DEVELOPMENT OF NEW ORGANO-MINERAL FERTILIZER USE IN SUSTAINABLE AGRICULTURE

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Worldwide a priority of the producers of fertilizers is the obtaining and promoting new organo-mineral fertilizer by developing new classes of fertilizers made of natural organic substances. These fertilizers, with a high humice acid content, fulvice and salts thereof, may contribute to improve plant nutrition, better indices of soil fertility and food security by providing superior quality, environmentally friendly agricultural products. Researches were conducted for obtaining agrochemicals and testing organo-mineral fertilizers with humice substances, microelements and fulvice used both in classic agriculture and ecological.

Fertilizers can be applied both extraradicular as well as irrigation or drop. Testing and evaluating these fertilizer has been compared with the witnesses represented by certificates fertilizers. The paper presents results of agrochemical testing carried out in solar on tomato culture using variant composition of organo-mineral fertilizer with opportunities to use both in classic agriculture and ecological.

Key words*: fertilizer, humice fatty, fulvice acids, organo-mineral, foliar*

Natural organic substances such as humic and fulvic acids plays an essential role in ensuring soil fertility and plant nutrition. These macromolecular compounds, in addition to the typical chemical elements (carbon, oxygen, hydrogen, nitrogen, sulfur), because chelated properties, may include a complex structure and a wide range of inorganic elements.

Thus, the carboxyl group ($-COO^-$) and the hydroxide ($-O^-$), present in the macromolecule, humic and fulvic acids. Thei act as chelation agents for inorganic cations, especially those involved in the optimal functioning of plant metabolism and also has biostimulatoare properties.

Fulvic acids, due to the smaller molecules compared with humic acids can be easily assimilated by the root but the stems and leaves of the plant by applying extraradicular.

Foliar application of fertilizer containing fulvic and humic acid chelates with various minerals, when implemented in specific periods of growth, is a superior technique to optimize plant health and production quality.

Compared with other synthetic chelation agents, fulvic and humic acids are compatible with the plant and non-toxic.

Fulvic and humic acids, natural compounds, are compatible with the plants, environment and non-toxic, compared with synthetic chelation agents to use classic.

In the Grant Agreement number 135080/2009 concluded with Competitiveness Grants Scheme (MAPDR) were made agrochemical activities for obtaining and testing of complex nutrient solutions containing natural organic substances with chelated and biostimulator properties. In the I.N.C.D.P.A.P.M. - ICPA - Bucharest experiments have led to many variants of processes and formulas of fertilizers with the possibility to use in classical and organic system of agriculture, these fertilizers were tested in the solarium by extraradicular application.

The principles were applied to define the technological processes for obtaining these fertilizers were specific standarelor both organic agriculture and classical, that Council Regulation EEC 2092/91, EC Regulation 834/2007 on organic production and labeling of organic products, Regulation (EC) 889/2008 laying down detailed rules for implementing Regulation (EC) no. 834/2007 on organic production and labeling of organic products and Regulation (EC) 2003/2003 on traditional chemical fertilizers.

MATERIAL AND METHOD

In the laboratory phase were obtained 3 variants of extraradicular fertilizers containing organic substances with role in stimulating the biochemical processes, obtained by extraction and separation of fulvic and humic acids from lignite. Experimental fertilizers have been tested experimentally by applying extraradicular at tomates cultivated in solarium area.

Experiments were performed to obtain fertilizers have focused:

- Setting materials;
- Define the structure of fertilizer composition;
- Setting level laboratory experimental schemes and operating parameters;
- Establishing control on the phase of the process and final;
- Verification technologies at the laboratory stage;
- Realization of samples in order to characterize physical, chemical and agrochemical testing.

Experimentally obtained extraradicular fertilizers to realize the agrochemical testing were:

- NPK type with fulvic acid salts and chelated trace elements - code version "OMI 1";
- NK type with humic acid salts and chelated trace elements - code version "OMI 2";
- NK type with humic and fulvic acids salts and chelated trace elements - code version "OMI 3";

Experimental fertilizers were tested against an unfertilized control leaf (M0), two witnesses fertilizers certified "ECO" (ECO 1 and 2). Experiments were performed at S.C. MARCOSER S.R.L., Matca, Galati County in solarium. The tests were performed on cultures established on the unfertilized agrofond.

Experiments were performed in solarium, on culture tomato, hybrid Shirley F1, on a ground well supplied with: 6.3% humus, 0.3% nitrogen, mobile phosphorus (P in AL) 1338 ppm, mobile potassium (K in AL) 1517 ppm and a slightly alkaline pH of 7.3 - 7.4 pH units. Values determined for the elements Ca, Mg, Zn, Cu, Fe and Mn showed a good supply. Six variants have been founded with 3 multiplication for each, a variant surface being 16 m^2. Drip irrigation was done every two days with a volume of 400 to 450 liters per 100 m^2.

Tomato Culture was established on 14.04.2009 and culture was the type short cycle with 4 to 6 floors.

Experimental fertilizers were applied extraradicular as a solution concentration 0.5%, in number of 4 treatments at intervals of 7 days. The first application was made when the plants had developed 30 - 35 cm. No pesticide treatments were performed.

At the end of cultures were made assessments of the parameters of production and analysis of nutrient value of fruit and leaf samples using the average of 3 repetitions.

RESULTS AND DISCUSSIONS

The use of extracts of natural substances of vegetable origin in a complex matrix of macro and micronutrients chelated leads to solutions of fertilizers stable physico-chemical.

When experiments carried out on tomato culture, Shirley F1 hybrids grown in unheated solarium at the end of the first cycle of vegetation, by estimating parameters of production, the sample average of the 3 repetitions were performed physico – chemical analysis in fruit and leaves.

Results of the agrochemical testing of fertilizers in the cultivation of tomates in solarium, are presented in *Tables 1 to 4.*

For agrochemical experiments performed in solarium for tomato hybrid Shirley F1 show that plant size at 45 days after planting, production, average fruit size and quantity of dry matter in fruit were used to assess the efficiency of fertilizers obtained experimentally with extraradicular application.

Thus, when assessing the waist of plants found that there were no significant differences between experimental variants towards the witness and average of the witness ECO 2 (*table 1*).

Analysis of data obtained indicated obtain some very significant production for the three experimental fertilizers compared to the unfertilized witness and variations over fertilized with products certified "eco", media productions obtained, except witness ECO 2 (*table 2*).

Average weight of fruit, the short cycle of vegetation, recorded very significant differences for the experimental fertilizers compared to the witness unfertilized. Significant and very significant effects is observed when comparing the three experimental solutions witness ECO 2 (t*able 3*).

Between the experimental variants, one can notice very significant differences for OMI 2 as compared with OMI 1 and OMI 3 on the quantity of dry matter determined in tomato fruits (t*able 4*).

Table 1

Evolution waist tomato plants by foliar treatment applied

No.	Type fertilizer	Plant height*, cm	Difference compared to control, cm	Statistical significance	Difference compared to control, cm	Statistical significance	Difference compared to control, cm	Statistical significance	Difference compared to control, cm	Statistical significance
			M_o		ECO 1		ECO 2		Average of variants	
1	M_0	67.00	67.00	-	-0.67	ns	-3.67	ns	-3.39	ns
2	ECO 1	67.67	67.67	ns	0.00	-	-3.00	ns	-2.72	ns
3	ECO 2	70.67	70.67	ns	3.00	ns	0.00	-	0.28	ns
4	OMI1	72.00	72.00	*	4.33	*	1.33	ns	1.61	ns
5	OMI2	73.33	73.33	**	5.67	**	2.67	ns	2.94	ns
6	OMI3	71.67	71.67	*	4.00	*	1.00	ns	1.28	ns

LSD 5% = 3.93 cm LSD 1% = 5.58 cm LSD 0.1% = 8.09 cm

* Plant height, cm, in 45 days from planting seedlings. Seedlings planted in the 4 leaf stage with a height of 15 cm.

Table 2

The evolution of tomato fruit production by foliar treatment applied

No.	Type fertilizer	Production, kg/100 m^2	Difference compared to control, kg	Statistical significance	Difference compared to control, kg	Statistical significance	Difference compared to control, kg	Statistical significance	Difference compared to control, kg	Statistical significance
			M_o		ECO 1		ECO 2		Average of variants	
1	M_0	256.67	0.0	-	-36.7	ooo	-56.3	ooo	-46.6	ooo
2	ECO 1	293.33	36.7	***	0.0	-	-19.7	ooo	-9.9	oo
3	ECO 2	313.00	56.3	***	19.7	***	0.0	-	9.8	**
4	OMI1	318.00	61.3	***	24.7	***	5.0	ns	14.8	***
5	OMI2	320.33	63.7	***	27.0	***	7.3	*	17.1	***
6	OMI3	318.00	61.3	***	24.7	***	5.0	ns	14.8	***

LSD 5% = 6.66 kg LSD 1% = 9.47 kg LSD 0.1% = 13.71 kg

Table 3

Evolution of the average weight of tomato fruit by foliar treatment applied

No.	Type fertilizer	Average weight/ fruit, g	Difference compared to control, g	Statistical significance	Difference compared to control, g	Statistical significance	Difference compared to control, g	Statistical significance	Difference compared to control, g	Statistical significance
			M_o		ECO 1		ECO 2		Average of variants	
1	M_0	100.33	0.00	-	-18.67	oo	-2.67	ns	-17.17	oo
2	ECO 1	119.00	18.67	**	0.00		16.00	**	1.50	ns
3	ECO 2	103.00	2.67	ns	-16.00	oo	0.0	-	-14.50	oo
4	OMI1	132.67	32.33	***	13.67	**	29.67	***	15.17	**
5	OMI2	128.33	28.00	***	9.33	*	25.33	***	10.83	*
6	OMI3	121.67	21.33	***	2.67	ns	18.67	**	4.17	ns

LSD 5% = 9.18 g LSD 1% = 13.05 g LSD 0.1% = 18.90 g

Table 4

Evolution quantity of dry matter of tomato fruit by treatment foliar applied

Nr. crt.	Type fertilizer	Dry substance %	Difference compared to control, %	Statistical significance	Difference compared to control, %	Statistical significance	Difference compared to control, %	Statistical significance	Difference compared to control, %	Statistical significance
			M_o		ECO 1		ECO 2		Average of variants	
1	M_0	5.36	0.00	-	-0.18	ns	-0.23	o	-0.24	o
2	ECO 1	5.54	0.18	ns	0.00		-0.05	ns	-0.06	ns
3	ECO 2	5.59	0.23	*	0.05	ns	0.0	-	-0.01	ns
4	OMI1	5.51	0.15	ns	-0.03	ns	-0.08	ns	-0.09	ns
5	OMI2	5.99	0.63	***	0.45	***	0.40	***	0.39	***
6	OMI3	5.61	0.25	ns	0.07	ns	0.02	ns	0.01	ns

LSD 5% = 0.18 % LSD 1% = 0.25 % LSD 0.1% = 0.36

CONCLUSIONS

1. Three extraradicular fertilizers were obtained and characterized physically and chemically. These fertilizers that apply extraradicular and stands out by a complex composition through a combination of NPK or NK-type matrix with trace elements Fe, Cu, Zn, Mn and Mg and fulvic and humic acids, natural substances with chelated role but biostimulator.

2. In tomato, Shirley F1 hybrid, for experiments conducted in the solarium found an upward trend of production increases over the witness M0, in order: 14, 3% for ECO 1, 21.9% for ECO 2, 24% for OMI1 and OMI 3 and 27% for OMI.

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