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Research regarding the effect of foliar fertilizers on the agrochemical characteristics of nutritive soil in the greenhouse culture of tomatoes

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Abstract The greenhouse soil we studied has a neutral to slightly alkaline reaction, a high content of humus and humified organic matter, resulting in a regime of excessive nitrogen and potassium, which may be at a disadvantage and imbalance toward the low representation of phosphorus.

Key words

soil fertility, agrochemical optimization, organic and mineral fertilizers, foliar fertilizers, risk areas, tomatoes

The technology of tomatoes grown in protected spaces, is relate to the use of great quanrities of organic and mineral fertilizers with the following objectives:

- optimization of organic matter content (o.m.) in soils as nutrient substrate and soil physical control;
- agrochemical improvement of the main nutrients N, P, K, S, Ca, Mg and microelements, according to the intensive vegetable consumption and prevention of nutritional disorders (deficiency and excess);
- in comparison to other intensive horticultural technologies, in the case of vegetables, regardless of technology, the organic and complex-mineral fertilization measures, deals on the one hand with the maintaining of a specific initial fertility and, on the other hand with the satisfying of intensive vegetable consumption, without intensive nutrient risk limits (2, 3, 4, 5, 6, 7).

The tomato culture, takes place in protected areas, in a greenhouse having a soil made of mixtures and sublayers, a soil wich usually relates to the organic component (animal waste, plant debris, compost, peat); its fertility is also finalized by mineral intake.

Thus, in the field of vegetable culture, tomatoes included, agrochemical interpretations relate to the optimal domain and define the situations at risk (1, 8, 9, 10, 11).

Material and Methods

The experiments were conducted in the vegetable growing greenhouse, within USAMV Cluj-Napoca. We have used the Cronos F1 hybrid.

The agrochemical indicators of the greenhouse soil are favorable for an intensive culture of tomatoes, due to its components, as well as to the fertilization program used in such cases.

The technology applied to this culture is the one recommended by the specialized literature for growing tomatoes in greenhouses.

The experimental protocol includes a range of foliar fertilizers after an organo-mineral fertilization, specific for the tomato crops (table 1).

Table 1

The foliar fertilizers assortment applied to greenhouse cultivated tomatoes
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Var. no.	Foliar assortment	Solution concentration %
1	Water sprayed witness	-
2	Folplant 231	1%
3	Ferticare 14-11-25	1%
4	Ferticare 24-8-16	1%
5	Polyfeed 19-19-19	1%

Foliar fertilization was done in the morning, by sprinkling the plants. Three treatments were applied: the first treatment was administered at first inflorescence, and the other two treatments at 14 days time intervals.

For he analytical approach of the soil samples, we used the following methodology:

- the pH was determined in aqueous suspension, 1:2,5 soil-solution proportion; using the potentiometric method, with a couple of electrodes bottle-calomel;
- the humus was determined by wet oxidation and titrimetric solution (after Walkley-Black, cocoon alteration);
- The N_t was determined by using the Kjeldahl method;
- P-mobil (accessible) was determined by using the Egner-Riehm-Domingo method (P-AL), colorimetric, in extraction with ammonium lacto-acetate;
- K-mobil (accessible, changeable) from the soil, was used in the same ammonium lacto-acetate extract (Egner-Riehm-Domingo) (K-AL), by flame photometry;
- $N\text{-}NO_3$ in the soil was dosed colorimetrically with phenol sulfuric acid, after an extraction with 0,1 n K_2SO_4.

Results and Discussions

The "greenhouse" soil has initially favorable indicators of fertility, assured by its formative components; but from an agrochemical point of view, this soil, as part of a nutrient intensive farm, is evolving. (Table 2).

Table 2

The agrochemical indicators of the greenhouse soil cultivated with tomatoes

Var No.	Applied foliar assortment	Soil analysis					
		pH_{H2O}	Humus %	I_N	P-AL ppm	K-AL ppm	$N\text{-}NO_3$ ppm
1	Water sprayed witness	7,2	7,76	7,60	70	386	120
2	Folplant 231	7,4	7,56	7,40	79	398	118
3	Ferticare 14-11-25	7,2	7,68	7,58	77	408	124
4	Ferticare 24-8-16	7,3	7,74	7,64	70	402	144
5	Polyfeed 19-19-19	7,3	7,02	6,87	98	420	126

Soil reaction (pHH_2O) is in the neutral-weak alkaline environment, within a soil physico- chemical enviornment, that is specific to the greenhouse soil, and to a normal nutrition of the tomatoes.

The humus and the humified organic matter are in high values, specific to a well prepaired greenhouse soil, maintained in the organic component, that can sustain a diet with an excessive supply of azoth (after I_N and $N\text{-}NO_3$ accumulation).

The soil has a low and medium phosphorus supply, which may be at a disadvantage and an imbalance regarding the azoth and potassium, wich are in excess.

The greenhouse soil fertility regime, having a high content of humus and azoth, toghether with a normal regulation of water and air, favor a productive development of nitrates in soil (Figures 1, 2, 3, 4).

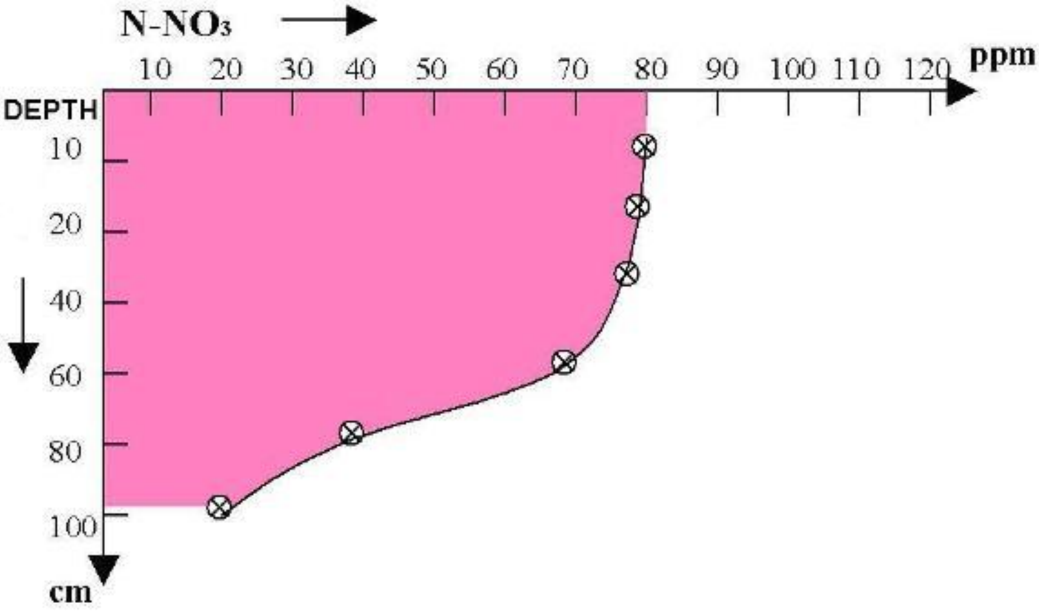

Fig. 1 Nitrates' representation (N-NO_3) in greenhouse soil at the beginning of first cycle

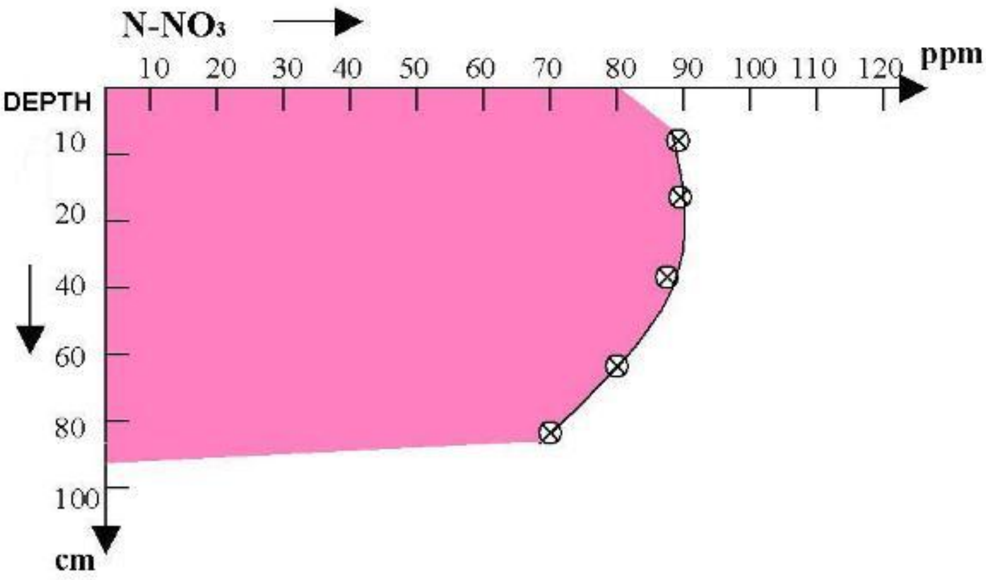

Fig. 2 Nitrates' representation (N-NO_3) in greenhouse soil at ½ and 1/3 of the first cycle

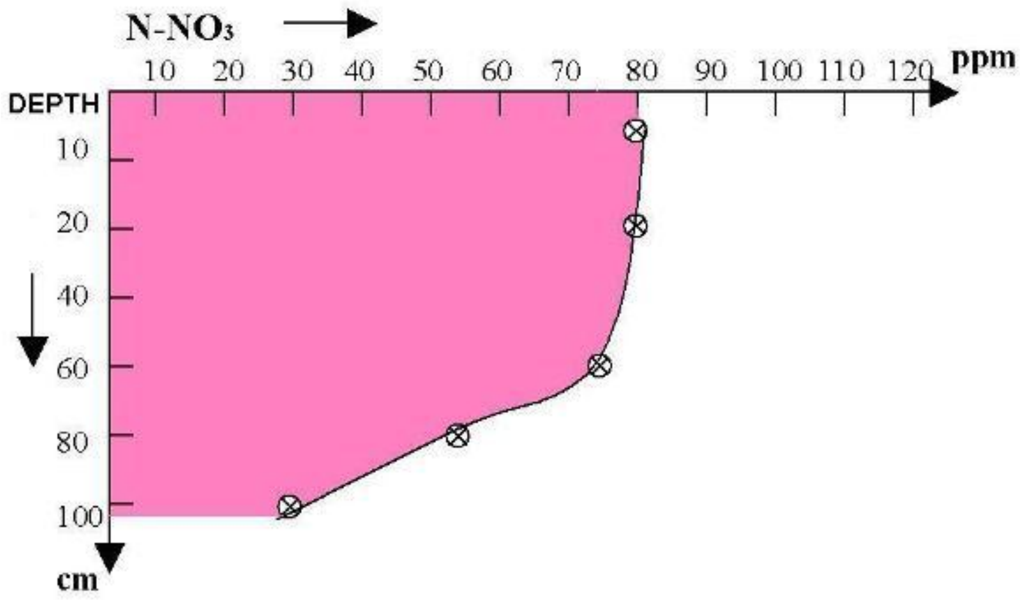

Fig. 3 Nitrates' representation ($N\text{-}NO_3$) in greenhouse soil at the beginning of the second cycle

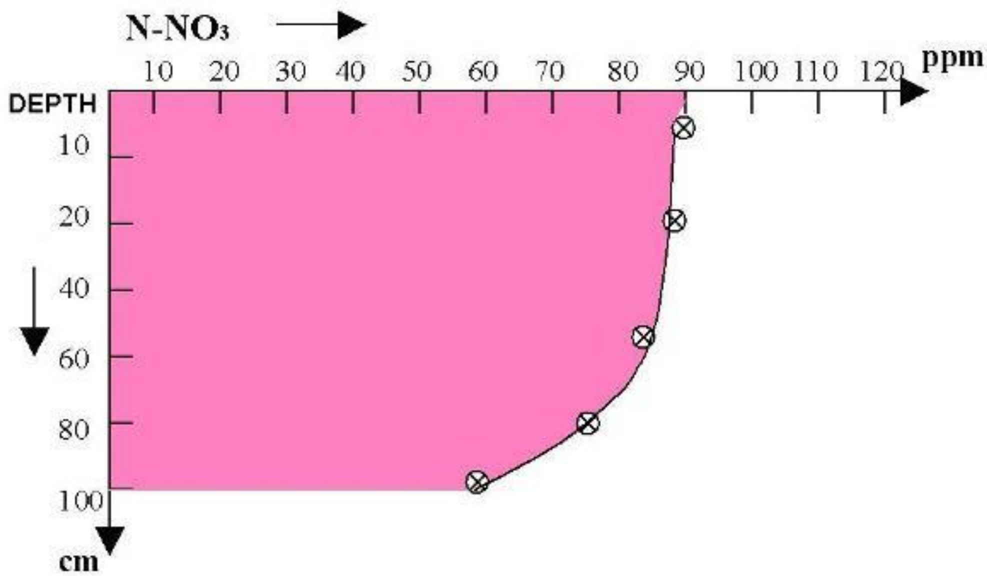

Fig. 4 Nitrates' representation ($N\text{-}NO_3$) in greenhouse soil at ½ and 1/3 of the second cycle

The dynamic of the greenhouse soil is not identical to the field cultivated tomato soil, because, when protected, fertilized and watered, the soil maintaines high concentrations $N\text{-}NO_3$ in surface area, and areas with roots, all throughout the two active cycles.
The "mirror nitrates" situation in greenhouse soil may suggest prevention of a certain impact due to high accumulation of these surface ions, because of a poor phosphates representation.

Conclusions

1. Foliar fertilization find their economic justification for the tomato crops, being a species with a high macro-and microelements specific consumption, on agrochemical optimized soils, by organo-mineral fertilization, through the vegetative phenophase with maximum consumption of nutrients.

2. Foliar fertilization that have proved effective are those fertilizers having a balanced and complex macroelements (N, P, K) and micronutrients

(Fe, Mn, B, Zn, Cu, Mo) chemical composition. Some of the foliar fertilizers contain biologically active substances that add to their role of physiological and biochemical stimulation of vegetal metabolism, with an essential involvement in photosynthesis adjustment and sustainment (Fe, Mn, Cu).

3. A rigorous experimentation of foliar fertilizer shows that these extraradicular fertilization compositions can fit in the context of soil fertilization, as an "integrated" and complementary measure .

4. Extraradiculare fertilization results in a higher emission of protons (H^+ ions) at the root level, favoring ionic exchange and a more active nutrition, so as the bioavailability and translocation of nutrients from the soil changes to positive.

5. Soil reaction is specific to that of the greenhouse soils (neutral to slightly alkaline).

6. The humified organic matter is well represented, resulting in excessive amounts of azoth.

7. Potassium levels are also high.

8. Phosphorus values are average to poor, in disequilibrium with the high levels of azoth and potassium.

9. Regular thorough soil analysis is recommended, to prevent risk, due to large accumulation of azoth and potassium because of a poor phosphates representation.

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