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EFFECT OF MICROBEIN (BIOFERTILIZER) AND DIFFERENT LEVELS OF NITROGEN AND PHOSPHORUS ON GROWTH AND YIELD OF POTATO PLANT (*Solanum tuberosum,* L.)

El-Banna, E.N.[*] and A.F. Tolba[**]

*** Vegetable Res. Dept., Hort. Res. Inst., Agric. Res. Center, Giza, Egypt.**

**** Integrated Control Res. Dept., Plant Pathology Res. Inst., Agric. Res. Center, Giza, Egypt**

ABSTRACT

This study was conducted in two successive summer seasons of 1998 and 1999 on potato cv. Diamant at El-Zahraa, Dakahlia Governorate, Egypt to evaluate the effect of microbein compound (biofertilizer) and four different levels of (N+P), i.e., 45 kg N + 18.75 kg P_2O_5, 90 kg N + 37.50 kg P_2O_5, 135 kg N + 56.25 kg P_2O_5, and 180 kg N + 75 kg P_2O_5/fed., as well as to the interactions on growth, tubers yield and their components of potato plant. Moreover, the concentrations of N, P, K, nitrate and nitrite in the tubers, were also determined.

Results indicated that treating seed potato tubers with microbein before planting increased the plant stand percentage at 25 and 30 DAP, vegetative growth, i.e., plant height, No. of main stems / plant, foliage fresh weight / plant (g), foliage dry weight / plant (%), total tuber yield (ton/fed.), number of tubers/plant, tuber average weight (g), tuber dry matter (%) and the concentrations of NPK in tubers, while, the concentrations of nitrate and nitrite decreased in the tuber by application of microbein during both seasons of 1998 and 1999.

Plant height, foliage fresh weigh/plant, foliage dry weight (%), total tubers yield / fed., number of tubers / plant, tuber average weight, tuber dry matter content ,%, concentrations of N, P, K, nitrate and nitrite in the tuber increased by increasing (N+P) levels in both seasons.

The interactions between microbein and (N+P) levels recorded positive effect on plant height, foliage fresh and dry weight / plant, total tubers yield, number of tubers / plant, tuber average weight, tuber dry matter conent and the tuber contents of NPK in both seasons. On the other hand, the concentrations of nitrate and nitrite were decreased in tubers during 1998 and 1999 by treating with microbein.

Generally, the results indicated that treating seed potato tubers with microbein at the rate of 10.670 kg/ton before planting in addition to (135 kg N + 56.25 kg P_2O_5)/fed. gave higher total tuber yield / fed. and lower concentration of both nitrate and nitrite in tubers as compared with the recommended dose of N and P fertilizers (180 kg N + 75 P_2O_5/fed.).

Finaly, treating seed tubers with microbein before planting would decrease the required amount of (N+P) fertilizers by 25% / fed. and consequently the total cost production/fed., in addition to reduce the pollution of environment.

INTRODUCTION

Potato (*Solanum tuberosum* L.) is considered one of the most important and popular vegetable crop in Egypt. It requires much more nutrients, particularly, N, P and K as compared with other vegetable crops.

There are many beneficial effects for using biofertilizers in agriculture such as, quick supplying of plant nutrients and increasing crop productivity, as well as reducing of the agricultural production costs and the pollution of environment.

Several researchers, *Dubetz and Bole (1975), Ashour (1979), Ibrahim et al. (1987), Kandeel et al. (1991), and Awad (1997)* reported that increasing of NPK levels led to significant increase of vegetative growth parameters, i.e. plant height, number of main stems / plant and both foliage fresh and dry weight / plant. *Ashour and Sarhan (1998), El-Hamdi and Dawa (1990), Hamil (1992) and Rabie (1996)* found that tubers yield, number of tuber / plant, dry matter content of tubers, tuber average weight and NPK content in tubers increased by increasing of NPK levels. *Hammad (1984), Fayez et al. (1985), Abdel-Ati et al. (1996) and Hammad and Abdel-Ati (1998)* reported that *Azospirillum* have not only the ability to fix nitrogen, but also to release certain phytohormones of gibberellinic and indolic nature, which could stimulate plant growth, absorption of nutrients and photosynthesis process. Using *Bacillus* as a phosphate solubilizing bacteria cause availability of soil immobilized phosphorus, which stimulate plant growth particularly during early stages of potato growth *(El-Dahtory et al., 1989 and Abdel-Ati et al., 1996).*

El-Gamal (1996) found that potato plant stand was not affected by neither N fertilizer levels nor biofertilizer, as well as by their interaction. *Abdel-Ati et al. (1996)* found that using mixture of *Azospirillium sp.* plus *Bacillus sp.* increased potato plant growth, i.e. plant height, number of branches / plant and fresh and dry matter content/ plant. Moreover, number of tubers / plant and the total tubers yield/ fed. were also increased. Similarly, *El-Gamal (1996)* and *Hammad and Abdel-Ati (1998)* reported that using biofertilizers with or without nitrogen fertilizer increased plant height, number of branches / plant, number and weight of tubers / plant, dry matter content of tubers and total tuber yield / fed., in addition to increasing of N and P content in foliage and tuber.

Nitrogenous chemical fertilizers are commonly added to the soil to produce high tuber yield. *Ashour and Sarhan (1998), Hammad and Abdel-Ati (1998) and Abd El-Naem et al. (1999)* observed that increasing of nitrogen fertilization levels led to an increase of nitrate and nitrite content in tuber.

Nitrate concentrations in vegetable crops vary enormously between 1 and 1000 mg / kg fresh weight *(MAFF, 1987*), while the concentration of nitrite is lower and usually is ranging bteween 1-2 mg/kg *(Corre and Breimer, 1979). Hammad and Abdel-Ati (1998), Abd El-Naem et al. (1999)* found that using biofertilizers for potato plants led to a reduction of both nitrate and nitrite concentrations in tuber.

Recently, application of biofertilizers is so important economically and ecologically to reduce the cost and the amount of chemical fertilizers, in addition to reduce the pollution of environment *(Verma, 1990; Abdel-Ati et al., 1996 and Abd El-Naem et al., 1999).*

This research was designed as an attempt to investigate the possible use of microbein plus different levels of (N+P) fertilizers to improve yield,

quality of tuber and to reduce both of nitrate and nitrite concentrations in potato tubers.

MATERIALS AND METHODS

This investigation was carried out during the two successive summer seasons of 1998 and 1999 at El-Zahraa, Belqas, Dakahlia Governorate. The physical and chemical analysis of the experimental soil are shown in Table (1) as follow:

Table 1: Physical and chemical characteristics of the experimental soil*.

Physical characteristics				Chemical characteristics			
Sand	Silt	Clay	Texture	pH	Available nutrients (ppm)		
(%)	(%)	(%)			N	P	K
32.60	24.15	37.90	Clay loam	7.9	49.5	33.6	352

*** according to method of Jackson (1973).**

Potato seeds cv. Diamant were sown on 16th and 12th of February, 1998 and 1999, respectively. The experimental design used was a split plots with three replicates, and the plot area was 11.25 m^2 (3 ridges each with 5 m. long and 0.75 m apart). The main plots were microbein treatments, whereas, the subplots were as follows:-

45 kg N + 18.75 kg P_2O_5/fed. as a 25% N + 25% P_2O_5 of the recommended dose.

90 kg N + 37.50 kg P_2O_5/fed. as a 50% N + 50% P_2O_5 of the recommended dose.

135 kg N + 56.25 kg P_2O_5/fed. as a 75% N + 75% P_2O_5 of the recommended dose.

180 kg N + 75 kg P_2O_5/fed. as a recommended dose.

Nitrogen in the form of ammonium nitrate (33.5% N) was added on three equal portions 3, 5 and 7 weeks from planting dates, while phosphorus as a single superphosphate (15.5% P_2O_5) was added once before planting. Potassium sulphate (48% K_2O) was added once after 7 weeks from planting date with rate of 96 K_2O/fed.

Before planting, the wet seed tubers were well mixed with microbein at rate of 10.670 kg/ton of seed tubers. The source of microbein was the General Organization Equalization Fund (GOEF), Ministry of Agriculture, Egypt. Microbein (a commercial product name of biofertilizer) is a mixture of N_2 fixing (*Azospirillum sp.* and *Azotobacter sp*) and P solubilizing bacteria (*Bacillus sp.*). Other cultural practices were applied according to the recommendation of the Ministry of Agriculture.

Plant stand (%) at 20, 35 and 30 days after planting (DAP) were recorded. At the age of 90 days, a random sample of 3 plants from each plot was taken to determine the plant height (cm), number of main stems / plant, foliage fresh weight / plant (g) and foliage dry weight (%).

The experiment was harvested at 115 DAP, then, average. of number tubers / plant, average tuber weight (g), tuber dry matter (%) and

total tubers yield (ton/fed.) were determined. The concentrations of N, P and K (%) were determined by using the methods outlined by Jackson (1973). Nitrate and nitrite concentration (ppm) were determined according to the methods described by A.O.A.C. (1980).

Data were statistically analyzed and means were compared by using L.S.D. test as described by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Data presented in Table (2) indicating that treating potato seed tubers with microbein significantly increased germination percentage at 20 and 25 DAP in the two succeive seasons, while germination percentage at 30 ADP was not significantly affected by microbein treating in both seasons. This result may be due to the role of the bacteria in releasing of auxins and gibberellin, which could stimulate potato root growth particularly during early stages of potato development (Hammad, 1984, Fayez *et al.,* 1985*,* El-Dahtory, 1989, Abdel-Ati *et al.*, 1996, and Hammad and Abdel-Ati, 1998).

Table 2. Plant stand % as affected by microbein, N and P levels and their interaction during summer seasons of 1998 and 1999.

Treatments	Plant stand (%)					
	At 25 DAP*		At 30 DAP		At 35 DAP	
	1998	1999	1998	1999	1998	1999
Microbein Treat.:						
With	75.42	73.25	85.92	84.00	91.08	90.58
Without	70.75	68.08	80.50	80.42	90.67	89.50
L.S.D. at 5%	1.83	1.55	2.96	2.09	NS	NS
N and P levels:						
25% N + 25% P	71.17	70.33	82.17	81.33	90.83	89.17
50% N + 50% P	72.17	69.83	82.33	81.83	90.83	90.17
75% N + 75% P	74.00	71.33	83.83	82.67	90.83	90.00
100% N + 100% P	75.00	71.17	84.50	83.00	91.00	90.83
L.S.D. at 5%	NS	NS	NS	NS	NS	NS
Interaction treat.:						
With Microbein:						
25% N + 25% P	73.67	73.00	85.67	83.67	91.00	90.00
50% N + 50% P	74.00	72.33	84.67	83.67	90.33	90.33
75% N + 75% P	76.00	74.33	86.33	84.67	91.33	90.33
100% N + 100% P	78.00	73.33	87.00	84.00	91.67	91.33
Without Microbein:						
25% N + 25% P	68.67	67.67	78.00	79.00	90.67	88.33
50% N + 50% P	70.33	67.33	80.33	80.00	91.33	90.00
75% N + 75% P	72.00	68.33	81.33	80.67	90.33	89.67
100% N + 100% P	72.00	69.00	82.00	82.00	90.33	90.00
L.S.D. at 5%	NS	NS	NS	NS	NS	NS

*** DAP = days after planting.**

On the other hand, the plant stand percentages at 20, 25 and 30 DAP were not significantly affected by neither (N+P) levels nor their interaction with microbein. Similar results were reported by El-Gamal (1996).

Data in Table (3) show that application of microbein gave a significant increase in the vegetative growth parameters, i.e. plant height, number of main stems / plant, foliage fresh weight / plant and foliage dry weight, %. These results are in agreement with both obtained by Abdel-Ati *et al.* (1996), who found that treating potato plants with mixture of *Azospirillum* plus *Bacillus* led to an increase in the vegetative growth parameters of potato plants.

Concerning the effect of (N+P) levels, plant height and both of fresh and dry weight / plant were significantly increased with increasing of (N+P) levels, while, number of main stems / plant was not significantly affected in the two seasons. Similar results were reported by Dubetz and Bole (1975), Ashour (1979), Ibrahim *et al.* (1987), Kandeel *et al.* (1991) and Awad (1997).

Data in Table (3) also reveal that the interactions between treatments had significant effects on all parameters of vegetative growth, except the number of main stems / plant in both seasons. These results are in agreement with those obtained *by El-Gamal (1996) and Hammad and Abdel-Ati (1998).*

Table 3: Vegetative growth as affected by microbein, N and P levels and their interaction during summer seasons of 1998 and 1999.

Characters / Treatments	Vegetative growth							
	Plant Height (cm)		No. of main stems / plant		Foliage fresh weight / plant (gm)		Foliage Dry weight / plant (%)	
	1998	1999	1998	1999	1998	1999	1998	1999
Microbein Treat.:								
With	43.33	41.25	2.92	2.98	375.7	326.7	14.13	13.74
Without	40.56	40.29	2.54	2.74	331.9	297.0	13.82	12.72
L.S.D. at 5%	0.77	0.59	0.27	0.20	22.18	13.42	0.007	0.38
N and P levels:								
25% N + 25% P	37.49	37.67	2.45	2.57	246.7	261.2	13.73	12.98
50% N + 50% P	40.94	39.58	2.67	2.82	356.7	302.2	14.00	13.14
75% N + 75% P	44.58	43.08	2.88	2.98	397.2	333.2	14.08	13.34
100% N + 100% P	44.78	42.75	2.92	3.08	415.1	350.8	14.08	13.44
L.S.D. at 5%	1.85	1.92	NS	NS	32.7	17.6	0.12	0.27
Interaction treat.:								
With Microbein:								
25% N + 25% P	38.55	38.33	2.50	2.63	277.8	272.7	13.97	13.50
50% N + 50% P	42.67	40.17	2.83	3.00	386.7	316.3	14.10	13.60
75% N + 75% P	46.22	43.67	3.17	3.13	416.7	364.3	14.20	13.85
100% N + 100% P	45.89	42.83	3.17	3.17	422.2	353.3	14.25	14.00
Without Microbein:								
25% N + 25% P	36.43	37.00	2.40	2.50	215.6	249.7	13.50	12.47
50% N + 50% P	39.22	39.00	2.50	2.63	326.7	288.0	13.90	12.68
75% N + 75% P	42.93	42.50	2.60	2.83	377.7	302.0	13.97	12.83
100% N + 100% P	43.67	42.67	2.67	3.00	407.9	348.3	13.92	12.88
L.S.D. at 5%	2.62	2.72	NS	NS	46.3	24.8	0.31	0.39

Data in Table (4) indicate clearly that treating potato seed tubers with microbein led to significant increase in total tuber yield, number of tubers / plant, tuber average weight and tuber dry matter in both seasons. The percentage of increment in total tuber yield / fed. due to microbein application were 27.44 and 24.07% in the two seasons, respectively. These results are in accordance with those obtained by Abdel-Ati *et al.* (1996), El-

Gamal (1996) and Hammad and Abdel-Ati (1998), they reported that treating potato tubers with bacteria or biofertilizer stimulated plant roots, absorption of nutrients and photosynthesis process which led to produce vigorous plants, numerous tubers, bigger tuber size, and total tuber yield.

Table 4: Total tuber yield and its components as affected by microbein, N and P levels and their interaction during summer seasons of 1998 and 1999 seasons.

Characters / Treatments	Yield and its components							
	Total tuber Yield (ton/fed.)		No. of tubers / plant		Tuber average weight (gm)		Tuber dry matter (%)	
	1998	1999	1998	1999	1998	1999	1998	1999
Microbein Treat:								
With	11.61	11.10	6.78	6.56	89.16	90.15	22.69	22.24
Without	9.11	8.89	5.88	5.87	90.81	78.97	20.83	20.86
L.S.D. at 5%	0.43	0.24	0.25	0.37	5.49	4.06	1.70	0.85
N and P levels:								
25% N + 25% P	6.85	6.80	5.43	4.93	74.73	74.45	21.11	20.99
50% N + 50% P	9.29	9.23	5.98	5.72	84.02	84.45	21.85	21.26
75% N + 75% P	11.92	11.42	6.70	6.92	89.43	87.90	22.00	21.62
100% N+ 100% P	13.37	12.83	7.18	7.28	91.75	91.44	22.10	22.33
L.S.D. at 5%	0.65	0.27	0.38	0.30	4.47	3.12	0.89	0.97
Interaction treat:								
With Microbein:								
25% N + 25% P	7.72	7.26	5.77	5.00	76.23	78.67	21.70	21.48
50% N + 50% P	10.89	10.81	6.57	6.33	89.71	91.80	22.87	21.77
75% N + 75% P	13.94	13.28	7.30	7.33	95.73	93.97	23.13	22.57
100% N+ 100% P	13.89	13.06	7.47	7.57	94.97	96.08	23.07	23.13
Without Microbein:								
25% N + 25% P	5.98	6.34	5.10	4.87	73.23	70.13	20.52	20.50
50% N + 50% P	7.69	7.65	5.40	5.10	78.33	77.10	20.83	20.75
75% N + 75% P	9.91	9.56	6.10	6.50	83.13	81.83	20.87	20.67
100% N+ 100% P	12.85	12.00	6.90	7.00	88.53	86.80	21.13	21.53
L.S.D. at 5%	0.92	0.39	0.53	0.43	6.32	4.42	1.26	1.37

Data in the same Table (4) also reveal that total tuber yield, number of tubers / plant, tuber average weight and tuber dry matter were increased by increasing of (N+P) levels in both seasons. Similar results were obtained by Ashour (1979), El-Hamdy and Dawa (1990), Hamail (1992) and Rabie (1996).

The interactions between microbein with (N+P) levels had significant effect on tuber yield / fed., number of tubers / plant, tuber average weight and tuber dry matter (%) in the two seasons. Data showed that treating potato seed tubers with microbein plus (75% N + 75% P/fed.) increased total tuber yield / fed. by 8.48 and 10.67% over the recommended level (100% N+P/fed.) in both seasons, respectively. These results are in agreement with those obtained by El-Gamal (1996) and Hammad and Abdel-Ati (1998).

Data in Table (5) show that application of microbein caused a significant increase in the percentage of N, P and K contents in tuber in both seasons. This increase may be due to the favourable effect of microbein as a biofertilizer on the roots in absorbing various nutrients. These results are in

agreement with those obtained by Abdel-Ati (1996), El-Gamal (1996) and Hammad and Abdel-Ati (1998).

With respect to the effect of (N+P) levels, data in the same Table (5) indicate that N, P and K percentage in potato tubers increased significantly with increasing (N+P) levels in the two seasons. Similar results were obtained by Ashour (1979), El-Hamdi and Dawa (1990), Hamail (1992) and Rabie (1996).

The interactions between microbein and (N+P) levels had also significant effects on the percentage of N, P and K in tubers in both seasons. These results are in agreement with those obtained by El-Gamal (1996) and Hammad and Abdel-Ati (1998).

Nitrate ion is a well known environmental pollutant because of its potential role in infant methemoglobinencia associated with consumption of nitrate-rich water or vegetables, in the meantime, nitrite may cause direct toxicity by the formation of carcinogenic N-nitrose compound by the reaction with amino compounds (Hill, 1991).

Results in Table (5) also indicate that application of microbein gave a significant decrease in the concentration of nitrate and nitrite in both seasons. Similar results were mentioned by Hammad and Abdel-Ati (1998) and Abdel-Naem *et al* (1999).

Concerning the effect of (N+P) levels, data in Table (5) also reveal that nitrate and nitrite concentration in tubers were significantly increased by increasing of (N+P) levels, the same trend was also reported with or without microbein application in both seasons. This result may be due to close correlation between application of N-fertilizer and accumulation of nitrate. These results are in agreement with those indicated by Ashour and Sarhan (1998), Hammad and Abdel-Ati (1998) and Abdel-Naem *et al.* (1999).

Conclusion and recommendation:

This investigation indicate that treating seed tubers with microbein with rate of 10.670 kg/ton before planting, in addition to (135 kg N + 56.25 kg P_2O_5 + 96 K_2O) / fed. gave higher tuber yield and lower concentration of both nitrate and nitrite in tuber than the recommended rate.

Moreover, the application of microbein will save about 25% of the rquired amounts of nitrogenous and phosphorus fertilizers / fed. particularly in the loam soil and will also reduce the pollution of environment.

REFERENCES

Abdel-Ati, Y.Y.; A.M.M. Hammad, and M.Z.H. Ali (1996). Nitrogen fixing and phosphate solubilizing bacteria as biofertilizers for potato plants under Minia conditions. 1st Egyptian Hung. Hort. Conf., Kafr El-Sheikh, Egypt, 15-17 Sept.

Abdel-Naem, G.F.; H.A. Ismail; A.M. Zaki and E.A. El-Moursi (1999). Effect of fertilization on chemical constituents, nitrates, nitrites, ascorbic acid and some antinutritional factor levels in potato tubers (*Solanum tuberosum* L.). J. Agric. Sci. Mansoura Univ., 24(2):873-889.

A.O.A.C. (1980). Official Method of Analysis. 13th Ed. Association of Official Agricultural Chemists. Washington, D.C.

Ashour, S.A. (1979). The effect of different levels of fertilization on potato (*Solanum tuberosum* L.). M.Sc. Thesis, Fac. of Agric., Mansoura Univ.

Ashour, S.A. and S.H. Sarhan (1998). Effect of organic and inorganic fertilizers on growth, yield and tuber quality of potato (*Solanum tuberosum* L.). J. Agric. Sci. Mansoura Univ., 23(7):3359-3368.

Awad, E.M. (1997). Studies on potato nutrition (*Solanum tuberosum* L.). Ph.D. Thesis, Fac. of Agric., Mansoura Univ., Egypt.

Corre, W.J. and T. Breimer (1979). Nitrate and nitrite in vegetables. Literature Survey No. 39. Center for Agricultural Publishing and Documentation, Wageningen, The Netherlands, 85 pp.

Dubetz, S. and Bole, J.B. (1975). Effect of nitrogen, phosphorus, and potassium fertilizers on yield components and specific gravity of potato. Amer. Potato J., 52:339-346.

El-Dahtory, Th. M.; Abdel-Nasser, M.; Abdallah, A.R. and El-Mohandes, M.A. (1989). Studies on phosphate solublizing bacteria under different soil amendments. Minia J. Agric. Res. & Dev., 11(2):935-950.

El-Gamal, A.M.M. (1996). Response of potato in the newly reclaimed areas to mineral nitrogen fertilizer levels and nitrogen fixing biofertilizer Halex 2. Assuit J. Agric. Sci., 27(2):89-99.

El-Hamdi, Kh. H. and K.K. Dawa (1990). Yield, quality and nutrient contents of potatoes (*Solanum tuberosum* L.) as influenced by fertilization. Egypt. J. Appl. Sci., 5(5):168-178.

Fayez, M.; Emam, Nadia, F. and Makboul, H.E. (1985). The possible use of nitrogen fixing *Azospirillum* as biofertilizer for wheat plants. Egypt. J. Microbiol., 20(2):199-206.

Gomez, K.A. and Gomez, A.A. (1984). Statistical Procedures for Agricultural Research. 2nd Ed. John Wiely & Sons, New York.

Hamail, A.F. (1992). Effect of nitrogen, phosphorus and potassium on growth tuber yield and quality of potato (*Solanum tuberosum* L.). J. Agric. Sci. Mansoura Univ., 17(6):2284-2290.

Hammad, A.M.M. (1984). Microbiological studies on salt affected soil. M.Sc. Thesis, Fac. of Agric., Minia Univ., Egypt.

Hammad, A.M.M. and Y.Y. Abdel-Ati (1998). Reducing of nitrate content of potato tubers via biofertilization with *Azospirillum* and Va-Mycorrhizal fungi. J. Agric. Sci. Mansoura Univ., 23(6):2597-2610.

Hill, M.J. (1991). “Nitrates and Nitrites in Foods and Water”. Published by Ells Horwood Limited Chichester, West Sussex, PO 19 IE B, England.

Ibrahim, S.A.; A.I. El-Zawily and E.A. Zayed (1987). Effect of NPK level and ratio on growth, yield and chemical composition of potato plants grown in sandy loam soil. Egypt. J. Soil Sci., 27(2):131-144.

Jackson, M.L. (1973). “Soil Chemical Analysis”. Prentice-Hall of India Private Limited, New Delhi.

Kandeel, N.M.; H.A. Hussein and M.A. Farghaly (1991). Effect of different NPK application on growth, yield and quality of two potato cutlivars. Assuit J. Agric. Sci., 22(5):131-142.

MAFF (1987). Nitrate, nitrite and N-nitrose compounds in foods. 20th Report of the Steering Group on Food Surveillance Paper No., 20, HMSO, London.

Rabie, A.R. (1996). Effect of some potato cultural practices on potato production for processing. M.Sc. Thesis, Fac. of Agric., Ain Shams Univ., Cairo.

Verma, L.N. (1990). Role of biotechnology in supplying plant nutrients in the nineties. Fertilizer News, 35:87-97.

تأثير سماد الميكروين الحيوى مع مستويات مختلفة من النتيروجين والفسفور على نمو محصول نبات البطاطس

السيد نادر البنا * عبد الرحمن فرحات طلبه**

*** قسم بحوث البطاطس وللخضر خضرية التكاثر، معهد بحوث البساتين ، مركز البحوث الزراعية الجيزة-مصر.**

**** قسم بحوث المكافحة المتكاملة، معهد بحوث أمراض النبات، مركز البحوث الزراعية الجيزة-مصر.**

أجريت هذه التجربة فى موسمين صيفيين متتاليين 1998، 1999 على نبات البطاطس صنف الديامونت بالزهراء- بلقاس – محافظة الدقهلية لتقيم تأثير مركب الميكروبين الحيوى مع أربعة مستويات سمادية مختلفة من (ن+ فو) هى كالتالى:- 45كم ن+ 75ر18 كجم فو2 أ5، 90 كجم ن + 5ر37كجم فو2 أ5 ، 135، كجم ن + 25ر56 كجم فو2 أ5 ، 180 كجم ن+ 75 فو2 أ5 / للفدان كذالك تفاعلات هذه المستويات السمادية مع الميكروبين وتأثيراتها على النمو الخضرى، محصول الدرنات ومكوناته.للاضافة إلى تقدير تركيزات ن، فو، بو، النيترات والنيتريت بالدرنة.

أوضحت النتائج أن معاملة تقاوى البطاطس بالميكروبين قبل الزراعة قد أدت إلى زيادة نسبة ظهور النبات فى الحقل عند 25، 30 يوم بعد الزراعة، ارتفاع النبات، عدد الأفرع الرئيسية للنبات، الوزن الأخضر للنبات، نسبة المادة الجافة للنبات (%)، محصول الدرنات الكلى (طن/فدان)، عدد الدرنات للنبات، متوسط وزن الدرنه، نسبة المادة الجافة بالدرنة (%)، وتركيز ن، فو، بو، بالدرنة، بينما أدت المعاملة بالميكروبين إلى تقليل تركيز النترات والنتيريت خلال 98/ 1999.

أدت الزيادة فى مستويات (ن+ فو) فى كلا الموسمين إلى زيادة إرتفاع النبات، الوزن الاخضر للنبات، نسبة المادة الجافة للنبات (%)، محصول الدرنات الكلى/ فدان، عدد الدرنات للنبات، متوسط وزن الدرنة، محتوى المادة الجافة فى الدرنة وتركيزات ن، فو، بو والنتيرات والنتيريت فى الورقة وقد أعطى التفاعل بين المكروبين مع المستويات المختلفة من (ن + فو) تأثيرا موجبا على إرتفاع النبات، وزن المجموع الخضرى للنبات، نسبة الوزن الجاف للنبات (%)، محصول الدرنات الكلى، عدد الدرنات للنبات، متوسط وزن الدرنة، محتوى المادة الجافة بالدرنه، محتويات الوزن من ،، فو، [و فى كلا الموسمين. ومن ناحية أخرى قفد تناقصت تركيزات النيترات والنتيريت فى الدرنات باستخدام الميكروبين خلال موسمى الزراعة 1999،1998.

بصفة عامه أوضحت النتائج أن معاملة تقاوى البطاطس بالمكروبين بمعدل 670ر10كجم / طن تقاوى قبل الزراعة بالإضافة إلى التسميد بـ (135 كجم ن + 25ر56 كجم فو2 أ5). قد أعطت محصولا عاليا من الدرنات للفدان مع أقل تركيز لكل من النيترات والنتيريت فى الدرنات مقارنة بالتسميد المعد نى الموصى به من النتيروجين والفوسفور (180 كجم ن + 75 كجم فو2 أ5).

أخيرا، فإن معاملة تقاوى البطاطس بالميكروبين قبل الزراعة قد أدت إلى تقليل كمية الاسمدة الأزوتية والفوسفاتية بمعدل 25% وبالتالى تقليل تكاليف الإنتاج للفدان بالإضافة إلى تقليل تلوث البيئة.

Table 5: N, P, K, nitrate and nitrite contents in potato tuber as affected by microbein, N and P levels and their interaction during summer seasons of 1998 and 1999.

Characters / Treatments	N%		P%		K%		Nitrate (ppm)		Nitrite (ppm)	
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
Microbein Treat:										
With	2.824	2.842	0.470	0.445	2.350	2.020	179.64	181.33	0.797	0.800
Without	2.325	2.419	0.300	0.315	2.130	1.825	183.06	187.80	0.845	0.852
L.S.D. at 5%	0.056	0.164	0.014	0.019	0.041	0.111	3.19	2.19	0.042	0.043
N and P levels:										
%25 N + 25% P	2.030	2.150	0.310	0.325	1.980	1.770	163.07	164.05	0.630	0.660
%50 N + 50% P	2.445	2.430	0.370	0.340	2.140	1.860	173.80	172.70	0.755	0.727
%75 N + 75% P	2.770	2.815	0.400	0.400	2.350	2.000	186.40	199.00	0.872	0.895
%100 N+ 100% P	3.053	3.128	0.460	0.455	2.400	2.060	202.13	202.50	1.028	1.023
L.S.D. at 5%	0.253	0.223	0.068	0.054	0.094	0.140	9.705	9.74	0.057	0.065
Interaction treat:										
With Microbein:										
%25 N + 25% P	2.250	2.380	0.400	0.420	2.020	1.880	160.40	157.80	0.620	0.650
%50 N + 50% P	2.740	2.600	0.470	0.420	2.300	1.960	175.00	170.00	0.730	0.693
%75 N + 75% P	3.080	3.180	0.500	0.460	2.420	2.080	182.30	196.50	0.820	0.830
%100 N+ 100% P	3.227	3.310	0.510	0.480	2.480	2.160	200.87	201.00	1.020	1.027
Without Microbein:										
%25 N %25 + P	1.810	1.920	0.220	0.230	1.940	1.660	165.73	170.30	0.640	0.670
%50 N + 50% P	2.150	2.260	0.270	0.260	1.980	1.760	172.60	175.40	0.780	0.760
%75 N + 75% P	2.460	2.450	0.300	0.340	2.280	1.920	190.50	201.50	0.923	0.960
%100 N+ 100% P	2.880	3.047	0.410	0.430	2.320	1.960	203.40	204.00	1.037	1.020
L.S.D. at 5%	0.358	0.315	0.096	0.076	0.133	0.198	13.59	13.77	0.081	0.092