RESEARCH ON THE ESTABLISHMENT OF INTERPRETATION LIMITS FOR THE AGROCHEMICAL INDICES IN SOIL IN DEFINING THE AGROCHEMICAL RISK AREAS IN GREENHOUSE TOMATO CROP UNDER THE INFLUENCE OF FERTILIZATION SYSTEMS

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Abstract

In protected areas, the "greenhouse" soil is prepared from mixtures and substrates which usually are related to the organic component (animal manure, plant leftovers, compost, peat) whose fertility is finalized also through mineral intake.

In this context the interpretation of values agrochemical indices values of the soil cultivated with tomatoes in protected system has a certain specificity due to the practiced fertilization systems which determine the change of indicators' parameters above the optimum agrochemical requirements with tendencies towards risk limits.

Key words: tomato, greenhouse, agrochemical indicators, agrochemical optimum, risk areas, agrochemical monitoring.

INTRODUCTION

The soil is for all vegetable species, both support material and a complex nutrient medium, which evolves under the influence of environmental factors and human activity.

The soil in protected areas, tunnels and greenhouses, due to the intensive cultivation of tomatoes undergoes changes of struco-texture and chemical composition. These complex agrochemical measures should allow better development of the root system, good permeability and water retaining capacity, organic the organic humifiable matter to be well represented, and the agrochemical indicators to range within the optimum agrochemical limits without reaching areas of risk.

Due to the intensive character of greenhouse cultures, large amounts of fertilizers and abundant watering are administered, which leads to an increase in the salt content. This phenomenon causes: reduced accessibility of water and nutrients from soil to plants, degradation of soil's physical characteristics, reducing the activity of soil microorganisms, reduced production of vegetables.

The increase of organic matter in the soil, especially in greenhouse soils up to 6-8% gives them a higher buffering capacity, that is : this component prevents the phytotoxic effect of salts.

The types of fertilizers that are applied will be chosen depending on the buffering capacity of the soil. Greenhouse tomato cultivation technology requires substantial application of organic fertilizers and minerals with the following objectives: optimizing the content of organic matter and the adjustment of soils' physical properties, improvement of content in the main nutrients and trace elements, provision of the necessary nutrients specific to intensive tomato crop with the avoidance of risk areas (Avarvarei I. et al., 1997, Black A., 1992, Borlan Z. et al., 1984, 1994, Davidescu D, Velicica Davidesc, 1999, Lăcătuș, 2006, Marilena Mărghitaș, et al., 2005, Mocanu, Ana Maria Mocanu, 2003, Alina Popa, 2007, Rusu M. et al., 2001, 2005, I.C.P.A., 1998).

MATERIAL AND METHOD

Experiments were conducted in the greenhouse of the University of Agriculture Sciences and Veterinary Medicine from Cluj-Napoca. CRONOS-F1 hybrid with indeterminate growth, medium vigor, very early, with open and ventilated port was used for the greenhouse culture. It is well adapted to all regimes of culture and is recommended for greenhouse (short cycle), tunnels and field crops. The large fruit (160-180g) has a globular shape, slightly flattened, evenly colored on the outside and inside. The fruit of an inflorescence matures uniformly so that they can be harvested individually or in bunches.

It is resistant to Verticillium, Fusarium oxysporum f. sp. lycopersici races 1 and 2 and tobacco mosaic virus. The experimental protocol contains several foliar fertilizers in order to support and complement the fertilization on the soil according to the crop technology (Table 1).

Tabel 1

The foliar fertilizers assortment applied to greenhouse-cultivated tomatoes, University of Agriculture Sciences and Veterinary Medicine Cluj-Napoca

Var. no.	Foliar assortment*	Concentration of solution %
1	Control sprinkled with water	-
2	Basfoliar Combi-Stipp	1%
3	Fertillilly	1%
4	Nutrifag	1%
5	Terra Sorb Foliar	1%
6	Folplant 231	1%
7	Ferticare 14-11-25	1%
8	Ferticare 15-30-15	1%
9	Ferticare 24-8-16	1%
10	Biodor 0.5	1%
11	Biodor 2312	1%
12	Ecofert 2	1%
13	Polyfeed 19-19-19	1%

* with three treatments: the first treatment at the first inflorescence, the other at fourteen shifted days.

The soil analyzes were performed by the following methods: the pH was determined in aqueous suspension, soil-solution ratio of 1: 2.5 was determined by the potentiometric method with a pair of glass-calomel electrodes; humus was determined by wet oxidation and titrimetric dosing (according to Walkley-Black, modification Gogoaşă); N_t was determined by Kjeldahl method; P-mobile (accessible) was determined by Egner-Riehm-Domingo method (P-AL), colorimetrically, in extraction with ammonium acetate-lactate; K-mobile (accessible exchangeable) in soil was dosed in the same ammonium acetate-lactate extract (Egner-Riehm-Domingo) (K-AL) by flame photometry; $N\text{-}NO_3$ in soil was dosed colorimetrically with phenoldisulfonic acid after a prior extraction with 0.1 n K_2SO_4.

RESULTS AND DISSCUSIONS

Greenhouse" soil has initially favorable fertility indicators provided by the formation components, but agrochemically this soil evolves as a nutrient medium of an intensive holding (Table 2).

Tabel 2

Agrochemical indicators of the greenhouse soil cultivated with tomatoes

Var. no.	Applied foliar assortment	Soil analyses					
		pH_{H2O}	Humus %	I_N	P-AL ppm	K-AL ppm	$N\text{-}NO_3$ ppm
1	Control sprinkled with water	7.2	7.76	7.60	70	386	120
6	Folplant 231	7.4	7.56	7.40	79	398	118
7	Ferticare 14-11-25	7.2	7.68	7.58	77	408	124
9	Ferticare 24-8-16	7.3	7.74	7.64	70	402	144
13	Polyfeed 19-19-19	7.3	7.02	6.87	98	420	126

In the interpretation of agrochemical indices for greenhouse tomato crop, their approach is made with a certain specificity, as the differentiated practiced fertilization systems change essentially the relevant indices of fertility and their applicability contributes towards the following directions:

- vegetable soils from protected areas are formed with a slightly acid - slightly alkaline pH, 6.5-7.5, which in terms of the class of reaction, generally have several advantages for fertilization and fertility of these media;

- the fertility indices of these soils determine significant growths in terms of organic matter, nitrogen, phosphorus and potassium and other elements content to be recovered in quantitatively and qualitatively higher productive yields;

- taking into account these accumulations of nutrients in the greenhouse soils, usually, the adverse impact states on soils and productions occur either due to mainly antagonistic influences of these accumulations, unbalanced reports between elements, and the ocurrance potential of some excess states / toxicity due to high concentrations of some elements.

Based on these soil agrochemical indicators for greenhouse tomatoes, an agrochemical monitoring of the soil has been developed. By the data received from this monitoring system we intend as for the major agrochemical indices determined - pH, humus, P, K, N- NO_3 and mineral residue to establish the limits of classification and representation and allow the development of tomato technology forecasts that would prevent the manifestation of nutritional disorders and / or fertilization (Table 3)

Table 3

Agrochemical monitoring of greenhouse soil cultivated with tomatoes

Nr. crt.	Soil	Determined agrochemical indices	Classification of agrochemical indices	Agrochemical forecasts
1	Greenhouse soil	pH_{H2O}	Neutral-poor alkaline reaction	The depreciation of this indicator is not forecast
		Humus	Very good supply	High regime of nitrogen and nitrates
		P-mobile	Poor – average supply	Disturbs the ratio N/P; jeopardizes the effect of nitrogen application; favors the nitric excess
		K-mobile	Very high content	Balances the nitrigen regime; disturbs the ratio P/K; favors magnesium and boron deficiency
		N-NO_3	Very high and constant content on the profile	Favors the nitric excess; favors molibdenum deficiency
		Mineral residue	Under the limit of toxicity	It doesn’t degrade the system momentarily

With respect to these elements of soil’s quality monitoring for tomato crop should be specified the interpretations of agrochemical areas that characterize the states of deficiency or excess of nutrients, which interpreted simultaneously with the soil monitoring define the agrochemical risk factors. (ICPA, 1998) (Table 4).

Table 4

Elements and domains of foliar diagnostic for the prognosis of negative vegetative states in tomatoes caused by the deficiency or excess of nutrients

Crt. no.	**Nutritive element**	**M.U.**	**Areas of nutritional status**		
			Insufficiency	**normal**	**excess**
1	Nitrogen	%/s.u.	<1.5	1.5-3.5	>3.5
2	N-NO_3	ppm	<100	100-1000	>1000
3	Phosphorus	%/s.u.	<0.15	0.15-0.40	>0.40
4	Potassium	%/s.u.	<1.5	1.5-3.0	>3.0
5	Sulfur	%/s.u.	<0.15	0.15-0.30	>0.30
6	Calcium	%/s.u.	<0.5	0.5-1.5	>1.5
7	Magnesium	%/s.u.	<0.2	0.2-1.0	>1.0
8	Iron	ppm	<50	50-200	>200
9	Manganese	ppm	<25	25-200	>200
10	Copper	ppm	<5	5-100	>100
11	Zinc	ppm	<10	10-100	>100
12	Boron	ppm	<10	10-50	>50
13	Molibdenum	ppm	<0.5	0.5-5	>5
14	Mineral residue	g/100g sol	• Limit to which the production starts to be affected:0.20 • Limit to which the production decreases with 50%:0,45		

CONCLUSIONS

The following conclusions can be drawn from the obtained analytical data:

1. Soil reaction (pHH2O) is in neutral-slightly alkaline area within the limits of a physico-chemical environment specific to greenhouse soils and a normal nutrition of tomatoes.

2. Humifiable humus and organic matter have high values, specific to a greenhouse soil that is well prepared and maintained regarding the organic component that can maintain an nitrogen excessively-supplied regime (after I_N and accumulation of N-NO_3).

3. The soil has a poor and mean supply of phosphorus, which can be a disadvantage and imbalance with respect to nitrogen and potassium holding excessive representations.

4. From the point of view of concentrations, soluble salts do not exist due to the high content of humus (humifiable organic matter), a prognosis of adverse effects.

5. The award/acordare of limits and agrochemical indices areas in the forecast of some poor nutritional states as the monitoring of soil quality, allows both fertilization-related decisions and measures to prevent insufficiency, deficiency and excess states - toxicity in tomato culture.

Further research is recommended.

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