RESEARCH ON AGROCHEMICAL INDICATORS RELEVANT FOR THE FERTILITY OF NUTRITIVE SUBSTRATE FROM THE HIGH TUNNEL IN FOLIARY FERTILIZED TOMATOES

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Abstract

Soil analyzes showed an agrochemically optimized soil that has a pH neutral, slightly alkaline, with a high humus content and a very good supply of phosphorus and potassium. Nitrates are well represented in the superficial layers of the soil at the root system level, especially in the early vegetative phenophases, and then to the end of the cycle of culture there is a reduction in their level. These results were obtained as a consequence of a complex fertilization program where foliar fertilization resulted in an active nutrition, favoring bioavailability and translocation of nutrients in the soil).

Key words: soil fertility, agrochemical indicators, foliar fertilizers, organic fertilizers and minerals, tomatoes.

INTRODUCTION

Tomato technology in protected areas involves high doses of organic fertilizers and minerals with the following objectives:

- optimizing the organic matter content in soils as nutrient substrate and soil physical control
- agrochemical improvement of main nutrients N, P, K, S, Ca, Mg and trace elements in accordance with the intensive need of consumption of vegetables and the prevention of nutritional disorders (deficiency and excess);
- compared to other horticultural technologies, also intensive, for vegetables, regardless of technology, the measures of organic and complex-mineral fertilization aims on the one hand to maintain the determined original fertility and then to meet the intensive consumption of vegetables without intensively nutrient risk areas and limits.

Tomato crop in tunnels is initiated on a soil rich in organic (animal manure) and mineral component. For these reasons, in case of the tomato crop, the agrochemical interpretation refers to the optimum and to the definition of risk limits.

MATERIAL AND METHOD

Experiments were conducted in the solarium/tunnel from Sântandrei. In experiments Cronos F1 hybrid have been used.

The cultivated soil presents agrochemical indicators favourable to an intensive culture of tomatoes, due to the formation components and fertilization program specific to such a system.

The culture technology was the one recommended in the literature for growing tomatoes in high tunnel.

The experimental protocol includes an assortment of foliar fertilizers due to organo-mineral fertilization specific to the tomato crop (Table 1).

Table 1

The foliar fertilizers assortment applied to the tomatoes cultivated in the high tunnel at Santandrei

No. var.	Foliary assortment	Concentration of solution %
1	Control	-
2	Folplant 231	1%
3	Folplant 411	1%
4	Polyfeed 19-19-19	1%
5	Basfoliar 36 Extra	1%
6	Ecofert 1 + Ecofert 2	1%
7	Sulphate of magnesium	1%

Foliar fertilization was applied in the morning, by fine spraying on plants. Three foliar treatments were applied: first at the appearance of the first inflorescence, and the next two every 14 days.

In the analytical approach of soil samples, the following methodology were taken into account:

- pH was determined in aqueous suspension, soil-solution ratio 1:2.5 by potentiometric method with a glass-calomel electrode pair;
- humus was determined by wet oxidation and titrimetric dosing (according to Walkley-Black, modified according to Gogoaşă);
- N_t was determined by Kjeldahl method;
- P-mobile (accessible, changeable) was determined by Egner-Riehm-Domingo (P-AL) method, colorimetrically, in extraction with ammonium acetate-lactate;
- K-Mobile (access, changeable) in the soil was dosed in the same extract of ammonium acetate-lactate (Egner-Riehm-Domingo) (K-AL) by flame photometration;
- $N\text{-}NO_3$ in soil was colorimetrically dosed with phenoldisulfonic acid after a preliminary extraction with 0.1 n K_2SO_4.

RESULTS AND DISCUSSION

The soil from high tunnel has favourable initial soil fertility indicators provided by the formation components but agrochemically this soil evolves as a nutritive medium of an intensive farm (Table 2).

Table 2

Agro-chemical soil indicators in the high tunnel at Sântandrei

Crt. no.	Foliary assortment	Soil analysis					
		pH_{H2O}	Humus %	I_N	P-AL ppm	K-AL ppm	N-NO_3 ppm
1	Control sprayed with water	7.3	6,24	6,01	124	389	107
2	Folplant 411	7.2	6,11	5,92	129	420	120
3	Polyfeed 19-19-19	7.2	6,18	6.00	134	433	116
4	Ecofert 1+ Ecofert 2	7,3	6,20	6,00	132	400	110
5	Sulfat Mg	7,2	6,22	6,01	130	388	109

The soil analyses from the tunnel under study brings closer the agrochemical conditions to the greenhouse soil, because the organic and mineral fertilization have strongly influenced the soil fertility in the tunnel.

The soil reaction characterizes a neutral-slightly alkaline medium. Humus content is specific to a very large supply, but not excessive. There are very good supply conditions with phosphorus, nitrogen and potassium, but not excessive, which proves that the soil from the tunnel at Sântandrei maintains a nutritive balance favorable to tomato culture.

The soil fertility regime in the high tunnel, with a high content of humus, phosphorus, potassium and nitrogen, as well as the provision of a normal water-air regime fosters a productive development of nitrates in the soil (Fig. 1-2).

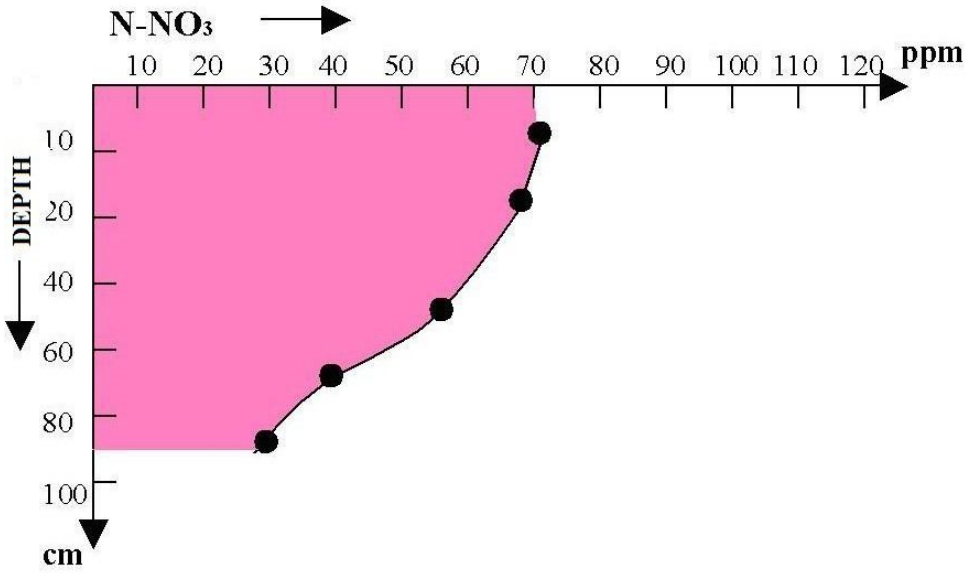

Fig. 1. Nitrates' representation ($N\text{-}NO_3$) in solar greenhouse soil at Oradea (the average determination during the early spring)

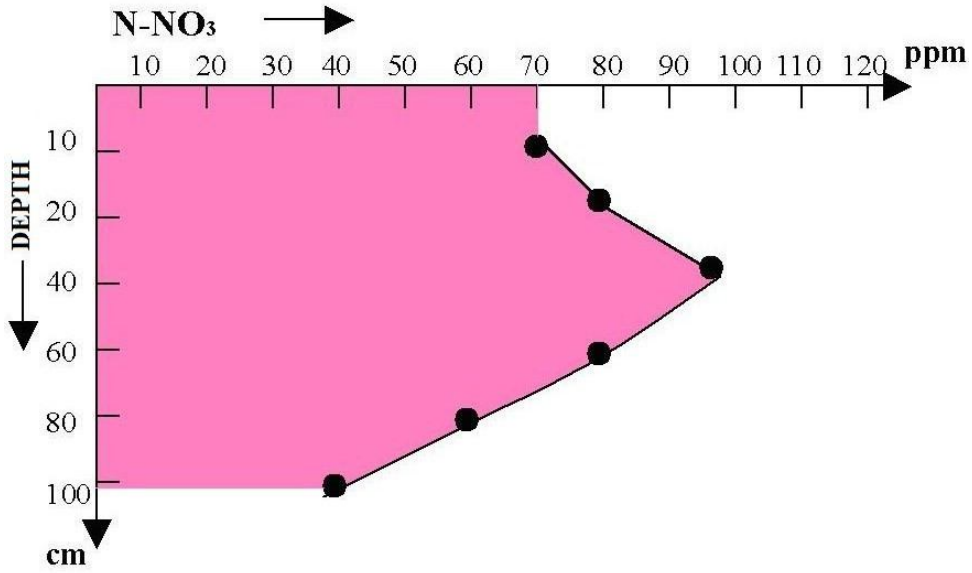

Fig. 2. Nitrates' representation ($N\text{-}NO_3$) in solar greenhouse soil at Oradea during the last harvests

CONCLUSIONS

1. Foliar fertilizations find their economic justification in tomato crops, being a species with a high specific consumption of macro- and microelements, on agrochemically optimized soil by organo-mineral

fertilizations in vegetative phenophases with a maximum consumption of nutrients.

2. Foliar fertilizations that have proven their efficiency are those with fertilizers having a balanced chemical composition and complex in macro (N, P, K) and trace elements (Fe, Mn, B, Zn, Cu, Mo). Some of these foliar fertilizers contain biologically active substances that complete the role of physiological and biochemical stimulation of plant metabolism having an essential involvement in regulating and sustaining photosynthesis (Fe, Mn, Cu).

3. Rigorous experimentation of foliar fertilizers shows that these compositions with extraroot application can be included in the context of soil fertilization measures as an "integrated" and complementary measure.

4. Extraroot fertilization causes a higher emission of protons (H+ ions) at root level favoring the ion exchange and an active nutrition so that the soil nutrient bioavailability and translocation is positively changed.

5. Soil reaction is specific to high tunnels soils (neutral to slightly alkaline).

6. Organic humificable matter is well represented, resulting in optimum values of nitrogen, phosphorus and potassium.

7. It is clear from " nitrates mirror " that initially the nitrogen reserves can maintain within the first phenophases the vegetation and tomato production and in late phenophases the nitrogen is reduced, a phenomenon that promotes ripening and the end life cycle of the crop.

8. It is recommended periodic rigorous analysis of soil to prevent the risk areas due to intensive crop-specific fertilization.

REFERENCES

1. Apahidean S., Maria Apahidean, 2000, Legumicultură specială, Ed. Risoprint, Cluj-Napoca;
2. Apahidean Al.S., Maria Apahidean, 2004, Cultura legumelor şi ciupercilor, Ed. AcademicPres, Cluj-Napoca, 177-187;
3. Avarvarei I., Velicica Davidescu, R. Mocanu, M.Goian, C. Caramete, M. Rusu, 1997, Agrochimie, Ed. Sitech, Craiova;
4. Borlan Z., Cr. Hera, D. Dornescu, P. Kurtinecz, M. Rusu, I. Buzdugan, Gh. Tănase, 1994, Fertilitatea şi fetilizarea solurilor (Compendiu de Agrochimie), Ed. CERES, Bucureşti;
5. Ciofu R., Nistor Stan, Victor Popescu, Pelaghia Chilom, Silviu Apahidean, Arsenie Horgoş, Viorel Berar, Karl Fritz Lauer, Nicolae Atanasiu, 2004, Tratat de legumicultură, Ed. CERES, Bucureşti, 129-136, 617-643.
6. Davidescu D., Velicica Davidescu, 1999, Compendium Agrochimic, Ed. Academiei Române, Bucureşti;
7. Lăcătuş V., 2006, Agrochimie, Ed. Terra Nostra;
8. Mărghitaş Marilena, M. Rusu, 2003, Utilizarea îngrăşămintelor şi amendamentelor în agricultură, Ed. Academic Press, Cluj-Napoca;

9. Mărghitaş Marilena, M. Rusu, Tania Mihăiescu, 2005, Fertilizarea Plantelor Agricole şi Horticole, Ed. Academic Press, Cluj-Napoca;
10. Mocanu R., Ana Maria Mocanu, 2003, Agrochimie, Ed. Universitaria, Craiova;
11. Popa Alina Grigoriţa, 2007, Teză de doctorat, Optimizarea agrochimică a sistemului sol- plantă în tehnologia de cultivare în spaţii protejate a tomatelor;
12. Rusu M**.,** 1993, Agrochimie vol.II, Tipoagronomia, Cluj-Napoca, 198-399;
13. Rusu M, V. Munteanu, N. Meteş, J. Jancu, 1988, Probleme ale ptimizării agrochimice a solurilor sub influenţa măsurilor agrochimice, Analele ICCPT, vol.LVI, 261-267;
14. Rusu M., Marilena Mărghitaş, C. Băluţiu, I. Oroian, I. Zborovski, Laura Paulette, M.I. Oltean, 2001, The effects of several foliar compositions in the agrochemical optimization of the soil-plant system, Publ. CIEC, Role of Fertilizers in Sustainable Agriculture, 415-418;
15. Rusu M., Marilena Mărghitas, I. Oroian, Tania Mihăiescu, Adelina Dumitraş**,** 2005, Tratat de Agrochimie, Ed. CERES, Bucureşti;