RESEARCH REGARDING THE INFLUENCE OF FOLIAR FERTILIZATION FOR FIELD AND GREENHOUSE CULTIVATED TOMATOES ON NUTRIENTS TRANSLOCATION IN PLANTS (COMPARATIVE STUDIES)

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Abstract

The parallel interpretation of soil analysis, along with the diagnosis of foliar and root system, in the conditions of applying foliar fertilizers, indicates an increased physicochemical activity and exchange in the root system, the rhizosphere, so that translocation and bioavailability of nutrients in the soil, has a positive change.

Key words: foliar diagnosis, root system, soil, foliar fertilizers, tomatoes.

INTRODUCTION

An intensification of vegetable production, involves the use of modern technologies, the introduction of crop varieties and hybrids productivity, and also, fertilizer use, in order to obtain the optimum agrochemical soil.

The biological potential of plants, genetically determined, can not be valued and maintained, unless all vegetation factors, including those relating to soil, will be provided at optimal levels both quantitatively and also qualitatively.

Knowing the soil fertility potential and directing the agrochemical development towards optimum levels, in terms of response and organic matter and nutrients supply, are the requirements of a system in which each factor should bring a substantial contribution to achieving high, quality crops.

The applying of fertilizers to vegetable crops, should be based on detailed knowledge of the principles of mineral nutrition and soil fertility properties.

When preparing for fertilization programs, we take into account the following aspects (Lixandru, 2006):

- the amount of nutrients extracted from the soil during production, according to the productive potential of the species;
- the physico-chemical characteristics of soil and their potential fertility;
- the plant rate of nutrients use of fertilizing elements;

- the plant biological and ecological property and the applied technology.

The soil nutrient content is determined for each soil agrochemical mapping (Davidescu, Davidescu, 1999).

For an accurate assessment of the plant's needs, foliar diagnostic tests are done, which can determine the dynamic accumulation of nutrients in different plant organs (leaves, stems, etc.), the values are compared with previous optimal values, already known for each species (Table 1).

Table 1

Plant parts and harvest timing of vegetative organ samples in different groups of plants for diagnosis (Davidescu V., 1997)

Group	Plant	Sample time	Plant part	Sample size
Solano - fruiting	Tomatos	Early binding fruit blossoms 1-2-3	Peţiol (NO_3, H_2PO_4)	From 20 plants
		After binding, the entry of the first ripe fruit blossom	Limb (N, P, K)	From 20 plants
	Pepper	Early flowering	Leaves that recently reached maturity	From 20 plants
		In full fruition	Leaves that recently reached maturity	From 20-25 plants

The quantities of fertilizer to be administered to tomato crops should be linked with the culture. Thus, in greenhouses large quantities of fertilizer as used, larger than in field crops; and in greenhouses, the quantities are even bigger than those used in greenhouses and field culture, due to the higher production potential, to a more abundant watering and different values of climatic factors (temperature and humidity) (Heuvelink, 2006; Apahidean, Apahidean, 2004; Ciofu et al., 2004).

Phasial foliar fertilization was applied in order to fill the needs of plants during the vegetation phases. Foliar fertilization is done with solutions of mineral fertilizers.

Liquid foliar fertilizers are complex solutions that have macro- and micronutrients, applicable at the extraroot, providing nutrients entering ions especially through the leaves, stimulates the uptake, translocation and assimilation of nutrients from the soil and apply it, with favorable effects on both the quantity and quality of agricultural hotricultural production (Rusu et al., 2001, 2005; Mărghitas et al., 2003, 2005).

This type of fertilization is recommended especially for crop protected areas, during critical periods of maximum consumption, in the

morning or in the evening, when temperatures are lower, so that the solution penetrates slowly into leaf and losses through evaporation are reduced (Apahidean, Apahidean, 2000).

Generally, foliar fertilizations are irrigated with water. Mineral absorption and nutrient consumption is closely related to water absorption and water consumption, so there is an increase in their consumption during the spring, the high values are mantained during summer, and they drop in autumn (Mocanu, Mocanu, 2003; Rusu, 1991, 1993).

Also, reports of various nutrients should be balanced and correlated with the phases of vegetation and environmental conditions existing during the vegetation period (Lăcătuș, 2006; Voican, Lăcătuș, 1998).

MATERIAL AND METHOD

The applying of fertilizers to field tomato, greenhouse and solarium culture is done by using a "conventional intensive system", through which, the species and the soil has a known and recognized interaction of organic fertilizers with simple and complex minerals. The experimental protocol on the application of foliar fertilizers has considered the use of fertilizing resources especially in the agro-chemical optimization of soil as a determining factor in the increase of foliar composition. Thus, the variants of application of foliar fertilizers are models of use in an "integrated system" fertilization.

For the field tomatos culture we used the "Unirea" type.

The types of foliar fertilizers in field culture were applied to a agrochemical fund resulting from the interaction with organic fertilizers (semi-fermented manure 50t/ha) with complex application of mineral fertilizers (N_{120} P_{120} K_{120}) (Table 2).

Table 2

The foliar fertilizers assortment applied to field cultivated tomatoes at Oradea

No. var.	Foliar type	Solution concentration%
1	Water sprinkled witness	-
2	Nutrifag	1%
3	Bionutrifag F	1%
4	Ferticare 24-8-16	1%
5	Polyfeed 19-19-19	1%

For the greenhouse tomatoes we used the Cronos- F1 hybrid, and were applied the following foliar fertilizers on agrochemical optimized soil (Table 3).

Table 3

The foliar fertilizers assortment applied to solar greenhouse cultivated tomatoes at Oradea-Santandrei

No. var.	Foliar assortment	Solution concentration (%)
1	Witness	-
2	Agrofeed 17-17-17	300kg/ha in 2 stages
5	Fitofolis 411	1%
10	Lecol 90-60-60	0,5%

Foliar fertilization was done in themorning, by spraying the plant. Three foliar treatments were applied: first at the appearance of the first inflorescence and the other two every 14 days.

Soil analyzes were performed by using the following methods:

- the pH was determined in aqueous suspension, the soil-solution ratio 1:2,5, the potentiometric method with a glass-calomel electrode couple;
- the humus was determined by wet oxidation and titration dose (after Walkley-Black, Doughnut change);
- the N_t was not determined by the Kjeldahl method;
- the P-mobil (accessible) was determined by the Egner-Riehm-Domingo (P-AL) method, colourmethrical, with ammonium acetate-lactate extraction;
- the K-mobile (available, exchangeable) was dosed in the same soil extract ammonium acetate-lactate (Egner-Riehm-Domingo) (K-AL), by flame fotometring;
- the N-NO3 in soil was dosed after a colourmethrical fenoldisulfonic acid extraction prior to 0,1 n K_2SO_4.

Plant analyzes were performed by using the following methods:

- the N_t was not determined by the Kjeldahl method;
- $N\text{-}NO_3$ in dry plant material, in 2% acetic acid extract, colourmethrical fenoldisulfonic acid (after Zinkevici, 1978);
- the P_t- total phosphorus was determined colorimetrically in plant ashes.

RESULTS AND DISCUSSION

The applying of fertilizers to field tomato, greenhouse and solarium culture is done by using a "conventional intensive system", through which, the species and the soil has a known and recognized interaction of organic fertilizers with simple and complex minerals. The experimental protocol on the application of foliar fertilizers has considered the use of fertilizing resources especially in the agro-chemical optimization of soil as a determining factor in the increase of foliar composition. Thus, the variants of application of foliar fertilizers are models of use in an "integrated system" fertilization.

For the field tomato crop, the interpretation of soil analysis along with the diagnosis of foliar and root system, reveal the fact that all indicators, without exception, in the conditions of applying foliar fertilizers, the activity and physico-chemical exchange in the root system and the rhizosphere is activated, so that translocation and bioavailability of nutrients from soil to plant undergo positive changes (Table 4).

Table 4

The influence of foliar fertilization in the tomatoes cultivated in the field up on the translocation of the nutrients in plants

No. var.	Applied foliar assortment	Root analysis (%/s.u.)			Leaf analysis (%/s.u.)		
		Nt	Pt	Kt	Nt	Pt	Kt
1	Water sprinkled witness	1,58	0,17	1,58	2,32	0,20	2,18
2	Nutrifag	1,62	0,16	1,56	2,59	0,25	2,62
3	Bionutrifag F	1,66	0,16	1,47	2,84	0,22	2,55
4	Ferticare 24-8-16	1,84	0,15	1,44	2,99	0,21	2,72
5	Polyfeed 19-19-19	2,02	0,17	1,44	3,12	0,26	2,93

It can be concluded that in the conditions of fertile soil grown tomatoes, initially ferilized with organo-mineral nutrients and supplementary (phasial) complex with N, P, K and N, the appling of foliar fertilizer favor the nutrition conditions in the soil, from the root system, for bio-offs and translocation of nutrients.

For the greenhouse tomato culture, the interpretation of soil analysis along with the diagnosis of foliar and root system, reveal the fact that confirm the results obtained with the field tomato culture, where we achieved nutritional positive effects on the root system, causing a better

translocation of foliar fertilizers towards the aerial organs of plants (Table 5).

Table 5

The influence of foliar fertilization in solar greenhouse cultivated tomatoes on the translocation of nutrients in plants

No. var.	Foliar assortment	Root analysis (%/s.u.)			Leaf analysis (%/s.u.)		
		Nt	Pt	Kt	Nt	Pt	Kt
1	Water sprinkled witness	1,64	0,184	1,60	2,38	0,190	2,06
2	Agrofeed 17-17-17	1,72	0,172	1,53	2,66	0,236	2,68
5	Fitofolis 411	1,93	0,169	1,42	3,06	0,206	2,64
10	Lecol 90-60-60	2,06	0,174	1,36	3,16	0,263	2,84

Considering that the indicators of nutrient accumulation show a higher level of their tissue in the greenhouse grown tomatoes, we conclude that the foliar fertilizers favor the nutrition soil conditions, the absorption and translocation of nutrients applied to soil towards the aerial vegetative organs.

CONCLUSIONS

Foliar fertilizations are justified for the tomato crops, on agrochemical optimized soils, by organo-mineral fertilizations, in vegetative phenophases with intensive nutrients use (at firstinflorescence), being a species with high specific consumption of nourishing elements.

Foliar fertilizations which proved their efficiency are those with balanced and complex macro elements (N, P, K) and microelements (Fe, Mn, B, Zn, Cu, Mo) composition. Some of these also contain biologically active substances, that replenish the role of these fertilizers, stimulating physiologically and biologically the vegetal metabolism, playing an essential part in controlling and sustaining of the photosynthesis (Fe, Mn, Cu).

For a long time, the extraroot fertilization effect was stressed upon the the advantage of direct use of some applied compositions on vegetation, especially on the plant leaves. The infiltration of nutrients in the leaves, makes them effectively fit in the plant metabolic processes, and a priming of the synthesis of organic substances produced.

In all research on the effect of foliar fertilizers, the results become increasingly contradictory even during the diversification and multiplication

of these products. A lot of research underlines the effect of composition leaf attention on quantitative indicators of plants, to which many other roles that emphasize results and their qualitative effects on crops and especially in recent decades highlights the role of these compositions in regulating foliar nutrition and fertilization.

From this latter view-point, it is accredits more the idea that foliar fertilization has a secondary role, does not exclude but complement soil fertilization, and the effect of foliar fertilization is assured to the extent that soil has an optimum agrochemical. In other words, the effects of fertilization on soil conditions the effects of appliying foliar fertilizers.

The present research, the application of foliar composition of field tomato and greenhouse tomato crops, proves a good effect of some fertilizers in foliar nutrient accumulation in plants. These compositions support the mineral nutrition of tomato for the optimal agrochemical.

The separate analysis of the root system and leaves, being appreciated as such, and the positive changes in rhizosphere of tomato plants, shows that absorption, translocation and mineral nutrition in general have a positive effect when applying foliar fertilizers especially on the background of an optimal agrochemical level.

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