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EFFECT OF SOAKING TABLE BEET SEEDS IN DIFFERENT CONCENTRATIONS OF B, Zn OR Mn AS WELL AS NPK FERTILIZATION LEVEL ON

2- TOTAL YIELD AND ITS COMPONENTS AND CHEMICAL COMPOSITION OF PLANT ROOTS

By

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ABSTRACT

Two field experiments were conducted at the experimental Farm of the Faculty of Agric. Moshtohor, Zagazig Univ. during the winter seasons of 1989/1990 and 1990/1991 to study the effect of soaking table beet seeds (Beta vulgaris, L.) cv. Early Flat Red Egyptian in different concentrations of boron, zinc or manganese as well as NPK fertilization on total yield and its components as well as chemical composition of plant roots. Obtained results showed that total yield and its components expressed as average root, weight roots yield per faddan and total yield per faddan were statistically increased with soaking seeds in different concentrations of B, Zn or Mn as well as increasing NPK-fertilization level. In this regard, soaking seeds in manganese at 1000 ppm for 24 hrs. and NPK fertilization at the highest used level (46.5 Kg N + 49.5 Kg P_2O_5 + 72 Kg K_2O/fad.) proved to be the effective treatment in increasing the yield and its components as well as improving the quality of the beet roots.

INTRODUCTION

The application of micro- and macro-nutrients to the vegetable crops proved to be of major importance for increasing vegetable crop production and improving its quality.

Using micro-nutrients in different concentrations either as seeds or cloves soaking (Gritsenko et al., 1985 and Sharabah and El-Tabbakh, 1985 on sugar beet; Abed et al., 1988, on garlic) and/or foliar spray (Eid et al., 1991 on garlic; El-Kafoury et al., 1991 on onion; Orabi et al., 1991 on carrot) increased the roots and bulbs yield of such studied crops.

In addition, Sharabash and El-Tabbakh (1985) on sugar beet, Abed et al. (1988) and Eid et al. (1991) on garlic pointed out that applying micro-nutrients, i.e., Zn, Cu, Mn

and B, at different concentrations either as seed or cloves soaking and/or as foliar spray increased the macro- and micro-nutrients content in plant bulbs. Positive results on total yield and chemical composition of plant bulbs and roots due to NPK fertilizers soil addition were obtained by some investigators (Abed et al., 1988 and Abo-Sedera et al., 1991 on garlic, Abo-Sedera and Shafshak, 1990 on garden beet; Orabi et al., 1991 on carrots).

Therefore, this study was conducted to elucidate the effect of seed soaking in B, Zn or Mn at different concentrations combined with N, P and K fertilizers as soil addition on yield and quality of garden beet roots.

MATERIALS AND METHODS

This experiment was conducted at the Experimental Farm of the Faculty of Agriculture, Moshtohor, Zagazig University during the winter seasons of 1989/1990 and 1990/1991 to study the effect of soaking seeds in different concentration of micro-nutrients (Boron, Zinc or Manganese) and soil fertilization with NPK fertilizers as well as their interaction on total yield and its components as well as the chemical composition of garden beet (Beta vulgaris, L.) cv. Early Flat Red Egyptian. The soil of the experimental farm was clay loam in texture with pH 7.7, 1.5% organic matter, 0.103% available N, 2.74 ppm soluble P and 0.5 meq/L.K. The used concentrations of forementioned micro-nutrients were as follows :

1. Distilled water to act as control.
2. 100, 200 and 400 ppm boron as borax salt.
3. 250, 500 and 1000 ppm zinc as sulphate salt.
4. 250, 500 and 1000 ppm manganese as sulphate salt.

The used levels of nitrogen, phosphorus and potassium fertilizer were as follows :

1. 15.5 Kg N + 16.5 Kg P_2O_5 + 24 Kg K_2O/fad. (level,1).
2. 31.0 Kg N + 33.0 Kg P_2O_5 + 48 Kg K_2O/fad. (level,2).
3. 46.5 Kg N + 49.5 Kg P_2O_5 + 72 Kg K_2O/fad. (level,3).

Seeds were soaked for 24 hours in different concentrations of aqueous solutions for studied micro-nutrients and the distilled water used as control. Seeds were sown in hills 10 cm apart at both sides of ridges on October 28th and November 2nd during 1989 and 1990 seasons, respectively. Split plot design with four replicates was adopted. The fertilization treatments were arranged in the main plots, while, the micro-nutrients treatments were distributed randomly in the sub-plots. The sub-plot area was about 10.5m^2 (1/400 fad.). Each experimental plot included five ridges 3m long and 70 cm wide. Four ridges were planted and

one was left as a border to prevent the discharge of fertilizers from any plot to adjacent one.

Calcium nitrate (15.5% N), calcium superphosphate (16.5% P_2O_5) and potassium sulphate (48% K_2O) fertilizers were used as sources of nitrogen, phosphorus and potassium, respectively. The amounts of fertilizers were divided into two equal portions. The first was added after thinning the plants, i.e., 21 days from seed sowing, and the second one added three weeks later. Other agricultural practices were carried out as commonly followed in the district. At marketable stage, 70 days after sowing, plants of each experimental plot were pulled up and the following data were recorded.

1. Yield and its components: Ten plants as a representative sample from each experimental plot were taken for measuring plant root weight (g). Meanwhile, all plants that pulled up from each experimental plot were used for calculating total root yield (ton/fad.) and total yield of plants (ton/fad.).
2. Chemical constituents of roots were assayed in the oven dry matter as follows :
   a- Total nitrogen, phosphorus and potassium were determined according to the methods described by Pregl (1945), Murphy and Riely (1962) and Brown and Lilleland (1946) for nitrogen, phosphorus and potassium respectively.

   b- Boron, zinc and manganese were assayed following the method described by Chapman and Pratt (1961).

   c- Reducing, non-reducing and total sugars were determined according to the method described by Morell (1941)

All obtained data were subjected to statistical analysis according to Gomez and Gomez (1983).

RESULTS AND DISCUSSION

1. Total yield and its components

Data presented in Table (1A) show the effect of soaking seeds of garden beet pre-sowing in different concentrations of boron, zinc or manganese as well as NPK fertilization level on the total yield and its components. Such data revealed that total yield and its components expressed as root weight per plant, total root yield and total yield of plants per faddan were significantly increased as a result of soaking seeds in boron, zinc or manganese solutions with its different used concentrations compared with the control. In this respect, the highest used concentration of boron or manganese and the medium concentration of zinc reflected the maximum increase in studied characters. Moreover, manganese was superior in this regard during both seasons of this study. These results are confirmed by those obtained

by Gritsenko et al. (1985) and Sharabash and El-Tabbakh (1985) on sugar beet; Abed et al. (1988) and Eid et al. (1991) on garlic; El-Kafoury et al. (1991) on onion and Orabi et al. (1991) on carrot. As for the effect of NPK fertilization, data in Table (1A) indicate that there was a significant increase in root weight per plant and root yield and total yield per faddan by the different levels used of NPK fertilization. In this regard, the maximum increments were connected with the highest used level of NPK-fertilizers (46.5 Kg N + 49.5 Kg P_2O_5 + 72 Kg K_2O/fad.) compared with the other used levels. Such results may be due to the role of NPK nutrient elements in increasing the meristematic activity of plant tissues, resulting in the increment in plant growth (as shown in Table 1A, in the first part of this work) and consequently, increments in yield and its components were obtained as a result of such treatment.

Obtained results are going with those reported by Abed et al. (1988) and Abo-Sedera and Shafshak (1990) on garden beet and Orabi et al. (1991) on carrots.

As for the interactional effect of both micro-nutrients concentration and NPK fertilizers level, it is evident from data in Table (1B) that average root weight, root yield and total yield per faddan were improved with increasing the concentration of any of the used micro-nutrients and NPK fertilization level. In this regard, soaking seeds prior to sowing in Mn at 1000 ppm, combined with NPK fertilizers as soil addition at the highest used level (46.5 Kg N + 49.5Kg P_2O_5 + 72 Kg K_2O/fad.) could be recommended for obtaining the maximum yield of table beet under such conditions.

2. Chemical constituents of plant roots

It is obvious from data shown in Tables (2,3 & 4A) that determined macro-nutrients expressed as total nitrogen, phosphorus and potassium contents of plant roots and micro-nutrients expressed as boron, zinc and manganese as well as reducing, non-reducing and total sugar contents were positively affected with increasing the micro-nutrients concentration. In this respect, the highest concentration (400, 1000 or 1000 ppm) of boron, zinc or manganese respectively reflected the highest significant values of macro- and micro-nutrients. Meanwhile, medium concentration, i.e., 200 ppm of boron reflected maximum contents of sugars in plant roots. The enhancing effect of micro-nutrients seed soaking was also reported by Sharabash and El-Tabbakh (1985) on sugar beet, Abed et al. (1988) and Eid et al. (1991) on garlic.

Concerning the NPK fertilizers soil addition effect, data in Tables (2,3 & 4A) showed clearly that macro-nutrients

Table (1A): Effect of soaking seed in B, Zn or Mn and NPK fertilization level on yield and its component of table beet plants.

Season				1989/1990			1990/1991		
Fertilization level (kg/fad.) N	P_2O_5	K_2O	Micro-nutrients concentrations (ppm)	Root weight/ plant (g)	Root yield/ faddan (Ton)	Total yield/ faddan (Ton)	Root weight/ plant (g)	Root yield/ faddan (Ton)	Total yield/ faddan (Ton)
15.5	16.5	24	--	107.3	8.596	14.84	108.7	8.697	15.04
31.0	33.0	48	--	126.9	10.151	17.28	128.9	10.317	17.56
46.5	49.5	72	--	150.5	12.051	20.25	150.1	12.009	20.16
L.S.D. at 0.05			--	1.6	0.079	0.061	1.4	0.077	0.055
			Control 0	89.5	7.174	12.800	89.6	7.164	12.533
			100	114.6	9.210	16.000	119.6	9.573	16.533
			B 200	127.7	10.178	17.467	132.6	10.610	18.000
			400	142.7	11.427	19.333	147.4	11.804	20.000
			250	122.2	9.778	16.533	117.4	9.381	16.000
			Zn 500	151.1	12.094	19.333	146.9	11.750	19.067
			1000	128.4	10.283	17.600	124.6	9.973	17.200
			250	120.6	9.652	16.800	120.9	9.685	16.933
			Mn 500	134.0	10.741	18.533	136.9	10.949	18.930
			1000	152.2	12.124	20.167	156.5	12.521	20.667
L.S.D. at 0.05				2.5	0.159	0.153	2.6	0.162	0.110

Table (1B): Effect of soaking seeds in B, Zn or Mn and NPK fertilization level on yield and its components of table beet plants.

Seasons			1989/1990			1990/1991		
Fertilization levels (kg/faddan)	Micro-nutrients	concentrations (ppm)	Root weight/ plant (g)	Root yield/ faddan (Ton)	Total yield/ faddan (Ton)	Root weight/ plant (g)	Root yield/ faddan (Ton)	Total yield/ faddan (Ton)
Level I: 15.5 kg N +16.5 kg P_2O_5 +72.0 kg K_2O/faddan	Control	0	78.1	6.260	11.20	73.5	5.866	10.40
	B	100	91.9	7.376	13.20	97.0	7.771	13.60
		200	106.7	8.550	15.20	107.6	8.610	14.80
		400	123.2	9.882	16.80	125.4	10.033	17.20
	Zn	250	109.9	8.800	14.40	100.5	8.043	14.00
		500	123.4	9.872	16.00	126.0	10.080	16.80
		1000	107.9	8.633	14.80	108.5	8.686	15.20
	Mn	250	97.2	7.778	14.00	100.4	8.047	14.40
		500	109.5	8.775	15.60	115.9	9.276	16.40
		1000	125.4	10.033	17.20	132.0	10.560	17.60
Level II: 31 kg N +33 kg P_2O_5 +72 kg K_2O/faddan	Control	0	90.4	7.240	12.80	94.8	7.583	13.20
	B	100	114.9	9.286	16.00	118.9	9.518	16.40
		200	124.7	9.983	17.20	131.3	10.500	18.00
		400	140.0	11.200	19.20	145.8	11.700	20.00
	Zn	250	119.6	9.567	16.40	116.7	9.300	16.00
		500	151.8	12.155	19.60	144.6	11.569	18.80
		1000	127.6	10.215	17.60	122.5	9.800	16.80
	Mn	250	113.4	9.076	15.60	118.9	9.518	16.40
		500	134.6	10.786	18.40	140.0	11.200	19.20
		1000	152.7	12.000	20.00	156.0	12.480	20.80
Level III: 46.5 kg N + 49.5 kg P_2O_5 + 72.0 kg K_2O/faddan	Control	0	100.0	8.023	14.40	100.5	8.043	14.00
	B	100	137.1	10.967	18.80	142.9	11.430	19.60
		200	150.0	12.000	20.00	159.0	12.720	21.20
		400	165.0	13.200	22.00	171.0	13.680	22.80
	Zn	250	137.0	10.967	18.80	135.0	10.800	18.00
		500	178.2	14.255	22.40	170.0	13.600	21.60
		1000	149.6	12.000	20.40	142.9	11.433	19.60
	Mn	250	151.2	12.102	20.80	143.6	11.490	20.00
		500	157.9	12.662	21.60	154.7	12.370	21.20
		1000	178.5	14.338	23.30	181.5	14.523	23.60
L.S.D. at 0.05			4.3	0.375	0.263	4.4	0.281	0.258

Table (2A): Effect of soaking seeds in B, Zn or Mn and NPK fertilization level on N, P and K (mg/100 g D.W.) content of plant root.

Season				1989/1990			1990/1991		
Fertilization level (kg/fad.)			Micro-nutrients concentrations (ppm)	N	P	K	N	P	K
N	P_2O_5	K_2O							
15.5	16.5	24	--	3366	147	1982	3397	152	1959
31.0	33.0	48	--	3577	177	2120	3614	187	2148
46.5	49.5	72	--	3752	210	2312	3811	228	2311
L.S.D. at 0.05				78	4	31	7	1	11
			Control 0	2867	53	1543	2913	77	1587
			100	3283	147	1697	3303	143	1683
			B 200	3333	190	1953	3397	197	1900
			400	3527	223	2027	3523	230	1997
			250	3837	133	2253	3887	137	2140
			Zn 500	4247	153	2353	4230	177	2290
			1000	4357	170	2460	4417	197	2450
			250	3013	183	2263	3083	200	2290
			Mn 500	3430	227	2330	3450	243	2437
			1000	3757	267	2500	3870	290	2620
L.S.D. at 0.05				429	33	137	42	21	52

Table (2B): Effect of soaking seeds in B, Zn or Mn and NPK fertilization levels on N, P and K content (mg/100 g D.W.) of plant roots.

Seasons			1989/1990			1990/1991		
Fertilization levels (kg/faddan)	Micro-nutrients	concentration (ppm)	N	P	K	N	P	K
Level I: 15.5 kg N + 16.5 kg P_2O_5 + 24.0 kg K_2O/faddan	Control	0	2780	60	1400	2840	50	1390
	B	100	3120	120	1540	3090	110	1500
		200	3160	160	1760	3191	150	1720
		400	3240	180	1890	3320	180	1840
	Zn	250	3720	110	2100	3680	100	2000
		500	4000	120	2180	3940	140	2100
		1000	4120	140	2290	4180	160	2210
	Mn	250	2820	150	2140	2900	170	2100
		500	3180	190	2200	3240	200	2270
		1000	3520	240	2320	3590	260	2460
Level II: 31.0 kg N + 33.0 kg P_2O_5 + 24.0 kg K_2O/faddan	Control	0	2890	80	1500	2920	70	1600
	B	100	3270	150	1710	3340	140	1680
		200	3320	200	1960	3380	210	1900
		400	3720	240	2000	3460	250	1980
	Zn	250	3820	130	2260	3900	120	2140
		500	4220	150	2360	4280	170	2310
		1000	4280	170	2430	4360	190	2520
	Mn	250	3000	180	2230	3080	200	2300
		500	3440	210	2290	3500	240	2450
		1000	3810	260	2460	3920	280	2600
Level III: 46.5 kg N + 49.5 kg P_2O_5 + 72.0 kg K_2O/faddan	Control	0	2930	120	1730	2980	110	1770
	B	100	3460	170	1840	3480	180	1870
		200	3520	210	2140	3620	230	2080
		400	3620	250	2190	3790	260	2170
	Zn	250	3970	160	2400	4080	190	2280
		500	4520	190	2520	4470	220	2460
		1000	4670	200	2660	4710	240	2620
	Mn	250	3220	220	2420	3270	230	2470
		500	3670	280	2500	3610	290	2590
		1000	3940	300	2720	4100	330	2800
L.S.D. at 0.05			743	57	237	72	36	90

Table (3A): Effect of soaking seeds in B, Zn or Mn and NPK fertilization level on B, Zn and Mn content (ppm) in plant roots.

Seasons				1989/1990			1990/1991		
Fertilization level (kg/fad.) N	P_2O_5	K_2O	Micro-nutrients concentrations (ppm)	B	Zn	Mn	B	Zn	Mn
15.5	16.5	24	--	16	87	33	17	89	34
31.0	33.0	48	--	19	100	37	21	101	39
46.5	49.5	72	--	22	114	43	25	116	43
L.S.D. at 0.05				0.4	0.7	1	0.4	3.7	1
			Control 0	10	50	24	10	48	21
			100	26	65	26	28	63	28
			B 200	29	76	29	32	77	31
			400	31	94	32	35	97	35
			250	12	136	31	14	137	32
			Zn 500	14	150	35	17	150	35
			1000	17	164	39	19	164	39
			250	13	76	49	16	78	50
			Mn 500	16	94	55	18	99	54
			1000	19	102	59	20	107	59
L.S.D. at 0.05				1	2.8	1	2	15	2

Table (3B): Effect of soaking seeds in B, Zn or Mn and NPK fertilization levels on B, Zn and Mn content (ppm) in plant roots.

Seasons			1989/1990			1990/1991		
Fertilization levels (kg/faddan)	Micro-nutrients	concentrations (ppm)	B	Zn	Mn	B	Zn	Mn
Level I: 15.5 kg N + 16.5 kg P_2O_5 + 24.0 kg K_2O/faddan	Control	0	8	38	20	7	34	18
	B	100	22	56	22	24	51	24
		200	24	63	24	27	67	26
		400	27	80	26	30	82	29
	Zn	250	10	115	26	11	120	28
		500	13	124	29	14	130	30
		1000	15	148	32	16	150	34
	Mn	250	11	68	48	12	71	46
		500	14	87	50	14	84	48
		1000	17	95	54	18	97	54
Level II: 31.0 kg N + 33.0 kg P_2O_5 + 48.0 kg K_2O/faddan	Control	0	10	47	24	9	44	22
	B	100	26	66	25	28	62	28
		200	29	78	27	32	74	30
		400	30	91	33	35	93	36
	Zn	250	12	132	31	13	136	33
		500	15	151	35	17	148	36
		1000	17	162	41	19	164	40
	Mn	250	13	76	42	16	78	49
		500	16	95	55	18	104	53
		1000	18	102	59	20	108	58
Level III: 46.5 kg N + 49.5 kg P_2O_5 + 72.0 kg K_2O/faddan	Control	0	13	64	28	14	67	24
	B	100	30	72	31	33	76	32
		200	34	86	35	37	89	37
		400	36	110	38	41	115	40
	Zn	250	15	160	37	18	155	36
		500	17	174	40	20	172	39
		1000	20	181	44	22	178	43
	Mn	250	14	85	56	19	86	54
		500	18	100	60	21	110	62
		1000	21	110	64	23	115	66
L.S.D. at 0.05			2	5	N.S	N.S	26	N.S

Table (4B): Effect of interaction between soaking seeds in B, Zn or Mn and NPK fertilization levels on sugars content (g/100 g D.W.) of table beet roots.

Seasons		1989/1990			1990/1991		
Fertilization levels (kg/faddan)	Micro-nutrients concentrations (ppm)	Reducing sugar	Non-reducing sugar	Total sugar	Reducing sugar	Non-reducing sugar	Total sugar
Level I: 15.5 kg N + 16.5 kg P_2O_5 + 24.0 kg K_2O/faddan	Control 0	0.70	6.32	7.02	0.64	6.32	6.96
	B 100	0.40	4.84	5.24	0.43	4.71	5.14
	B 200	0.60	7.48	8.08	0.59	7.37	7.96
	B 400	0.31	4.31	4.62	0.31	4.19	4.50
	Zn 250	0.74	10.54	11.28	0.79	10.58	11.37
	Zn 500	0.96	11.18	12.14	0.99	11.25	12.24
	Zn 1000	1.22	11.88	13.10	1.21	12.02	13.23
	Mn 250	1.10	7.77	8.88	1.15	7.74	9.89
	Mn 500	1.30	9.73	11.03	1.38	9.82	11.20
	Mn 1000	1.43	13.17	14.60	1.52	13.05	14.57
Level II: 31.0 kg N + 33.0 kg P_2O_5 + 48.0 kg K_2O/faddan	Control 0	0.92	9.68	10.60	0.94	9.67	10.61
	B 100	0.54	6.03	6.57	0.59	5.74	6.33
	B 200	0.75	8.45	9.20	0.73	8.39	9.12
	B 400	0.39	5.51	5.90	0.41	5.48	5.69
	Zn 250	1.15	10.93	12.08	1.09	11.05	12.14
	Zn 500	1.25	12.81	14.06	1.27	12.92	14.19
	Zn 1000	1.33	13.54	14.87	1.38	13.64	15.02
	Mn 250	1.40	10.42	11.82	1.38	9.87	11.25
	Mn 500	1.48	12.02	13.50	1.60	11.86	13.46
	Mn 1000	1.61	13.81	15.42	1.72	13.92	15.64
Level III: 46.5 kg N + 49.5 kg P_2O_5 + 72.0 kg K_2O/faddan	Control	1.11	10.82	11.93	1.13	10.54	11.67
	B 100	0.63	8.66	9.29	0.71	7.79	8.50
	B 200	0.86	10.50	11.36	0.88	10.00	10.88
	B 400	0.53	7.34	7.87	0.55	7.24	7.79
	Zn 250	1.30	11.86	13.16	1.29	12.09	13.38
	Zn 500	1.41	13.88	15.39	1.45	13.97	15.42
	Zn 1000	1.50	14.39	15.89	1.55	14.53	16.08
	Mn 250	1.58	12.35	13.93	1.56	12.31	13.87
	Mn 500	1.67	13.23	14.90	1.71	13.25	14.96
	Mn 1000	1.82	14.09	15.91	1.88	14.29	16.17
L.S.D. at 0.05		0.09	0.38	0.45	0.08	0.45	0.46

expressed as total nitrogen, phosphorus and potassium contents of roots and micropnutrients expressed as B, Zn and Mn as well as sugars expressed as reducing, non-reducing and total sugars were positively affected steadly with increasing the NPK fertilizers level up to the highest used one (46.5 Kg N + 49.5 Kg P_2O_5 + 72 Kg K_2O/fad.). The favourable effect of NPK fertilization on increasing the macro- and micro-nutrients contents in the roots may be due to the increasing of plant growth and consequently the need and uptake of such nutrients. This, in turn, activate the plant metabolism which led to the synthesis of sugars, that takes part in the formation of betadin pigment in the beet roots. Similar results were reported by Abed et al. (1988) and Abo-Sedera et al. (1991) on garlic, Abo-Sedera and Shafshak (1990) on garden beet and Orabi et al. (1991) on carrots.

As for the interactional effect of NPK fertilizers level and micro-nutrient treatments, it seems from data in Tables (2,3 & 4B) that the contents of macro-nutrients (N, P and K) and micro-nutrients (B, Zn and Mn) and total sugar (reducing and non-reducing sugars) were significantly increased with increasing NPK fertilization level and micro-nutrients concentration. This was true during the two seasons of growth.

In this respect, the maximum increments of macro-nutrients (N, P and K) and micro-nutrients (B, Zn and Mn) as well as total sugars (reducing and non-reducing sugars) were obtained in plants fertilized with the highest used level of fertilizers (46.5 Kg N + 49.5 Kg P_2O_5 + 72 Kg K_2O/fad.) within seed soaking in micro-nutrients solutions of B at 200 ppm, Zn at 1000 ppm or Mn at 1000 ppm.

Generally, it could be concluded that soaking seeds of table beet in manganese at 1000 ppm within NPK fertilization at the highest used level proved to be the most effective treatment in increasing yield and its components as well as root quality.

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تأثير نقع بذور البنجر فى التركيزات المختلفة لكل من البورون والزنك أو المنجنيز ومستوى التسميد الازوتى والفوسفاتى والبوتاسى على : ٢ ـ المحصول الكلى ومكوناته والتركيب الكيماوى لجذور النباتات

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الملخص العربى

أجريت تجربتان حقليتان بمزرعة التجارب بكلية الزراعة بمشتهر ـ جامعة الزقازيق خـلال الموسم الشتوى لعامى ١٩٩٠/٨٩ م، ١٩٩١/٩٠ م لدراسة تأثير نقع بذور بنجر المائـدة صنف ايرلى فلات رد ايجيبشيان فى تركيزات مختلفة من كل من البورون والزنك أو المنجنـيز مع التسميد الازوتى والفوسفاتى والبوتاسى على المحصول ومكونات والتركيب الكيماوى للجذور . قد أظهرت النتائج المتحصل عليها أن المحصول الكلى ومكاوناته معبرا عنه بمتوسط وزن الجـذر ومحصول الجذور الكلى للفدان والمحصول الكلى للنباتات للفدان قد زاد احصائيا نتيجة لنقع البذور فى التركيزات المختلفة من البورون والزنك أو المنجنيز مع زيادة مستوى التسميد .

وفى هذا الخصوص فان نقع بذور البنجر فى المنجنيز عند ١٠٠٠ جزء فى المليون لمـدة ٢٤ ساعة والتسميد بالمستوى العالى (٤٦,٥ كجم ن + ٤٩,٥ فو٢ أ٥ + ٧٢ كجم يو٢ أ / فدان) كان له أكبر الأثر فى زيادة المحصول ومكوناته وتحسين جودة جذور البنجر .