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PREVENTION AND TREATMENT OF NUTRITION DEFICIENCIES ON TOMATOES CROP IN ENVIRONMENTAL PROTECTION CONDITIONS

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Abstract

Experimentation was realized in the greenhouse of ICPA Bucharest (2006-2007), experiments were placed in Mitscherlich pots, which were introduced 20 kg soil, on two topsoils.

The test plants used were tomatoes, Dacia cultivar. The soil material used was chernozem (CZcb) from Fundulea.

The fertilizers tested were applied both to root and leaves by three treatments. The treatment variants were: unfertilized control, Neb-26, Stimusoil, Kelpak and Bionat. The experience ended with the harvesting of tomatoes fruits. The experimental results were statistically processed by the analysis of data variance, with multiple t test for insurance 5%.

INTRODUCTION

The negative status of vegetation from tomatoes, and vegetables in general, manifested by various deviations from normality color and plant forms, can be also caused by nutrient deficiency or excess of the substrate on which plants grow. Typically, the negative status of vegetation is caused by the interaction of several factors and causing or favorable conditions.

For the prevention and treatment of nutritional deficiencies in intensive crop of tomatoes in environmental protection conditions, a range of liquid fertilizers with ecological features were tested.

MATERIAL AND METHODS

The influence of unconventional fertilization methods applied to tomatoes was observed in the ICPA greenhouse. The experiments were organized in Mitscherlich pots with 20 kg of soil per pot.

The experiment soil material was Fundulea Chernozem topsoil.

The experiment included two kinds of prepared soil material, that is:

- A_1 - topsoil plus: N-300 mg/kg of soil, P_2O_5-300 mg/kg of soil, K_2O-300 mg/kg of soil, and 30 g peat/kg of soil;
- A_2 - topsoil plus: N-300 mg/kg of soil, P_2O_5-300 mg/kg of soil, K_2O-300 mg/kg of soil.

Table 1

Chemical composition of fertilizers

Components	**KELPAK***	**BIONAT***	**STIMUSOIL**	**NEB - 26**
	conc./UM			
N organic	0.4%	1.28%	0.125%	-
N total	0.04%	1.28%	0.125%	-
P_2O_5	0.03%	1.37%	0.175%	0.355%
K_2O	0.61%	0.24%	0.278%	0.108%
Fe	2.2 ppm	0.152%	$7.8 \cdot 10^{-4}$ %	14 ppm
Cu	1.8 ppm	0.215%	0.025%	0.048%
Zn	0.9 ppm	0.195%	$6.9 \cdot 10^{-5}$%	2.1 ppm
Mg	56.4 ppm	0.2%	0.03%	0.025%
Mn	0.8 ppm	0.078%	-	1.7 ppm
B	3.2 ppm	-	$7.3 \cdot 10^{-4}$%	2.5 ppm
Mo	-	-	$8.2 \cdot 10^{-6}$%	0.033 ppm
Sodium	0.16%	-		0.017%
Ca	0.02%	-	0.042%	0.03%
Auxin, citokinone	auxin 10.7 ppm citokinone 0.03 ppm	-	-	-
Protein	0.2%	-	0.78%	0.233%
Amino acids	0.1%	-	-	-
Other organic substances	carbohydrates 1.0%	salicylic acid 1% organic extract from plants 10%	20.87%	11%

*Amounts of organic substances are those declared by the producer

The test plant used was tomato, Dacia cultivar.

The applied treatment fertilizers included: NEB-26, STIMUSOIL for application in soil, and KELPAK, BIONAT for application on plant leaves in three splittings.

The three foliar fertilizations were carried out as follows:

- the first fertilization after 10 days from the plantation;
- the second and the third fertilization at every 7-8 days between them.

The chemical composition of tested fertilizers is presented in the table 1. The used solution concentration was 1% and the applied quantity was 30 ml solution/pot for each treatment. Treatments included: V_1 - control, V_2 - NEB-26, V_3 - STIMUSOIL, V_4 - KELPAK and V_5 - BIONAT.

RESULTS AND DISCUSSION

To quantify the influence of treatments applied to plant mineral nutrition of tomato, the leaves samples were collected from the top of the plant fully developed, the time of the first fruits. Harvesting was done at 10 days after application of the second foliar treatment. Timing of harvest was justified by the fact that tomatoes require increased quantities of N in the growth and nitrate assimilation occurs at a rate of 80% in leaves [4].

Samples of leaves were harvested for foliar diagnosis in two experimental years, 2006 and 2007. The results are presented for each experimental year and topsoil.

The contents of N determined in tomato leaves considered normal values between 2.8-4.9% (IFA**) in both experimental years.

In 2007, on A1 topsoil, in variants fertilized with Neb and STIMUSOIL nitrogen contents were situated within the optimum limits 4.0-5.5%. On both topsoils and in both experimental years were recorded low values of nitrogen content in leaves less than 2% even in ecological unfertilized control variant. Of the fertilizers tested, NEB-26 and STIMUSOIL determined increases nitrogen content in leaves, variant in which have been obtained the largest yield increases too (Tables 2-5).

P contents in tomato leaves had placed in the optimum values of 0.40-0.65%. Fertilizers tested caused increases phosphorus content in leaf, higher values being obtained in variants fertilized with KELPAK and BIONAT (Tables 2-5).

K contents in leaves had low value less than 2.5% (IFA**), symptoms of potassium deficiency is not visible, but the content fits within the average values of 1-5%, determined by Marschner in 1995, both on topsoils in all experimental years. In these conditions, the fertilizers tested had generally significant increasesd potassium content in leaf, compared to the ecological unfertilized control (Tables 2-5).

Ca contents of leaves recorded positive values under the influence of fertilizers applied in the optimal nutrition limits (Tables 2-3).

Mg contents showed the same trend growth as the calcium contents recorded in variants fertilized, the values obtained are optimal limits of 0.35-0.80% (Tables 2-5).

The contents of Fe and Cu generally showed values exceeding the upper optimal limit but stay within normal values limits in leaves from healthy plants (IFA**). In these conditions, under the influence of treatments applied, the content of these micronutrients in the leaves presented lower values than the unfertilized ecological control, which again highlighted the balancing effect on treatment on mineral nutrition plant (Tables 2-5).

Mn and Zn contents were situated within the normal limits, characteristic for healthy plants in fertilized variants (IFA**), and higher compared with the unfertilized ecological control.

CONCLUSIONS

The application of this fertilization method and the compositions of liquid fertilizers with tested ecological features, as a method and agrochemical means for fertilization of plants, present a series of advantages:

1. Applying fertilizers with organic features resulted in generally increased contents of N, P, K, Ca, Mg, Mn and Zn in tomato leaves collected at 10 days after application of the second foliar treatment, provided that the content values determined were classified in normal and optimal supply of plants with these elements.
2. In case on contents of Fe and Cu, which presented values of the optimum upper limit in leaf, under the influence of treatments applied were recorded lower values than the unfertilized ecological control variant. By increasing the nutrient content and lower content of certain others, these fertilizers balance and optimize plant mineral nutrition.
3. Prevention and curative treatment of nutrition deficiences with tomatoes crops (with minimum costs).
4. By their contents in proteins, auxin, the tested fertilizers ensure the increase of plant resistance to the stress caused by various excessive conditions.
5. Prevention of environmental chemical pollution phenomena by stimulation of photosynthesis process and increase of root uptake, that has as a result the increase of degree of productive valorization of nutritive elements in the fertilizers applied to sol and soil reserves.

REFERENCES

1. Anton Iulia, A. Dorneanu, P. Niculiță, D. Dana, G. Bireescu, I. Oprică, 2008. *Results regarding the effects of Fertec fertilizers on tomatoes grown in glasshouse of S.C. SERE S.A., Codlea*. Lucr. Șt., seria Agronomie, vol. 51, Ed. Ion Ionescu de la Brad, Iași.

2. Anton Iulia, A. Dorneanu, D. Dana, G. Bireescu, L. Ilie, V. Coteț, I. Oprică, D. Mihalache, A. Grigore, 2009. *Research on ecological protection effect on the environment ensured by fertilization with new range of liquid fertilizers*. Scientific Papers, Series A, LII, Agronomy, Bucharest.
3. Borlan Z., et all., 1998. *Diagnosticarea stărilor negative în vegetație cauzate de insuficiența sau excesul elementelor nutritive. Recomandări pentru prevenirea şi combaterea dereglărilor de nutriție la principalele culturi*. Ed. Tehnică Agricolă.
4. Burzo I., Elena Delian, Aurelia Dobrescu, Viorica Voican, Liliana Bădulescu, 2004. *Fiziologia plantelor de cultură. Vol. I, Procesele fiziologice din plantele de cultură*. Ed. Ceres, Bucureşti.
5. Cioroianu T., C. Sîrbu, M. Dumitru, A. Dorneanu, D. Ştefănescu, 2009. *Îngrăşăminte neconvenționale - Fertilizanți lichizi*. Ed. EstFalia.
6. Marschner H., 1995. *Mineral nutriție of higher plants*. Londra.
7. ***http/www_fertilizer_org-ifa-publicat-html-pubman.
8. ****Metodologia de analiză a plantei pentru evaluarea stării de nutriție minerală*, 1980. Răuță C. şi Chiriac A. (Redactori coordonatori), ICPA.

Table 2

Experimental data on the effect of liquid fertilizer with ecological features NEB 26, STIMUSOIL, KELPAK, BIONAT on the macro and microelements content of tomatoes leaves, DACIA cultivar, 2006 (A1-600 g peat + 300 mg NPK a.s./kg soil)

Treatment	N	P	K	Ca	Mg	Fe	Mn	Zn	Cu
	%					ppm			
Control unfertilized in soil	3.360	0.564	1.04	3.44	0.62	325	130	51	16
NEB-26	3.899	0.608	2.00	4.47	0.78	235	180	62	13
STIMUSOIL	3.308	0.556	2.00	4.40	0.74	278	170	66	12
KELPAK	3.617	0.572	1.16	3.86	0.71	247	170	63	11
BIONAT	3.435	0.684	1.40	4.04	0.82	203	140	62	17
Optimal limits * (Bergmann W., 1992)	4-5.50	0.40-0.65	3.00-6.00	3.00-4.00	0.35-0.80	107-50***	40-100	20-70	7-15
Optimal contents in mature young leaves (IFA**)	2.7	0.5	2.9	1.2	0.4	119	76	24	7
Normal values in leaves from healthy plants (IFA**)	2.8-4.9	0.4-0.7	2.7-5.9	2.4-7.2	0.4-0.9	101-291	55-220	20-85	10-16
Deficiency values on content of nutrients in leaves (IFA**)	< 2	< 0.2	< 2.5	< 1	< 0.3	-	-	-	-

**upper leaves fully developed when the first appearance of fruit*
***http--www_fertilizer_org-ifa-publicat-html-pubman*
****Methodology ICPA, 1980*

Table 3

Experimental data on the effect of liquid fertilizer with ecological features NEB 26, STIMUSOIL, KELPAK, BIONAT on the macro and microelements content of tomatoes leaves, DACIA cultivar, 2006 (A2-300 mg NPK a.s./kg soil)

Treatment	N	P	K	Ca	Mg	Fe	Mn	Zn	Cu
	%					ppm			
Control unfertilized in soil	3.238	0.552	1.66	3.67	0.69	391	210	56	18
NEB-26	3.285	0.500	2.28	6.23	0.72	318	200	72	16
STIMUSOIL	3.350	0.588	2.20	4.94	0.68	331	220	65	15
KELPAK	3.247	0.552	2.08	5.05	0.53	398	224	74	12
BIONAT	3.332	0.556	2.28	5.34	0.58	372	200	60	17
Optimal limits * (Bergmann W., 1992)	4-5.50	0.40-0.65	3.00-6.00	3.00-4.00	0.35-0.80	107-250***	40-100	20-70	7-15
Optimal contents in mature young leaves (IFA**)	2.7	0.5	2.9	1.2	0.4	119	76	24	7
Normal values in leaves from healthy plants (IFA**)	2.8-4.9	0.4-0.7	2.7-5.9	2.4-7.2	0.4-0.9	101-291	55-220	20-85	10-16
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Table 4

Experimental data on the effect of liquid fertilizer with ecological features NEB 26, STIMUSOIL, KELPAK, BIONAT on the macro and microelements content of tomatoes leaves, DACIA cultivar, 2007 (A1-600 g peat + 300 mg NPK a.s./kg soil)

Treatment	N	P	K	Mg	Fe	Mn	Zn	Cu
	%				ppm			
Control unfertilized in soil	3.740	0.496	1.92	0.56	381	215	72	18
NEB-26	4.080	0.600	1.84	0.58	351	289	64	1\8
STIMUSOIL	4.080	0.590	2.05	0.60	375	293	69	16
KELPAK	3.670	0.491	2.08	0.64	365	293	95	12
BIONAT	3.670	0.492	1.98	0.50	373	248	88	13
Optimal limits * (Bergmann W., 1992)	4-5.50	0.40-0.65	3.00-6.00	0.35-0.80	107-250***	40-100	20-70	7-15
Optimal contents in mature young leaves (IFA**)	2.7	0.5	2.9	0.4	119	76	24	7
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Table 5

Experimental data on the effect of liquid fertilizer with ecological features NEB 26, STIMUSOIL, KELPAK, BIONAT on the macro and microelements content of tomatoes leaves, DACIA cultivar, 2007 (A2-300 mg NPK a.s./kg soil)

Treatment	N	P	K	Mg	Fe	Mn	Zn	Cu
	%				ppm			
Control unfertilized in soil	2.040	0.480	1.52	0.42	383	294	76	19
NEB-26	3.190	0.570	1.88	0.44	333	262	50	14
STIMUSOIL	3.530	0.535	1.80	0.40	331	222	82	12
KELPAK	3.247	0.582	1.96	0.40	353	294	98	15
BIONAT	3.330	0.552	1.70	0.44	330	291	95	14
Optimal limits * (Bergmann W., 1992)	4-5.50	0.40-0.65	3.00-6.00	0.35-0.80	107-250***	40-100	20-70	7-15
Optimal contents in mature young leaves (IFA**)	2.7	0.5	2.9	0.4	119	76	24	7
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