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EFFECT OF SOME SOURCES OF ORGANIC MANURES AND FOLIAR SPRAY WITH SOME MICRO-NUTRIENTS ON PRODUCTIVITY AND QUALITY OF POTATO CROP (*Solanum tuberosum*, L.)

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ABSTRACT

two field experiments were carried out during two fall seasons of 2004/2005 and 2005/2006 on potato (variety Spunta) at Kafr Meet Faris village, Mansoura, Dakahlia Governorate to study application effect of some organic manure sources and foliar spraying with mixture of micro-nutrients (Fe, Zn and Mn) in addition to their interaction on vegetative growth characters, yield and its components, as well as tubers quality and some chemical concentrations in tubers.

Results indicated that plant length (cm), number of main stems/plant, number of leaves/plant, foliage fresh weight/plant (gm), number of tubers /plant, tuber weight average (gm) and total tubers yield (tons/fed), as well as contents of N, P and K (%) in tuber were significantly increased in both seasons by using the chicken manure at rate of (10 m^3/fed). On the other hand dry weight of tuber (%) was affected significantly in the two study seasons by using (50% of cattle manure + 50% of chicken manure). Micro-nutrients concentration of Fe ,Zn and Mn (ppm) in tuber increased significantly by using cattle manure at rate of (20 m^3/fed) , while, foliage dry weight/plant (gm) and T.S.S. of tuber were not affected by the different organic manures.

Application of foliar spraying three times by mixture of chelated micro-nutrients Fe, Zn and Mn (1:1:1) at concentration of (150 ppm) led to significant increases of the plant length, number of main stems/plant, number of leaves/plant, foliage fresh weight/plant, foliage dry weight/plant, total tubers yield, number of tubers/plant, tuber weight average, percentage dry weight of tuber, T.S.S. and the tuber concentration of N, P, K (%), Fe, Zn and Mn (ppm) in both seasons .

The interaction between organic manures and foliar spraying by mixture of micro-nutrients indicated that the vegetative growth characters, total tubers yield , number of tubers/plant, tuber weight average, percentage dry weight of tuber and T.S.S. of tuber were significantly affected by using the chicken manure at rate of (10 m^3/fed) together with foliar spraying three times by mixture of chelated micro-nutrients Fe, Zn and Mn (1:1:1) at concentration of (150 ppm) during the two fall seasons.

INTRODUCTION

Potato (Solanum tuberosum, L.) is among the most important world food crop. Potato is exceeded only by wheat, rice, and maize in world production. Using organic manures to the soil improve the soil structure and its biological activity, in addition to the positive effect on the environment and public health. Application of organic manures contribute to plant growth through its effect on physical, chemical and biological properties of the soil as well as through its effect as source of essential nutrients (El-Nagar, 1996).

Mathers and Goss (1979) reported that applying of chicken manure increased the supply of P and K to the soil by 100% also improved the soil fertility and 90% of N becomes available in the 1 st season. Abou-Hussein (1995) declared that using cattle manure (30 m^3/fed) combined with chicken manure (10 m^3/fed) increased the vegetative growth parameters and gave the highest yield of potato. Kolbe et al (1995) found that the continued organic fertilizer application led to 10 – 20 % higher tuber yield, dry matter, starch, N, P and K compared to mineral fertilization. Saleh and Abd El-Fattah (1997) indicated that chicken manure and compost increased percentage of N, P and K in sorghum leaves. Abdel-Ati (1998) reported that the high rates of chicken manure (15m^3) increased tuber weight, tuber size and Potato yield as well as the contents of N, P and K percentage. Arisha and Bardisi (1999); found that plant height, NPK contents in foliage and tuber, number and weight of tubers/plant and the total tubers yield/fed, as well as the tuber dry matter content were significantly increased with increasing FYM. Abou-Hussein et al (2002) found that applying of chicken manure with compost and biofertilizer gave the highest value of vegetative growth characters. In another study, Abou- Hussein et al (2002) reported that applying of compost with chicken manure increased the dry matter content, total carbohydrates and total yield / plant. Abou-Hussein et al (2003) indicated that applying of cattle manure mixed with chicken manure increased tuber dry matter, total carbohydrates, specific gratify and potato tuber yield.

Mengel, (1972) reported that the availability of most micro-nutrients declines rapidly as soil pH rises above 7 although micro-nutrients are used in very small quantities, they are just important as the macro-nutrients.

Obukhov et al (1985) reported that organic manure increased the content of Fe in potato tuber. Shehata et al (1990) indicated that treating potato plants with the mixture of micronutrients (Fe+Zn +Nn) increased number of stems, fresh and dry weight of plant foliage, number of tubers and tuber yield. Srikumar and Okerman (1990) found that Fe and Zn concentrations in tuber were higher with organic manure application than inorganic NPK fertilizer. Abdel-Razik and Gaber (1994) indicated that foliar spray of Zinc increased significantly the total tubers yield, tuber dry matter and tuber content of Zinc and protein. Abo-Sedera and Shehata (1994) revealed that spraying potato plants with Mn at 100 ppm was most effective on the vegetative growth rate, tuber dry matter, specific gratify and starch in tubers. Spray of micro-element solution (B,Cu,Mn,Zn and Mo) on potato leaves increased the uptake of N, P , K , content of chlorophyll and photosynthesis in leaves, promote the expansion of tuber and increase potato yield (Meng et al . 2004).

The present study was carried out to indicate the response of potato plants in clay loamy soil to some organic manure sources i.e. cattle manure, chicken manure and their mixture as well as the use of foliar spraying by mixture of chelated micro-elements (Fe, Zn and Mn) and their interactions on vegetative growth, quality and potato productivity.

MATERIALS AND METHODS

Two field experiments were carried out in vegetable private farm at Kafr Meet Faris, Dakahlia Governorate, during two Fall seasons of 2004/ 2005and 2005/2006, to study the effect of some organic manure sources and micro-nutrients (Fe, Zn and Mn) on potato (var. Spunta) growth, yield and its components, as well as tuber quality and chemical concentrations in tuber. The soil of the experimental field texture was clayey loamy with pH 7.9, available N, P and K contents were (21.6 - 25.3), (15.6 - 17.9) and (290 – 310) ppm during the first and second seasons, respectively. The organic manures are used as shown in table (1)

Table (1): Analysis of organic manures used in the experiment soil.

Organic manure analysis	Microelements (%)			Microelements (ppm)		
	N	P	K	Fe	Zn	Mn
Cattle manure	1.580	0.553	1.625	346	210	185
Chicken manure	2.965	1.180	2.482	187	168	146

According to methods of (Jackson, 1973).

The experimental design used was split plots with three replicates. Potato seeds were planted on 20th and 15th of October in the first and the second fall seasons, respectively. Organic manures occupied the main plots which were sub-divided to 4 sub plots each contained one of the micro-nutrients levels. The plot area was $15m^2$ (4 ridges each with 5m. long and 0.75 m apart). Each experiment included 16 treatments which were 4 sources of organic manure and 4 levels of micro-nutrients as follows

a-Organic manures:

1- Control treatment (untreated).
2- Cattle manure (20 m^3/fed).
3- Chicken manure (10 m^3/fed).
4- Mixture at rate of 50% from cattle manure and chicken manure.

b- Micro-nutrients:

The mixture of chelated Fe, Zn and Mn (1:1:1) was supplied as a foliar application in three concentrations (50, 100 and 150 ppm) at 45, 60 and 75 days after planting (DAP) in the rate of 400 L/fed. The control treatment was sprayed with tap water.

All the treatments were fertilized with the recommendation rates of NPK, 180 kg N/fed (ammonium nitrate, 33.5% N) and was added at three equal doses after 3, 5 and 7 weeks from planting, 75 kg P_2O_5/fed (Super phosphate 15.5%) was added once before planting and 96 kg potassium sulphate (48% K_2O) was added once after 7 weeks from planting date. The other cultural practices were applied according to recommendation of the Ministry of Agriculture, Egypt.

Data recorded:

1- Growth parameters:

A random sample of four potato plants were taken from each plot after 90 DAP to estimate the plant stem length (cm), number of main stems/plant, number of leaves/plant, foliage fresh weight/plant (gm) and foliage dry weight/plant(gm) .

2- Yield and its components:

At harvest time, yield of each plot weighted in kg and converted to total yield (tons/fed), number of tubers/plant, average of tuber weight (gm) and total soluble solids (T.S.S) of tuber were recorded, as well as dry weight of tuber (%) and starch content in tuber (%)were determined according to the methods which described by (AOAC, 1990) .

3- Macro and micro-nutrients content in tuber:

Nitrogen, phosphor, potassium, iron, zinc and manganese concentrations were determined after harvest in the digested dry matter of tubers according to Rangana methods (1979).

Data were subjected to the statistical analysis and means were compared using new L.S.D according to (Gomez and Gomez 1984).

RESULTS AND DISCUSSIONS

1- Vegetative growth characters:

Data in Table (2) show that stem length, number of main stems/plant, number of leaves/plant and foliage fresh weight/plant were significantly increased in both seasons by using the chicken manure at rate of (10 m^3/fed), while the foliage dry weight/plant was not affected by the different sources of organic manures. This result may be due to the higher contents of microelements (NPK) in chicken manure and this led to an increase of the metabolism activity and consequently increasing of plant growth.

The results in Table (2) indicate that the vegetative growth characters of potato plants were significantly increased in the two growing seasons with foliar spraying by mixture of chelated micro-nutrients Fe, Zn and Mn (150 ppm).

In the same table, the interaction results indicated that the vegetative growth characters i.e. stem length, number of main stems/plant, number of leaves/plant and foliage fresh weight/plant were significantly affected by using the chicken manure with foliar spraying three times by mixture of chelated micronutrients Fe, Zn and Mn(1:1:1) at concentration of(150 ppm) whereas, the foliage dry weight/plant was not affected with different treatments during the seasons of study.

These results are in agreement with those reported by Mathers and Goss (1979); Shehata et al (1990); Abo-Sedera and Shehata (1994); Abou-Hussein (1995); El-Nagar, 1996; Arisha and Bardisi, 1999; Abou-Hussein et al (2002).

Table (2): Vegetative growth characters of potato plants at 90 DAP as affected by organic manures, micronutrients and their interactions during fall seasons of 2004/2005 and 2005/2006

Characters / Treatments		Stem length (cm)		Number of main stems/ plant		Number of leaves/plant		Foliage fresh weight/plant (gm)		Foliage dry weight/plant (gm)	
		*S1	*S2	S1	S2	S1	S2	S1	S2	S1	S2
Organic manures											
Control		37.26	33.87	2.7	2.7	17.8	18.9	296.30	323.62	19.57	21.20
Cattle manure 1		39.48	35.25	3.2	3.3	19.2	20.3	313.34	334.42	19.81	21.38
Chicken manure 2		42.87	37.35	3.5	3.4	19.8	21.1	320.26	342.99	19.98	21.73
50% of 1 + 50% of 2		41.47	36.07	3.2	3.4	19.4	20.7	316.43	338.64	19.77	21.51
LSD at 5%		0.22	0.42	0.3	0.4	01.0	0.4	14.40	3.25	N.S	N.S
Micro-nutrients concentr.											
Control		33.43	32.08	2.8	2.8	16.8	18.2	293.51	316.54	18.85	20.33
50 ppm		39.66	34.60	3.1	3.1	18.6	19.8	309.06	330.03	19.50	21.14
100 ppm		43.26	37.36	3.3	3.3	20.1	21.2	316.51	344.18	20.34	22.04
150ppm		44.74	38.52	3.5	3.6	20.8	21.8	327.06	348.94	20.45	22.31
LSD at 5%		0.60	0.59	0.4	0.4	0.7	0.8	12.02	4.02	0.21	0.12
Interactions:											
O.M.	Micro. concentr.										
Control	Control	30.20	30.60	2.4	2.2	15.5	16.6	280.64	304.83	18.54	20.11
	50 ppm	36.10	32.70	2.7	2.6	16.5	18.4	302.15	319.74	19.00	20.91
	100 ppm	39.80	35.13	2.9	2.6	19.3	20.3	286.99	330.41	20.05	21.71
	150ppm	42.93	37.07	3.0	3.3	20.0	20.5	315.42	339.53	20.40	22.08
Cattle manure 1	Control	31.53	31.90	2.8	3.0	16.9	18.1	293.21	316.70	18.85	20.31
	50 ppm	38.40	34.20	3.3	3.3	18.9	19.9	306.61	329.21	19.49	21.05
	100 ppm	43.50	36.90	3.3	3.5	20.1	21.1	322.22	342.50	20.37	21.92
	150ppm	44.50	38.00	3.4	3.6	20.9	22.0	330.52	349.30	20.55	22.26
Chicken manure 2	Control	36.90	33.30	3.1	3.1	17.6	19.2	301.80	323.80	19.05	20.52
	50 ppm	43.13	36.40	3.3	3.3	19.9	20.7	317.34	338.17	19.56	21.39
	100 ppm	45.27	39.70	3.7	3.6	20.7	21.9	330.62	354.90	20.48	22.46
	150ppm	46.20	40.00	3.9	3.7	21.1	22.4	331.30	355.11	20.65	22.58
50% of each (1+ 2)	Control	35.10	32.50	2.9	3.0	17.1	18.9	298.41	320.85	18.96	20.38
	50 ppm	41.00	35.10	3.0	3.3	19.1	20.3	310.14	333.00	19.66	21.22
	100 ppm	44.47	37.70	3.3	3.5	20.4	21.4	326.20	348.92	20.48	22.09
	150ppm	45.33	39.00	3.6	3.7	21.0	22.2	331.00	351.82	20.00	22.35
L.S.D. at 5%		1.20	1.19	0.8	0.7	1.3	0.2	5.06	3.62	N.S	N.S

*** S1 (First fall season) -* S2 (Second Fall season)**

2- Yield and its components:

Data in table (3) indicated that the total tubers yield, number of tubers /plant and tuber weight average were significantly increased in the two study seasons of 2004/2005 and 2005/2006 with applying the chicken manure, while the dry weight of tuber was affected significantly in the two study seasons by using (50% of cattle manure + 50% of chicken manure). On the other hand, T.S.S. of tuber was not affected significantly with the different organic manures treatments.

Table (3): Total yield and its components of potato plants at harvest as affected by organic manures, micronutrients and their interactions during fall seasons of 2004/2005 &2005/2006

Characters / Treatments		Total yield (tons/fed)		Number of tubers /plant		Tuber weight average (gm)		Dry weight of tuber (%)		T.S.S.	
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Organic manures											
Control		11.140	11.547	3.8	4.2	105.6	110.3	16.27	16.85	5.51	6.18
Cattle manure 1		11.503	11.965	4.2	4.4	116.6	119.5	16.70	17.88	5.61	6.38
Chicken manure 2		12.073	12.477	4.5	4.7	122.3	127.0	17.58	18.88	5.77	6.60
50% of 1 + 50% of 2		11.795	12.178	4.4	4.5	121.1	123.9	18.21	19.25	5.64	6.50
LSD at 5%		0.15	0.06	0.1	0.1	0.86	0.18	0.14	0.35	N.S	N.S
Micro-nutrients contrat.											
Control		10.621	11.078	3.7	3.8	103.1	106.2	16.54	16.85	5.42	6.10
50 ppm		11.531	11.790	4.1	4.3	114.2	117.5	16.81	17.83	5.56	6.34
100 ppm		12.073	12.152	4.5	4.8	121.6	125.9	17.40	18.66	5.69	6.52
150ppm		12.333	12.747	4.7	4.9	126.8	131.2	18.35	19.80	5.87	6.71
LSD at 5%		0.45	0.09	0.1	0.1	1.32	0.35	0.19	0.20	0.14	0.32
Interactions:											
O.M.	**Micro. Concent.**										
Control	Control	10.210	11.050	3.5	3.5	90.88	99.25	15.82	15.82	5.33	6.02
	50 ppm	10.950	11.130	3.7	4.0	105.0	107.4	15.81	16.03	5.45	6.11
	100 ppm	11.630	11.660	4.0	4.7	110.0	115.1	16.24	17.39	5.52	6.28
	150ppm	11.970	12.350	4.1	4.7	116.6	119.7	17.20	18.15	5.74	6.32
Cattle manure 1	Control	10.470	11.010	3.6	3.8	104.5	106.2	16.00	16.69	5.40	6.10
	50 ppm	11.500	11.850	4.0	4.3	114.2	118.8	16.24	17.04	5.51	6.27
	100 ppm	12.040	12.150	4.5	4.7	120.1	124.1	16.89	18.15	5.73	6.45
	150ppm	12.187	12.550	4.7	4.9	127.8	129.1	17.67	19.66	5.80	6.72
Chicken manure 2	Control	10.910	11.130	4.0	4.0	109.9	110.4	16.52	16.66	5.50	6.16
	50 ppm	11.857	12.210	4.3	4.6	117.5	122.1	17.09	18.76	5.69	6.39
	100 ppm	12.407	13.070	4.8	5.0	129.5	135.6	17.71	19.21	5.88	6.92
	150ppm	12.920	13.100	5.0	5.1	132.2	140.0	18.99	20.81	6.01	6.94
50% of 1 + 50% of 2	Control	10.893	11.120	3.8	4.0	107.1	109.0	16.41	17.01	5.44	6.11
	50 ppm	11.817	11.970	4.2	4.3	120.0	121.7	18.12	19.51	5.60	6.61
	100 ppm	12.217	12.330	4.5	4.8	126.8	128.8	18.78	19.89	5.61	6.45
	150ppm	12.253	12.990	4.0	5.0	130.7	136.2	19.54	20.58	5.92	6.85
L.S.D. at 5%		0.88	0.18	0.2	0.2	2.64	3.70	0.48	0.26	0.11	0.15

Highest values of total tubers yield/fed in both seasons were obtained by using of chicken manure followed by using mixture of cattle manure + chicken manure at rate of (50% for each) .Results declared that using chicken manure recorded an increment in total tubers yield approached (8.36% – 8.05%) compared with the control during the two seasons of study, respectively. These results may be due to the effect of organic manures in increasing soil nutrients which contribute in plant growth through its effect on physical, chemical and biological properties of the soil. These results are in accordance with those obtained by Abou-Hussein (1995) , Kolbe et al (1995), Abdel-Ati (1998) , Arisha and Bardisi (1999); Abou-Hussein et al (2002) and Abou-Hussein et al (2003).

Concerning the effect of the foliar spraying by mixture of micro-nutrients on the yield and its components, data in Table (3) revealed that the maximum total tubers yield; number of tubers/plant, tuber weight average, percentage dry weight of tuber and T.S.S. of tuber in both seasons were obtained by foliar spraying three times by mixture of chelated micronutrients Fe, Zn and Mn(150 ppm) this treatment caused clearly increment in total

tuber yield approached (15.67% and 15.06%) compared with the control during the two study seasons respectively .

The interaction between organic manures and the micro-nutrients mixture had significant effect on total tubers yield (tons/fed), number of tubers /plant, tuber weight average dry weight of tuber and T.S.S. of tuber with applying the chicken manure and foliar spraying three times by mixture of chelated micro-nutrients Fe, Zn and Mn at concentration of (150 ppm) in the two study seasons of 2004/2005 and 2005/2006. Similar conclusions were obtained by Shehata et al (1990); Abdel-Razik and Gaber (1994), Abo-Sedera and Shehata (1994) and Meng et al. (2004).

Macro and micro-nutrients content in tuber:

Data in table (4) indicated that the contents of N, P and K (%) in tuber increased significantly during both study seasons by using the chicken manure.

Table (4): N,P and K contents in potato tubers at harvest as affected by organic manures, micronutrients and their interactions during fall seasons of 2004/2005 and 2005/2006

Characters / Treatments		N(%)		P(%)		K(%)	
		S1	S2	S1	S2	S1	S2
Organic manures							
Control		1.51	1.53	0.25	0.25	1.96	1.97
Cattle manure 1		1.54	1.57	0.27	0.26	1.97	1.97
Chicken manure 2		1.66	1.70	0.31	0.32	2.09	2.10
50% of 1 + 50% of 2		1.59	1.65	0.30	0.31	2.04	2.03
LSD at 5%		0.06	0.02	0.02	0.03	0.01	0.01
Micro-nutrients concentr.							
Control		1.55	1.59	0.26	0.25	1.95	1.95
50 ppm		1.56	1.60	0.27	0.28	2.00	2.01
100 ppm		1.58	1.62	0.29	0.30	2.02	2.03
150ppm		1.59	1.65	0.30	0.31	2.08	2.09
LSD at 5%		0.01	0.02	0.02	0.01	0.08	0.11
Interactions:							
O.M.	Micro. concent.						
Control	Control	1.50	1.52	0.23	0.22	1.94	1.94
	50 ppm	1.51	1.52	0.24	0.24	1.95	1.96
	100 ppm	1.51	1.53	0.26	0.26	1.97	1.98
	150ppm	1.52	1.55	0.26	0.27	1.98	2 00
Cattle manure 1	Control	1.53	1.55	0.25	0.23	1.94	1.94
	50 ppm	1.53	1.55	0.26	0.25	1.97	1.96
	100 ppm	1.53	1.57	0.28	0.27	1.97	1.98
	150ppm	1.55	1.59	0.28	0.29	1.99	1.98
Chicken manure 2	Control	1.62	1.64	0.27	0.28	1.96	1.95
	50 ppm	1.65	1.67	0.29	0.31	2.08	2.10
	100 ppm	1.68	1.71	0.32	0.33	2.10	2.12
	150ppm	1.68	1.79	0.34	0.35	2.20	2.22
50% of 1 + 50% of 2	Control	1.55	1.64	0.27	0.28	1.97	1.97
	50 ppm	1.56	1.64	0.30	0.31	2.01	2.00
	100 ppm	1.59	1.66	0.31	0.32	2.03	2.02
	150ppm	1.61	1.68	0.33	0.34	2.16	2.15
L.S.D. at 5%		0.04	0.04	0.03	0.02	0.15	0.16

On the other hand data in table (5) revealed that concentration of Fe, Zn and Mn in tuber increased significantly by applying the cattle manure. These results are considering good reflection for the components of chicken and cattle manure respectively. Use of organic manures along with chemical fertilizers increase the soil fertility in nutrients with good physical and microbiological properties; this will increase the availability of nutrients and consequently increase the macro and micro-nutrients concentrations in the tubers.

These results are in agreement with those obtained by Mathers and Goss (1979), Obukhov et al (1985), Srikumar and Okerman (1990) , Kolbe et al (1995) , Saleh and Abd El-Fattah (1997) , Abdel-Ati (1998), Arisha and Bardisi (1999) .

With respect to the effect of micro-nutrients mixture concentrations, results in tables (4) and (5) showed that the contents of N , P , K (%) and Fe, Zn and Mn (ppm) in tubers increased significantly with using the foliar spraying by mixture of micronutrients Fe, Zn and Mn at concentration of (150 ppm) . Similar results were reported by Abdel-Razik and Gaber (1994) and Meng et al (2004).

Table (5): Fe,Zn and Mn concentrations in tuber at harvest as affected by organic manures, micronutrients and their interactions during fall seasons of 2004/2005 and 2005/2006

Characters / Treatments		Fe(ppm)		Zn(ppm)		Mn(ppm)	
		S1	S2	S1	S2	S1	S2
Organic manures							
Control		155.75	160.75	14.75	18.50	11.00	12.00
Cattle manure 1		188.50	189.75	20.50	24.00	13.95	15.75
Chicken manure 2		171.50	173.35	19.25	19.75	12.50	13.25
50% of 1 + 50% of 2		178.25	181.25	20.00	21.75	12.00	13.00
LSD at 5%		4.8	6.07	2.5	2.4	1.1	0.6
Micronutrients concentr.							
Control		160.50	163.25	10.50	12.00	10.75	12.25
50 ppm		171.25	172.75	12.75.	14.00	11.75	13.25
100 ppm		177.25	179.00	14.50	17.25	12.50	13.50
150ppm		187.25	190.25	16.75	20.25	14.25	15.00
LSD at 5%		3.6	5.6	2.9	2.1	1.4	1.0
O.M.	**Micro. concentr.**						
Control	Control	144	149	14	16	10	11
	50 ppm	154	158	14	17	11	12
	100 ppm	165	162	15	19	11	12
	150ppm	169	174	16	22	12	13
Cattle manure 1	Control	170	172	14	17	11	14
	50 ppm	188	184	19	21	13	15
	100 ppm	192	196	23	27	14	16
	150ppm	204	207	26	29	17	18
Chicken manure 2	Control	163	165	17	17	11	12
	50 ppm	169	171	19	18	12	13
	100 ppm	170	172	20	21	13	13
	150ppm	184	186	21	23	14	15
50% of 1 + 50% of 2	Control	165	167	17	18	11	12
	50 ppm	174	178	19	20	11	13
	100 ppm	182	186	20	22	12	13
	150ppm	192	194	24	27	14	14
L.S.D. at 5%		7.4	11.2	4.8	4.1	2.9	2.0

Data in table (4) indicated that the interaction between organic manures and micro-nutrients mixture levels had significant effect on the tuber contents of N, P and K. Highest values of N, P&K were obtained by applying chicking manure with the spraying by mixture of micro-nutrients Fe, Zn and Mn (150 ppm) as compared with the other treatments in both years. On the other hand, data in table (5) illustrated that highest concentrations of Fe, Zn &Mn (ppm) in the tuber were obtained by using cattle manure at rate of with foliar spraying by mixture of micronutrients Fe, Zn and Mn at (150 ppm) in both study seasons compared with control. These results are in accordance with those obtained by Mathers and Goss (1979) ; Abdel-Razik and Gaber (1994) ; Kolbe et al (1995); Saleh and Abd El -Fattah (1997) ; Abdel-Ati (1998) ; Arisha and Bardisi (1999) and Meng et al (2004).

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تأثير بعض مصادر الأسمدة العضوية والرش ببعض العناصر الصغرى على انتاجية وجودة محصول البطاطس

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أقيمت تجربتان خلال موسمى خريف ٢٠٠٤/٢٠٠٥ ، ٢٠٠٥/٢٠٠٦ على نباتات البطاطس صنف اسبونتا فى قرية ميت فارس ــ المنصورة محافظة الدقهلية وذلك لدراسة تأثير استخدام بعض مصادر الأسمدة العضوية والرش الورقي بخليط من العناصر الصغري (حديد- زنك - منجنيز) على صفات النمو الخضرى،المحصول ومكوناتة وكذلك جودة الدرنات وبعض المكونات الكيميائية بالدرنة.

وقد أوضحت النتائج أن طول النبات ،عدد الأفرع الرئيسية/ نبات ، عدد الأوراق/ نبات، وزن النبات الطازج ، المحصول الكلى/فدان ،عدد الدرنات /نبات ومتوسط وزن الدرنة وكذلك محتوى الدرنة من النيتروجين و الفوسفور و البوتاسيوم قد زادت زيادة معنوية خلال موسمى التجربة باستخدام سماد الدواجن بمعدل (١٠م٣ / فدان). من ناحية أخرى فان المادة الجافة بالدرنة قد تأثرت معنويا خلال موسمى الدراسة باستخدام خليط الأسمدة العضوية(٥٠ % سماد بلدى+٥٠ % سماد دواجن) . زاد تركيز العناصر الصغري (حديد- زنك - منجنيز) فى الدرنة زيادة معنوية باستخدام السماد البلدى بمعدل (٢٠م٣/فدان) بينما لم يتاثر الوزن الجاف للعرش والمادة الصلبة الكلية بالدرنة باستخدام الأسمدة العضوية المختلفة .

وقد أدى الرش الورقي ثلاث مرات بخليط من العناصر الصغري المخلبة (حديد- زنك - منجنيز) بنسبة (١:١:١) بتركيز ١٥٠ جزء فى المليون إلى زيادة معنوية فى صفات النمو الخضرى مثل طول النبات ، عدد الأفرع الرئيسية للنبات، عدد الأوراق للنبات ،وزن العرش الأخضر والجاف للنبات، محصول الدرنات الكلى للفدان عدد الدرنات/نبات، متوسط وزن الدرنة،النسبة المئويةللمادة الجافة بالدرنة ، المادة الصلبة الكلية بالدرنة و محتوى الدرنة من النيتروجين، الفوسفور ، البوتاسيوم ، الحديد، الزنك، المنجنيز فى كلا الموسمين .

أوضح التفاعل بين الأسمدة العضوية والرش الورقي بخليط العناصر الصغري ان كل صفات النمو الخضرى ماعدا الوزن الجاف للعرش ، محصول الدرنات الكلى للفدان (طن/فدان) ، عدد الدرنات/نبات، متوسط وزن الدرنة (جم)، الوزن الجاف للدرنة (%) قد تاثرت معنويا باستخدام سماد الدواجن بمعدل (١٠م٣ / فدان) مع الرش الورقي ثلاث مرات بخليط من العناصر الصغري (حديد- زنك - منجنيز) بنسبة (١:١:١) بتركيز ١٥٠ جزء فى المليون وذلك خلال موسمى خريف ٢٠٠٤/٢٠٠٥ ، ٢٠٠٥/٢٠٠٦ .