# RESEARCH REGARDING THE EFFECT OF THE FOLIAR FERTILIZERS OVER THE SOLAR GREENHOUSE CULTIVATED TOMATO PRODUCTION

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***Abstract***

*The foliar fertilizers are complex liquid solutions, having macro- and microelements, used extraradicular, ensuring that nutritional ions penetrate into the leaves, simulating absorption, translocation and assimilation of the nutrients into the soil, with positive effects over the quantity and quality level of horticultural farming. (Rusu et al., 2001, 2005; Mărghitas M. et. al., 2005).*

*In our experience, the foliar fertilizer types applied to the solar greenhouse cultivated tomatoes, had different effects over the quality and quantity of production.*

*The best results were obtained on those fertilized with foliar types having a complex and balanced chemical content, the foliar fertilizers type: Nitrophoska 10- 4- 7, Multifertil 5-10-10, Fitofolis 141 si Fitofolis 411.*

**Key words:** foliar fertilization, mineral fertilizer, vegetative phenophases, balanced nutrition, tomatoes.

## INTRODUCTION

Compared to field grown cultures, the cultures grown in protected spaces require higher quantities of nourishing elements, due to an increased productivity rate, obtained in such cultures (Heuvelink E., 2006; Apahidean Al.S., M. Apahidean, 2004).

Mineral absorption and the nourishing elements consumption are directly connected with water absorption and water use, so that, during spring we notice a higher consumption, during summer, consumption is also increased, and these levels decrease in autumn. (Rusu M., 1991, 1993).

For stabilizing the doses for tomatoes grown in protected spaces, we must take into consideration a series of factors: the level of nourishing elements in the soil, the vegetative phases of the plants, and also a series of physical factors (light, temperature, humidity), and, lastly, we must also think about the planned production. (Ciofu R., et.al, 2004).

Furthermore, the proportion between the different nourishing elements must be balanced and correlated with the vegetation phases and environment conditions during the vegetation period. (Voican V., Lăcătus V., 1998).

The applying of fertilizers to the tomatoes grown in protected spaces is done by an intensive “conventional system of culture”, where the respective species and the soil benefit from the interaction of organic fertilizers with

mineral simple and complex fertilizers. The experimental protocol regarding the applying of foliar fertilizers, took this into account, also considering the fact that the utilizing of such fertilizing resources was done respecting the conditions of agrochemical soil optimization, the soil being a determining agent in increasing the effect of foliar fertilizers. Thus, the types chosen for applying the foliar fertilizers become models in using the foliar fertilizers in an "integrated system" of fertilization. (Popa A., 2007).

Within the framework of the experiment, foliar fertilizers were applied during the vegetation period with the purpose of completing the nourishing elements necessities of the plants, throughout the vegetation phases with maximum consumption.

Foliar fertilization is mostly recommended for protected space cultures, during critical times of maximum consumption or times of maximum efficiency, in the morning or at night, when temperature is lower, so that the solution penetrates slower into the leaf, and evaporation loss is reduced. (Apahidean S., M. Apahidean, 2000)

**MATERIAL AND METHODS**

The experiments took place in the solar greenhouse at the USAMV Cluj- Napoca, with the use the Cronos F1 hybrid. The soil used for growing the culture has all the necessary quality agrochemical particularities, such a culture recommends: neuter reaction, a bit acidic (pH 6,5), a good humifiable organic matter supply (7,15), and a high content of Nt (0,350%). The phosphorus and mobile potassium increase is very high, reaching excessive values (780 ppm P mobil and 806 ppm K mobil). The physical proprieties of the soil are favorable – seemingly normal density (1,18 g/mc) and a good porosity (65%), all suitable indicators for tomato culture. The technology applied was that recommended by the specialty literature, for the solar greenhouse grown tomatoes. The experimental protocol includes an assortment of foliar fertilizers, and also fertilizers applied to the soil (Table 1).

*Table 1*

Foliar fertilizers assortment applied to tomatoes cultivated in poliethylene tunnel

| Var. no. | Foliar assortment* | Solution concentration % |
|---|---|---|
| 1 | Witness | - |
| 2 | Fitofolis 411 | 1% |
| 3 | Fitofolis 141 | 1% |
| 4 | Kelpak | 0.2% |
| 5 | Neb – 26 | 1 l/ha |
| 6 | Nitrophoska 10-4-7 | 1% |
| 7 | Flexom | 0.2% |
| 8 | Multifertil 5-10-10 | 1% |
| 9 | Agrofeed 17-17-17-soil | 200kg/ha |
| 10 | Agroblend 15-25-10-soil | 200kg/ha |

Foliar fertilization was done in the morning, by pulverization on the plant. Three foliar treatments were applied: the first one at first inflorescence, and the other two treatments at 14 days time intervals.

**RESULTS AND DISCUSSION**

The experiments on the tomatoes grown in solar greenhouses generally confirm the significantly positive effect of foliar fertilizers over production, on an agrochemical-optimized soil (by organic-mineral fertilization).

By analyzing the obtained results (Table 2, Figure 1) we can notice the considerable positive effect of the foliar fertilizers with a chemically balanced and complex content, and also a good composition of the nourishing elements.

*Table 2*

The effect or foliar fertilization upon the production in the tomato crop (Cronos F1) from the Solarium of University of Agriculture Sciences and Veterinary Medicine Cluj-Napoca

| Var. no. | Foliar assortment | Solutions concentration | Medium production | | Difference t/ha | Difference significance |
|---|---|---|---|---|---|---|
| | | | t/ha | % | | |
| 1 | Witness | | 98.20 | 100 | 0 | - |
| 2 | Fitofolis 411 | 1% | 115.14 | 117.25 | 16.94 | *** |
| 3 | Fitofolis 141 | 1% | 113.20 | 115.27 | 15.00 | *** |
| 4 | Kelpak | 0,2 | 107.10 | 109.06 | 8.90 | * |
| 5 | Neb - 26 | 1 1/ha | 106.20 | 108.15 | 8.00 | * |
| 6 | Nitrophoska 10-4-7 | 1% | 131.24 | 133.65 | 33.04 | *** |
| 7 | Flexom | 0,2% | 112.20 | 114.26 | 14.00 | ** |
| 8 | Multifertil 5-10-10 | 1% | 122.17 | 124.41 | 23.97 | *** |
| 9 | Agrofeed 17-17-17 soil | 200 kg/ha | 126.32 | 128.64 | 28.12 | *** |
| 10 | Agroblen 15-25-10 soil | 200 kg/ha | 124.17 | 126.45 | 25.97 | *** |

LSD (5%) = 6.54 LSD (1%) = 10.12 LSD (0.1%) = 14.30

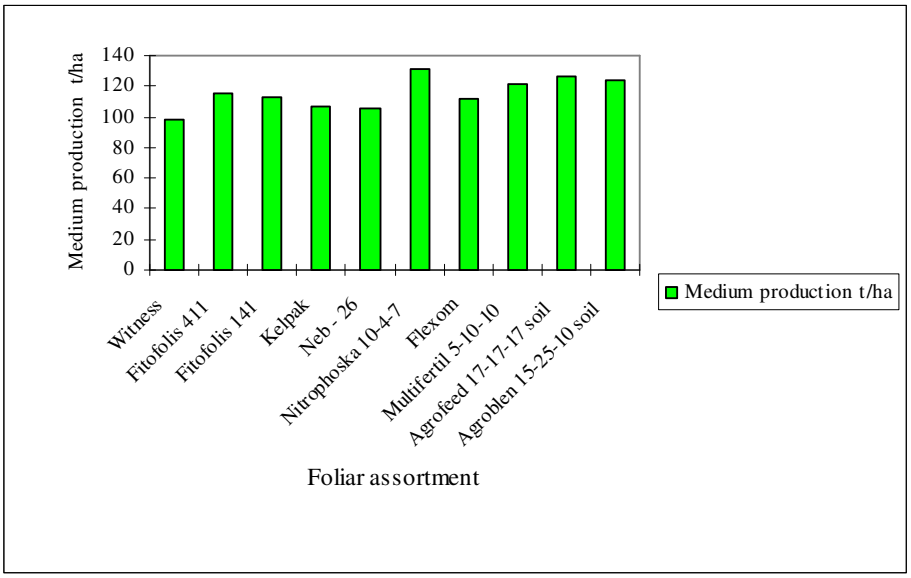


**Fig. 1.** The effect or foliar fertilization upon the production in the tomato crop (Cronos F1) from the Solarium of University of Agriculture Sciences and Veterinary Medicine Cluj-Napoca

Statistically provided positive significant results were obtained for the V2, V3, V6, V8 variants, fertilized with the following foliar fertilizers: Nitrophoska 10- 4-7, Multifertil 5-10-10, Fitofolis 411 and Fitofolis 141, as well for the V9 and V 10 variants, fertilized on the soil with Agrofeed 17-17-17 and Agroblen 15-25-10.

These very significant positive production differences obtained by using the foliar fertilized variants confirm the fact that the applying of foliar fertilizers assures a better plant usage of the nutrients in the soil and also of the nutrients found in these foliar fertilizers.

There are foliar fertilizers assortment with low efficiency and also foliar fertilizers with no significant effects over tomato production.

The chemical composition of the tomato fruits is a specific and complex one, being determined by a series of factors (type- genotype, ecobiological factors), and is maintained by a balanced and complex nutrition. For tomatoes, the specialty literature confirms high specific consumption of potassium, azoth and calcium, and an almost as high usage of phosphor and magnesium (Table 3).

*Table 3*

Nutrient specific consumption in tomato culture (Ciofu et al.,2003)

| Culture Type | U/M Production | Production | N | P | K | CaO | MgO |
|---|---|---|---|---|---|---|---|
| In the field | t/ha | 35 | 2.6-3.8 | 0.4-1.0 | 3.6-4.0 | 4 | 0.60 |
| Greenhouse-cycle I | kg/m$^2$ | 8-10 | 3.09 | 0.64 | 3.36 | 2.19 | 0.63 |
| Greenhouse-cycle II | kg/m$^2$ | 5-7 | 4.00 | 0.39 | 5.23 | 3.30 | 0.48 |
| Solar | kg/m$^2$ | 5-7 | 5.00 | 0.47 | 5.73 | 4.16 | 0.63 |

Such a specific high consumption for the tomatoes grown in protected spaces explains the necessity of applying of high quantities of organic and mineral fertilizers, in order to reach the planned production.

The foliar fertilizers experimented upon, had the best results when dealing with a complex and balanced macro- and microelements chemical composition.

These types valorized better the organic-mineral fertilization of the soil, having a role in balancing the nutrition and the extending of the vegetation period, and also in the ripening and harvesting of the fruits.

**CONCLUSION**

1. Foliar fertilizations are economically justified for intensive cultures in protected spaces, on agrochemical-optimized soils, by organic-mineral fertilizations, in vegetative phenophases, with a high consumption of nourishing elements.
2. 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).
3. A strict experimentation of the foliar fertilizers, in terms of a technology with an intensive character on tomatoes, emphasizes the fact that these extraradicular compositions can be considered as soil fertilizing measures, as measures having an “integrated” and complementary character.

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