheekh, 1997).** Utilization of bio-fertilizers is very successful in minimizing chemical fertilizers in different vegetable crops **(Azcon-Aguilar and Barea, 1997; Shaheen *et al* 2007 and Sorial and Abd El-Fattah, 1998).**

Therefore, the aim of this study was to investigate the effect of some commercial bio-fertilizers i.e. microbein, nitrobein, rhizobacterin, biogein, phosphorein and their combinations with different levels of NPK fertilizers on the growth, yield, quality and storability of onion bulbs.

MATERIALS AND METHODS

Two field experiments were carried out during the winter seasons of 2006/2007 and 2007/2008 at the Experimental Farm of the Faculty of Agriculture, Tanta University, Egypt to investigate the effect of some bio-fertilizers in combinations with different levels of NPK fertilizers on the growth, yield as well as quality of onion bulbs.

The experimental soil was clay loam in texture and the chemical analysis of this soil was done according to **Ryan *et al* (2003)** and the results were as follows:

pH = 7.88	HCO_3 = 5.15 meq/l
E.C. = 2.15 mmhos	Cl = 8.19 meq/l
Mg = 4.95 meq/l	N = 38.5 (mg / 100g soil)
Na = 12.8 meq/l	P = 6.9 (mg / 100g soil)
Ca = 6.45 meq/l	K = 156.1 (mg / 100g soil)

Onion seeds of the cultivar Giza 6 Mohassan were used in this experiment. Uniform onion seedlings (60 days old) were planted on 21th and 20th of November in the two growing seasons, respectively at 10 cm apart in both sides of the ridges. The plot area was 18 m^2 which contained 5 rows with 6 m in length and 60 cm in width.

The biofertilizers used in this experiment were, rhizobacterin, biogein (a nitrogenous biofertelizer containing nitrogen fixing bacteria like *Azotobacter*), microbein (a nitrogenous biofertelizer containing nitrogen fixing bacteria like *Rhizobium*), phosphorein (a phosphorus biofertelizer containing phosphate dissolvers or vesicular arbuscular mycrohizas and silicate bacteria) and nitrobein (a nitrogenous biofertelizer containing nitrogen fixing and phosphate dissolving bacteria).

Onion seedlings were inoculated at planting with rhizobacterin, nitrobein, biogein, phosphorein, microbein, and mixture of rhizobacterin plus phosphorein (1:1), mixture of nitrobein plus phosphorein (1:1) and mixture of biogein plus phosphorein (1:1). Enriching seedling roots with bio-fertilizers suspension by dissolve the bio-fertilizers in water mixing with arabic gum with dipping the roots for 3 minutes in the suspension before transplanting. Bio-fertilizers were added at 3 kg/fed according to the recommendation of Ministry of Agriculture, Egypt.

All the previous biofertilizers treatments were applied in combination with ½ or ¾ of the recommended dose of NPK mineral fertilizers. In addition, the complete dose of NPK fertilizers was applied as control.

Recommended units of mineral NPK fertilizers were 100 N, 60 P_2O_5 and 100 K_2O/fed. as recommended by Ministry of Agriculture, Egypt.

Calcium super phosphate (15.5% P_2O_5) was added during soil preparation, while ammonium sulphate (20.5% N) and potassium sulphate (48% K_2O) were divided into two equal parts applied after 4 and 8 weeks from transplanting.

The other cultural practices were done as recommended.

The treatments were arranged in a complete randomized block design with three replicates as follows:

1- 1/2 Recommended rate of NPK mineral fertilizers + Rhizobacterin
2- 1/2 Recommended rate of NPK mineral fertilizers + Nitrobein
3- 1/2 Recommended rate of NPK mineral fertilizers + Biogein
4- 1/2 Recommended rate of NPK mineral fertilizers + Phosphorein
5- 1/2 Recommended rate of NPK mineral fertilizers + Microbein

6- 1/2 Recommended rate of NPK mineral fertilizers + (Rhizobacterin + Phosphorein)
7- 1/2 Recommended rate of NPK mineral fertilizers + (Nitrobein + Phosphorein)
8- 1/2 Recommended rate of NPK mineral fertilizers + (Biogein + Phosphorein)
9- 3/4 Recommended rate of NPK mineral fertilizers + Rhizobacterin
10- 3/4 Recommended rate of NPK mineral fertilizers + Nitrobein
11- 3/4 Recommended rate of NPK mineral fertilizers + Biogein
12- 3/4 Recommended rate of NPK mineral fertilizers + Phosphorein
13- 3/4 Recommended rate of NPK mineral fertilizers + Microbein
14- 3/4 Recommended rate of NPK mineral fertilizers + (Rhizobacterin + Phosphorein)
15- 3/4 Recommended rate of NPK mineral fertilizers + (Nitrobein + Phosphorein)
16- 3/4 Recommended rate of NPK mineral fertilizers + (Biogein + Phosphorein)
17- Recommended rate of NPK mineral fertilizers was used as control.

Ninety days after transplanting 5 plants were taken randomly from each plot to measure growth parameters, i.e. plant height, number of leaves/ plant and dry weight/plant. Also, the content of NO_3-N was determined in fresh leaves. At harvest period (131 days after transplanting), all bulbs of each treatment were digged to determine the total yield. Unmarketable bulbs (double and bolters) were separated to determine culls yield percentage. The remained bulbs were weighed as marketable yield. A bulb sample (40 bulbs) from each plot was taken to determine average bulb weight, TSS using refractometer, vit. C using the method described in **A.O.A.C. (1995)**. Another bulb sample were oven dried at 70°C to measure dry matter/plant, and then the dry matter was ground and used to determine N, P and K. The content of NO_3-N was determined in fresh bulbs according to **A.O.A.C. (1995)**.

A portion of twenty kilograms of single bulbs from each treatment were stored in common burlap bags and kept under normal storage conditions (25± 2°C and 65% ± 5 RH). The percentages of weight loss, decay and sprouting were recorded.

All data were subjected to analysis of variance using MSTATC program. Means were compared using LSD test at 5 %.

RESULTS AND DISCUSSION

1- Vegetative growth

Data in **Table (1)** clearly demonstrate that applying the microbein, (rhizobacterin plus phosphorein), (nitrobein plus phosphorein), (biogein plus phosphorein) combined with ¾ of the recommended rate of NPK mineral fertilizers significantly increased plant height and dry weight per plant in both seasons. There were no significant differences between these treatments and the complete recommended dose of chemical fertilizers. The number of leaves per plant was increased as a result of using various biofertilizer treatments, however, the differences were significant only in the second season (**Table 1**).

The increment in vegetative growth characters may be due to the release of the fixed phosphorus from the soil and fixing nitrogen, hence increasing the concentrations and availability of these two elements (P and N) in the root zone. Phosphorus plays a great role in cell division and cell enlargement as well as the synthesis of nucleic acids **(Abdalla, 2002)**. Nitrogen also enhances protein synthesis, division and enlargement of cells as well as it is important for the photosynthetic processes **(Cao and Tibbitis, 1993)**. Thus, an increase in plant growth and its development was obtained. Other investigators recorded a similar trend **(Abdalla *et al* 2001** on pepper; **Abou El-Salehein *et al* 2005** on peas; **El-Awag *et al* 1993** on soybean; **El-Habbasha *et al* 2007** on faba bean; **El-Kramany *et al* 2000** on other crops; **El-Shaikh, 2005** on onion; **El-Sheekh, 1997** on onion; **El-Zelny, 2007** on bean; **Hewedy, 1999** on tomato; **Najafvand Direkvandi *et al* 2008** on tomato; **Rizk and Shafeek, 2000** on other crops and **Shaheen *et al* 2007** on onion).

2- Yield and quality of bulbs

Average bulb weight and total bulb yield were significantly increased as a result of applying different biofertilizers treatments in both seasons (**Table 2**). Otherwise, T.S.S and vitamin C were enhanced but the differences were significant only in the first season, while dry weight per bulb, single bulbs percentage and culls yield percentage (measured as double and bolter bulbs) were not affected in both seasons. Applying the rhizobacterin plus phosphorein, nitrobein plus phosphorein and biogein plus phosphorein combined with 3/4 of the recommended rate of mineral fertilizers and the

Table 1. Effect of different levels of NPK fertilizers with some bio-fertilizers on the vegetative growth of onion plants during 2006/2007 and 2007/2008 seasons

Treatments*	2006/2007 season			2007/2008 season		
	Plant height (cm)	No. of leaves/ plant	Dry wt. / Plant (g)	Plant height (cm)	No. of leaves/ plant	Dry wt. / Plant (g)
1/2 RD + Rhizobacterin	52.6	8.7	15.5	54.9	7.6	14.7
1/2 RD + Nitrobein	53.7	8.8	15.7	55.7	7.5	14.9
1/2 RD + Biogein	54.9	8.6	15.5	53.6	7.7	14.8
1/2 RD + phosphorein.	52.8	8.7	15.7	54.7	7.5	14.9
1/2 RD + Microbein	54.0	8.9	16.1	56.1	7.6	15.2
1/2 RD +Rhizo.+ Phos.	55.9	8.8	15.9	56.4	7.7	15.3
1/2 RD + Nitro. + Phos.	57.1	9.0	16.0	55.9	7.6	15.2
1/2 RD + Bio. + Phos.	58.4	8.9	16.5	56.8	7.6	15.0
3/4 RD + Rhizobacterin	57.9	8.7	16.3	57.4	7.7	15.1
3/4 RD + Nitrobein	58.3	8.7	16.2	57.1	7.9	15.4
3/4 RD + Biogein	59.7	8.9	16.6	58.3	7.8	15.7
3/4 RD + phosphorein.	61.9	9.1	16.4	61.9	8.1	15.5
3/4 RD + Microbein	65.0	9.3	16.5	65.0	8.1	16.2
3/4 RD +Rhizo.+ Phos.	68.4	9.4	17.0	65.8	8.2	16.4
3/4RD + Nitro. + Phos.	67.2	9.1	16.9	66.9	8.1	16.1
3/4 RD + Bio. + Phos.	69.7	9.3	17.5	65.9	8.3	15.7
All RD (control)	65.9	9.4	17.3	64.2	8.1	15.9
L.S.D. at 5%	5.96	N.S	0.82	3.53	0.32	0.76

*:- RD = Recommended dose of NPK mineral fertilizers, Rhizo. = Rhizobacterin, Nitro. = Nitrobein, Bio = Biogein, Phos. = phosphorein

recommended rate of mineral fertilizers gave the highest values of bulb weight, total bulb yield, T.S.S and vitamin C in both seasons.

In general, the results indicate that there were insignificant difference between the recommended rate of mineral fertilizers and 3/4 recommended rate of mineral fertilizers with all bio-fertilizers in both seasons. These results may be due to the increase of the estimated attributes in leaves. In addition, the promotion in leaf number, dry weight of plants and plant height reflected in a significant increase of the bulb yield. On the other hand, the microorganisms found in these biofertilizers acted mainly in increasing the availability of phosphorus and nitrogen, and consequently increasing their absorption by the plants. The two elements play an important role in the plant development and production. Nitrogen is present in chlorophyll molecule and a component of all proteins. Phosphorus is important for production. It is also a part of the enzyme system having a vital role in the synthesis of other compounds from carbohydrates and is considered a constituent of nuclear proteins. Similar positive responses were reported by **Abdalla, (2002); Abdalla *et al* (2001); Abou El-Salehein *et al* (2005); El-Habbasha *et al* (2007); El-Kramany and Bahr (1999); El-Shaikh, (2005); El-Sheekh, (1997); El-Zeiny, (2007); Hewedy, (1999); Najafvand Direkvandi *et al* (2008); Rizk and Shafeek (2000) and Shaheen *et al* (2007)** on different crops.

3- Chemical composition

The effect of all treatments on P and K percentage in leaves and bulbs of onion plants were insignificant in both seasons. But, N and NO_3 contents of leaves and bulbs were significantly

Table 2. Effect of different levels of NPK fertilizers with some bio-fertilizers on yield and quality of onion bulbs during 2006 /2007 and 2007/2008 seasons

Treatments*	Ave-rage Bulb wt. (g)	Dry wt. / bulb (%)	Total yield (ton/ fed.)	Single bulbs (%)	Culls (%)		T.S.S (%)	Vit. C (mg/ 100 f.wt.)
					doubles	bolters		
	2006/2007 season							
1/2 RD+Rhizobacterin	86.0	13.48	10.92	98.8	0.6	0.6	10.8	11.4
1/2 RD + Nitrobein	85.5	13.54	10.99	99.1	0.5	0.4	10.9	11.5
1/2 RD + Biogein	88.9	13.61	10.95	98.6	0.9	0.5	11.0	11.6
1/2 RD+ phosphorein.	84.7	13.46	11.29	98.9	0.6	0.5	11.0	11.5
1/2 RD+ Microbein	85.9	13.61	11.49	98.7	0.7	0.6	10.7	11.4
1/2 RD+Rhizo.+ Phos.	86.2	13.66	11.41	98.9	0.7	0.4	10.8	11.8
1/2 RD+ Nitro. + Phos.	88.1	13.71	11.36	98.8	0.6	0.5	11.0	11.6
1/2 RD+ Bio. + Phos.	89.7	13.76	11.45	99.0	0.5	0.5	10.9	11.5
3/4 RD+Rhizobacterin	98.9	13.99	11.82	99.3	0.4	0.3	10.8	11.8
3/4 RD + Nitrobein	96.9	14.00	11.89	99.4	0.3	0.3	11.0	11.6
3/4 RD + Biogein	97.5	13.95	12.00	99.5	0.3	0.2	10.9	11.7
3/4 RD+ phosphorein.	99.1	13.97	11.93	99.4	0.4	0.2	11.0	11.8
3/4 RD+ Microbein	97.7	14.09	12.19	99.4	0.3	0.3	11.5	12.4
3/4 RD+Rhizo.+ Phos	107.1	14.07	12.35	99.3	0.5	0.2	11.4	12.2
3/4RD + Nitro. + Phos.	109.7	14.02	12.42	99.5	0.3	0.2	11.6	12.5
3/4 RD + Bio. + Phos.	108.0	14.10	12.51	99.5	0.3	0.2	11.7	12.4
All RD (control)	100.3	13.91	12.05	99.6	0.2	0.2	11.5	12.0
L.S.D. at 5%	9.40	N.S	0.59	N.S	N.S	N.S	0.27	0.36
	2007/2008 season							
1/2 RD+Rhizobacterin	75.9	13.19	10.29	95.9	1.2	2.9	10.4	10.9
1/2 RD+ Nitrobein	77.3	13.29	10.61	95.5	1.3	3.2	10.5	10.6
1/2 RD + Biogein	79.1	13.25	10.48	95.8	1.2	3	10.2	10.7
1/2 RD+ phosphorein.	75.4	13.28	10.38	95.4	1.5	3.1	10.3	10.7
1/2 RD + Microbein	77.8	13.36	10.59	96.0	1.3	2.7	10.4	10.8
1/2 RD+Rhizo.+ Phos.	79.9	13.35	10.43	96.2	1.2	2.6	10.5	10.9
1/2 RD+ Nitro. + Phos.	79.6	13.30	10.52	96.1	1.3	2.6	10.7	10.7
1/2 RD + Bio. + Phos.	80.9	13.39	10.61	96.3	1.3	2.4	10.4	11.0
3/4 RD+Rhizobacterin	84.7	13.51	10.79	96.8	1	2.2	10.6	10.8
3/4 RD + Nitrobein	82.9	13.49	10.74	96.6	1.1	2.3	10.7	10.9
3/4 RD + Biogein	87.4	13.43	10.87	96.7	1.1	2.2	11.0	10.7
3/4 RD + phosphorein.	85.2	13.40	10.82	96.9	0.9	2.2	10.9	10.8
3/4 RD + Microbein	89.7	13.47	10.89	97.1	1	1.9	10.7	11.0
3/4 RD +Rhizo.+ Phos	95.4	13.53	11.15	96.8	0.9	2.3	10.8	11.4
3/4 RD +Nitro. + Phos.	94.5	13.47	11.22	97.0	1	2	11.0	11.1
3/4 RD + Bio. + Phos.	92.7	13.50	11.10	97.3	0.8	1.9	10.7	11.3
All RD (control)	90.8	13.52	11.00	97.1	0.8	2.1	10.8	11.4
L.S.D. at 5%	8.62	N.S	0.22	N.S	N.S	N.S	N.S	N.S

*:- RD = Recommended dose of NPK mineral fertilizers, Rhizo.= Rhizobacterin, Nitro. = Nitrobein, Bio = Biogein, Phos. = phosphorein

Table 3. Effect of different levels of NPK fertilizers with some bio-fertilizers on chemical composition of onion plants during 2006/2007 and 2007/2008 seasons

Treatments*	Leaves				Bulbs			
	N (%)	NO_3 (mg/kg F.W.)	P (%)	K (%)	N (%)	NO_3 (mg/kg F.W.)	P (%)	K (%)
	2006/2007 season							
1/2 RD + Rhizobacterin	2.10	825	0.26	2.74	1.39	523	0.17	1.15
1/2 RD + Nitrobein	2.13	831	0.25	2.70	1.31	517	0.18	1.18
1/2 RD + Biogein	2.17	839	0.25	2.71	1.33	509	0.17	1.17
1/2 RD + phosphorein.	2.24	851	0.26	2.65	1.38	513	0.18	1.15
1/2 RD + Microbein	2.40	849	0.25	2.69	1.45	521	0.17	1.16
1/2 RD +Rhizo.+ Phos.	2.35	832	0.27	2.67	1.43	527	0.18	1.18
1/2 RD + Nitro. + Phos.	2.39	843	0.28	2.71	1.52	534	0.16	1.19
1/2 RD + Bio. + Phos.	2.32	851	0.26	2.74	1.58	545	0.17	1.17
3/4 RD + Rhizobacterin	2.45	867	0.27	2.73	1.57	538	0.19	1.15
3/4 RD + Nitrobein	2.41	856	0.26	2.69	1.60	540	0.17	1.16
3/4 RD + Biogein	2.50	863	0.27	2.71	1.65	546	0.18	1.18
3/4 RD + phosphorein.	2.46	874	0.28	2.79	1.61	553	0.19	1.17
3/4 RD + Microbein	2.51	850	0.31	2.74	1.64	549	0.18	1.21
3/4 RD +Rhizo.+ Phos	2.54	889	0.28	2.83	1.66	566	0.20	1.20
3/4RD + Nitro. + Phos.	2.58	876	0.30	2.81	1.71	579	0.19	1.22
3/4 RD + Bio. + Phos.	2.56	900	0.29	2.89	1.69	574	0.19	1.26
All RD (control)	2.61	949	0.31	2.88	1.72	609	0.21	1.25
L.S.D. at 5%	0.15	47.0	N.S	N.S	0.13	28.0	N.S	N.S
	2007/2008 season							
1/2 RD + Rhizobacterin	1.89	544	0.19	2.57	1.46	287	0.18	1.22
1/2 RD + Nitrobein	1.86	531	0.20	2.59	1.51	294	0.16	1.24
1/2 RD + Biogein	1.92	537	0.22	2.58	1.45	300	0.20	1.25
1/2 RD + phosphorein.	1.85	545	0.19	2.65	1.48	291	0.17	1.26
1/2 RD + Microbein	1.93	521	0.20	2.64	1.55	299	0.19	1.27
1/2 RD +Rhizo.+ Phos.	1.99	539	0.21	2.63	1.64	293	0.19	1.28
1/2 RD + Nitro. + Phos.	1.90	547	0.18	2.57	1.52	285	0.18	1.24
1/2 RD + Bio. + Phos.	1.95	560	0.19	2.59	1.54	291	0.17	1.22
3/4 RD + Rhizobacterin	2.04	591	0.22	2.59	1.68	301	0.18	1.28
3/4 RD + Nitrobein	2.08	568	0.20	2.63	1.79	294	0.20	1.27
3/4 RD + Biogein	2.15	599	0.19	2.60	1.70	302	0.18	1.26
3/4 RD + phosphorein.	2.12	579	0.18	2.61	1.75	315	0.19	1.25
3/4 RD + Microbein	2.20	595	0.20	2.67	1.78	307	0.21	1.29
3/4 RD +Rhizo.+ Phos	2.17	586	0.20	2.62	1.83	305	0.19	1.27
3/4RD + Nitro. + Phos.	2.21	594	0.21	2.68	1.80	314	0.21	1.25
3/4 RD + Bio. + Phos.	2.22	600	0.24	2.72	1.81	308	0.18	1.30
All RD (control)	2.25	675	0.25	2.70	1.88	365	0.20	1.29
L.S.D. at 5%	0.17	37.5	N.S	N.S	0.18	23.0	N.S	N.S

*:- RD = Recommended dose of NPK mineral fertilizers, Rhizo. = Rhizobacterin, Nitro. = Nitrobein, Bio = Biogein, Phos. = phosphorein

Table 4. Effect of different levels of NPK fertilizers with some bio-fertilizers on storability of onion bulbs during 2006/2007 and 2007/2008 seasons

Treatments*	Weight loss (%)				Decay (%)				Rooting and sprouting (%)	
	Storage period (month)				Storage period (month)				Storage period (month)	
	2	4	6	8	2	4	6	8	6	8
	2006/2007 season									
1/2 RD + Rhizobacterin	20.4	24.6	27.5	30.3	8.3	10.0	13.5	17.1	1.37	10.61
1/2 RD + Nitrobein	20.1	24.9	27.5	30.6	8.1	10.0	13.3	17.5	1.36	10.58
1/2 RD + Biogein	20.6	24.8	27.4	30.2	7.9	9.6	13.4	17.0	1.35	10.64
1/2 RD + phosphorein.	19.9	24.6	26.7	30.1	8.0	9.8	13.4	17.2	1.35	10.59
1/2 RD + Microbein	19.3	23.7	25.9	29.2	8.2	9.8	13.1	17.1	1.32	10.46
1/2 RD +Rhizo.+ Phos.	18.6	22.9	26.4	29.1	8.3	10.2	13.4	17.0	1.29	10.38
1/2 RD + Nitro + Phos.	19.1	23.8	26.7	29.5	8.4	10.3	13.5	16.9	1.25	10.29
1/2 RD + Bio. + Phos.	18.3	22.5	25.9	28.6	8.2	10.0	12.9	16.5	1.28	10.25
3/4 RD + Rhizobacterin	17.0	21.9	23.6	25.2	8.4	10.1	13.3	16.8	1.27	10.27
3/4 RD + Nitrobein	17.3	21.8	24.1	26.8	8.5	9.9	13.0	16.7	1.25	10.15
3/4 RD + Biogein	18.6	23.1	25.3	26.9	8.0	9.6	13.4	16.2	1.22	10.21
3/4 RD + phosphorein.	17.5	21.9	23.5	25.4	8.2	10.1	12.9	16.3	1.24	10.00
3/4 RD + Microbein	16.9	20.7	22.9	24.7	8.4	10.0	13.1	16.7	1.26	10.08
3/4 RD +Rhizo.+ Phos	15.9	19.5	21.8	23.3	7.6	9.6	13.2	16.5	1.23	9.95
3/4RD + Nitro + Phos.	15.3	18.9	21.5	22.9	7.9	9.7	13.0	16.3	1.19	9.89
3/4 RD + Bio. + Phos.	16.0	19.5	21.9	22.8	7.8	9.6	13.3	16.1	1.20	10.00
All RD (control)	15.5	19.6	22.1	23.4	7.6	9.5	12.9	15.8	1.21	9.72
L.S.D. at 5%	1.20	1.30	1.64	2.4	N.S	N.S	N.S	N.S	N.S	N.S
	2007/2008 season									
1/2 RD + Rhizobacterin	25.3	27.9	30.1	32.6	9.9	12..5	14.7	18.0	2.18	12.22
1/2 RD + Nitrobein	24.8	27.4	29.7	31.6	10.0	12.4	14.8	18.4	2.19	12.28
1/2 RD + Biogein	25.6	28.3	29.9	31.5	10.2	12.5	15.4	18.0	2.24	12.21
1/2 RD + phosphorein.	25.9	28.2	30.0	31.9	10.4	12.1	15.4	8.7	2.22	12.24
1/2 RD + Microbein	24.8	26.7	29.1	30.8	10.2	12.4	15.3	18.4	2.15	12.30
1/2 RD +Rhizo.+ Phos.	23.9	26.4	28.2	30.4	9.6	11.9	14.9	17.8	2.24	12.27
1/2 RD + Nitro + Phos.	22.4	25.8	28.0	30.1	9.9	11.8	15.1	18.7	2.18	12.24
1/2 RD + Bio. + Phos.	22.8	25.7	27.8	30.1	9.8	12.2	15.6	18.6	2.23	12.21
3/4 RD + Rhizobacterin	22.4	25.1	26.8	29.0	10.0	12.1	15.4	18.7	2.21	12.15
3/4 RD + Nitrobein	21.0	24.5	26.9	29.0	10.2	11.9	15.1	18.6	2.19	12.20
3/4 RD + Biogein	21.9	24.9	26.4	27.9	9.8	11.4	14.8	18.3	2.15	12.17
3/4 RD + phosphorein.	21.5	23.8	25.9	28.1	9.6	11.8	14.9	18.2	2.14	12.10
3/4 RD + Microbein	24.7	22.9	24.7	27.0	9.9	12.3	15.0	18.3	2.17	12.09
3/4 RD +Rhizo.+ Phos	20.1	22.6	24.9	26.5	9.8	11.8	14.8	18.1	2.12	12.00
3/4RD + Nitro + Phos.	20.4	22.3	24.4	25.9	9.6	11.6	14.5	17.5	2.06	12.03
3/4 RD + Bio. + Phos.	19.4	22.1	23.9	25.8	9.4	11.9	14.3	17.0	2.00	11.97
All RD (control)	20.2	22.4	24.2	25.6	9.5	11.8	14.1	17.2	2.08	11.91
L.S.D. at 5%	1.25	1.74	1.86	2.75	N.S	N.S	N.S	N.S	N.S	N.S

*:- RD = Recommended dose of NPK mineral fertilizers, Rhizo. = Rhizobacterin, Nitro. = Nitrobein, Bio = Biogein, Phos. = phosphorein

affected by applying some bio-fertilizer treatments in both seasons. The highest values of N percentage and NO_3-N (nitrate) contents in leaves and bulbs were obtained from applying the recommended rate of mineral fertilizers (**Table 3**). Onion plants fertilized with bio-fertilizers combined with the mineral fertilizers gave the lowest values of nitrate in each of leaves or bulbs in the two growing seasons. The significant effect of bio-fertilizers may be due to the effect of different strain groups of microorganisms such as nitrogen fixers, nutrient mobilizing microorganisms which help in increasing the availability of minerals and their forms in the composted material and increase the levels of extractable NPK or Fe, Zn, Mn **(El-Kramany & Bahr, 1999 and El-Kramany *et al* 2000)**.

4- Storability (Keeping quality)

Concerning the effect of bio-fertilizer treatments on onion storability, data in **Table (4)** show that applying the rhizobacterin plus phosphorein, nitrobein plus phosphorein and biogein plus phosphorein combined with ¾ of the recommended rate of mineral fertilizers and the recommended rate of mineral fertilizers significantly decreased the bulb weight loss percentage during the storage periods, i.e. 2, 4, 6 and 8 months in both seasons. While, the effect of all treatments on the percentages of decayed and sprouting percentage were insignificant in both seasons. Similar responses in this respect were reported by **El-Sheekh, (1997)**.

CONCLUSIONS

From the previous results, it could be concluded that applying the rhizobacterin plus phosphorein, nitrobein plus phosphorein and biogein plus phosphorein combined with ¾ of the recommended rate of mineral fertilizers can be used in onion production without reducing the productivity. These biofertilizers treatments will reduce the cost of chemical fertilizer, avoid the risk of nitrate accumulation in the edible portions and decrease the pollution of the environment.

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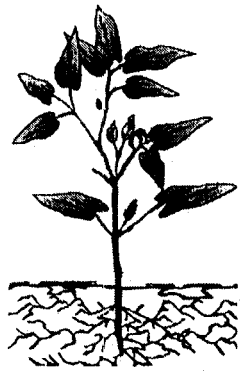

حوليـــات العلـــوم الزراعية
جامعة عين شمس ، القاهرة
مجلد(٥٤)، عدد (٢)، ٤٢٧-٤٣٦، ٢٠٠٩

تأثير بعض مستويات التسميد الحيوى والمعدنى على النمو والإنتاجية والقدرة التخزينية للبصل

[٣٣]

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الموجـــز

أجريت هـــذه الدراســـة خلال موسمين زراعيين متتالين هما ٢٠٠٦/٢٠٠٧ و٢٠٠٧/٢٠٠٨ بالمزرعة البحثية بكلية الزراعة – جامعة طنطا وأستخدم فيها صنف البصل جيزة ٦ محسن لدراسة تأثير أستخدام مستويات مختلفة من السماد المعدنى (٥٠% و ٧٥% و١٠٠% من المعدل الموصى به) مع بعض الأسمدة الحيويـــة (الريزوباكترين والنيتـــروبين والبيـــوجين والفوسفورين والميكروبين سواء منفردة أو مخلوطة) على نمو وإنتاجية والقدرة التخزينية لنباتات البصل.

وكانت أهم النتائج المتحصل عليها

أدت معاملة النباتات بالكميات الموصى بها من السمـــاد المعـــدنى وكذلك إضافة ٧٥% من السمـــاد المعدنى الموصى به مع إضافة الفوسفورين المخلوط بالريزوبكترين أو النيتروبين أو البيـــوجين أدى إلـــى الحصول على أعلى القيم لصفات طول النبات والوزن الجـــاف للنبـــات ومتوسط وزن البصلة والمحصول الكلى ومحتوى الأوراق والأبصال من النيتروجين وكذلك أعطت أقل نسبة فقد فى وزن الأبصال أثناء التخزين. كما أعطت نباتات البصل المسمدة بالأسمدة الحيوية أقل قيمة لمحتوى الأوراق والأبصال من النترات.

عموماً يمكن التوصية بتسميد نباتات البصل بنسبة ٧٥% من كمية السماد المعدنى الموصـــى بـــه مـــع إضافة الفوسفورين مخلـــوط مـــع الريزوبكتـــرين أو النيتروبين أو البيوجين وذلك للحصول علـــى نفـــس الإنتاج والجودة بالمقارنة بإســـتخدام كميـــة التـــسميد المعدنـــى الموصى به. وبالتالى يمكن تقليـــل كميـــة الأسمدة المعدنية المستخدمة بمقدار ٢٥% مما يـــؤدى إلى تقليل تكاليف التسميد وتقليل مستوى التلوث الناتج من إستخدام السماد الآزوتية وكذلك تقليل أثر تـــراكم النترات.

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