NEW FERTILIZERS WITH PROTEIN STRUCTURE WITH FITOSTIMULATOR ROLE

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In recent years, on an international level, are frequently used protein hydrolysate, from natural plants or animal in fertilizers composition, these representing substances with chelated micro-nutrients properties important for plant metabolism, but also with the fitostimulator role. A priority of Romanian research is to use a protein hydrolysates to obtain various compositions extraradiculara application of fertilizers. Researches were conducted for obtaining agrochemicals and testing of a liquid fertilizer NPK or NK with microelements (Fe, Cu, Zn, Mn), secondary (Mg, S) and protein hydrolysates chelated. There are presented chemical characteristics of experimental fertilizer that have been tested agrochemical in vegetation on tomatoes. The paper presents results of agrochemical testing performed in vegetation house, new variants of fertilizer composition with opportunities to use both in classic agriculture and ecological.

***Key words**: fertilizers, hydrolyzate, collagen, biostimulator, foliar*

There are a remarkable number of products and experimental data that are based on complex solutions containing phosphates, polyphosphates, potassium and nitrogen compounds, protein hydrolysates used as fertilizers both high culture and the intensive greenhouses and solariums.

It is well known that the use of micro-elements like iron, copper, zinc, calcium, magnesium and manganese chelated with hydrolysed proteins are more easily absorbed by both plant and animal organisms. It also mentions use of protein hydrolysates in combination with potassium polyphosphates to increase agricultural production by increasing the absorption of phosphorus and potassium.

In the Grant Agreement with number 141708/2008 which was completed with the Competitive Grant Scheme (MAPDR) were made agrochemical testing activities and were obtained some complex nutrient solutions containing organic substances with properties chelated. In the Testing Laboratory and Quality Control of the fertilizers of INCDPAPM - ICPA - Bucharest and Chemical Testing Laboratory of S.C. Chimro S.R.L. tests were made and have led to many variants of processes and formulas of fertilizers with the possibility to use classical system of agriculture, but organic. Fertilizers obtained were applied extraradicular and were carried agrochemical tests.

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

Were obtained from laboratory phase 3 variants with fertilizers extraradiculari role in stimulating composition with organic substances that were obtained by neutral hydrolysis of collagen.

Protein substances with biostimulator role and contain: glycine 30 to 40%, alanine 10 to 15%, proline 10 to 15%, glutamic acid 5 to 10%, hydroxyproline 5 to 10%, acid aspargic 4 to 6%, arginine 4-6 %, serine 3 to 5%, Threonine 1 to 3% and the amino acids in significant proportions: lysine 2 to 4%, valine 2 to 4%, leucine 2 to 3%, phenylalanine 1.5 to 2%, isoleucine 1 to 1.5%, histidine 0.7 to 1.5%, methionine 0.2 to 0.5%. Experimental fertilizers have been tested experimentally, by applying extraradicular, in the house of vegetation.

Experiments were performed to obtain fertilizers are concerned:

- 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 achievement testing.

Experimentally obtained extraradiculari fertilizers to realize the agrochemical testing were:

- NPK type with organic materials and trace elements in the array (code "Fert 1");
- NPK type with organic materials and trace elements in the array (code "Fert 2");
- N-type with organic substances and trace elements introduced in the process of obtaining (code "Fert 4").

Experimental fertilizers were tested against an unfertilized control leaf (M0), two witnesses with fertilizers certified "ECO" (ECO 1R and ECO 2F). Agrochemical experiments were performed in the House of vegetation of INCDPAPM - ICPA Bucharest in pots type Mitscherlich with 20 kg of soil.

The tests were performed on tomato culture, on unfertilized agrofond, and fertilized with a fertilizer complex type 15.15.15, in doses of 50 mg to for each nutrient / kg soil.

The experiments were conducted on tomato culture, variety Dacia - Pontica, the soil type mold vermouth with: 3.18 - 3.55% humus, 0.18 - 0.26% nitrogen, 37.6 - 138 ppm phosphorus (P in AL), from 199 to 364 ppm mobile potassium (K in Al) and an alkaline pH of 8.0 - 8.2 pH units. 14 variants have been founded with 4 repetitions each of 3 plants, of which 2 plants were kept for achieving agrochemical experiments.

Experimental fertilizers were applied as 1% concentration solution in quantities of 30 ml / pot, in number of 3 treatments at intervals of 10 to 15 days. The first application was made when the plants had developed 35 - 40 cm.

At 7 days after the last application, a plant of each variant was sacrificed and the leaf system were carried out chemical analysis of elements: N, P, K, secondary elements and micronutrients.

At the end of the vegetation were performed assessments of the parameters of production and analysis of the value of nutrients in the fruit samples using the average of 3 repetitions remaining in vegetation.

RESULTS AND DISCUSSIONS

The use of proteins in a complex matrix of macro and micronutrients chelated leads to solutions of fertilizers stable physico-chemically. Besides the properties of chelated, protein hydrolyzate used serves as protective colloid which helps maintain stability of fertilizer applied, the components with molecular weight of approx. 14,000 Da form films on plant tissue surface. These films of collagen polypeptides have the ability to transfer gradually while chelated trace elements, acting both as a hydrophilic protective environmental factors as well as biostimulator.

When experiments carried out on tomato culture, Dacia variety of vegetation grown in pots at the end of crop production and by estimating parameters of the sample average of the 3 rehearsals left in vegetation were carried out chemical analysis of elements present.

Results of the agrochemical testing of fertilizers on tomato culture and the analysis performed on samples of plants and fruits are presented in *Table 1* and *Figures 1 to 3.*

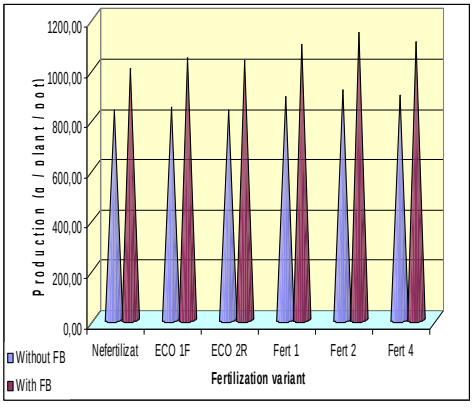

Figure 1 **Evolution of production depending on fertilization extraradiculara applied to tomato variety Dacia - Pont (with and without soil fertilization)**

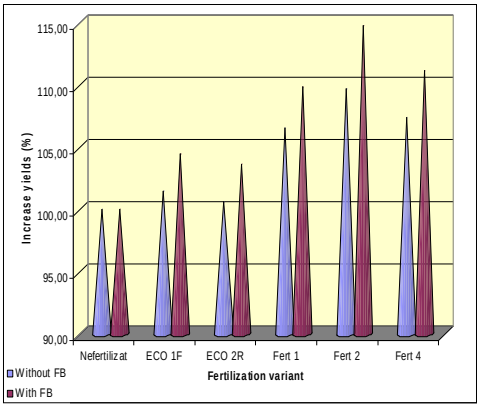

Figure 2 **Evolution of production gain depending on fertilization extraradiculara applied to tomato variety Dacia - Pont (with and without soil fertilization)**

Production increases for experienced variations on an agrofond without fertilization were 1% (control, "ECO") to 9% (Fert 2) higher than the unfertilized

witness extraradicular (M0) and have evolved increased in order: ECO witnesses, Fert 1, Fert 4 and Fert 2. When experiments carried out with a agrofond with fertilization, increases of production of the witness - M0 was higher by 4% (control, "ECO") and up to 14.7% (Fert 2), note the same evolution as in the case of extraradicular fertilizers apply to unfertilized soil.

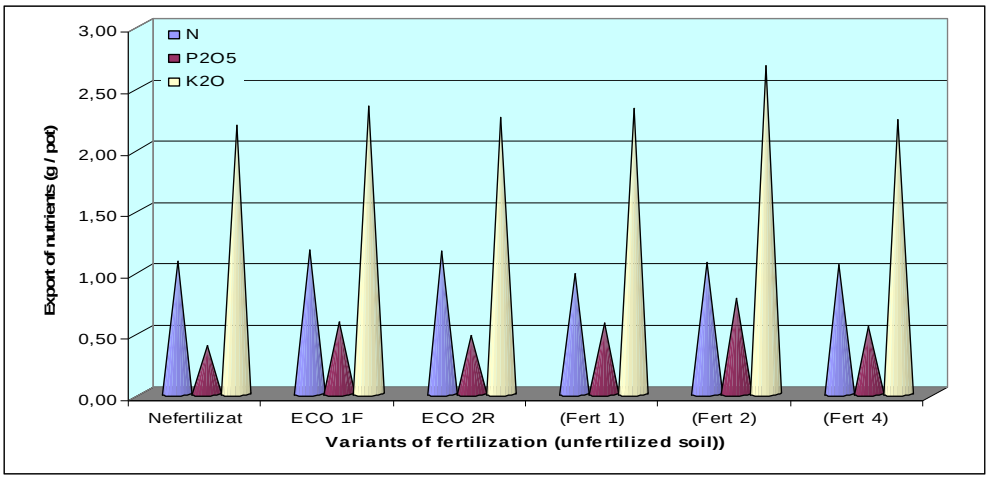

Figure 3 **Export of nutrients (N, P and K) according to the extraradicular fertilizers applied to tomato variety Dacia - Pont (unfertilized agrofond base)**

Table 1

Composition of tomato fruit variety Dacia - Pontica, tomatoes in pots vegetation

Variant	Nitrates (ppm)	Azot (%)	P_2O_5 (%)	K_2O (%)	Cu (ppm)	Zn (ppm)	Fe (ppm)	Mn (ppm)	Mg (ppm)	Ca (ppm)
Unfertilized	3.20	0.13	0.05	0.26	0.52	1.81	2.39	0.34	44.78	2.49
ECO 1F	6.60	0.14	0.07	0.28	0.63	1.82	2.91	0.44	56.98	2.51
ECO 2R	4.45	0.14	0.06	0.27	0.91	1.80	8.35	0.44	46.73	2.80
(Fert 1)	4.60	0.11	0.07	0.26	0.40	1.37	2.71	0.34	48.13	2.07
(Fert 2)	5.33	0.12	0.23	0.29	0.71	1.86	6.39	0.78	61.14	3.57
(Fert 4)	5.80	0.12	0.06	0.25	0.46	1.25	1.71	0.32	43.25	1.50
Fertilized	4.90	0.13	0.05	0.27	0.75	1.83	3.98	0.44	48.97	2.64
ECO 1F	2.30	0.17	0.05	0.26	0.62	1.80	4.05	0.43	51.00	1.22
ECO 2R	3.20	0.15	0.06	0.25	0.77	1.76	3.54	0.38	43.85	2.13
(Fert 1)	5.13	0.16	0.07	0.32	0.65	1.62	3.50	1.24	53.54	5.27
(Fert 2)	3.10	0.20	0.05	0.27	0.72	1.76	4.50	0.48	44.38	3.64
(Fert 4)	2.80	0.18	0.05	0.24	0.68	1.89	3.68	0.41	40.35	3.10

Analysis of data obtained for tomato fruit composition and export of nutrients with the harvest, indicated that it is 8.8% (for phosphorus), 22.7% (for potassium) and up to 66.8% (for nitrogen) higher for experiments carried out on a

agrofond with fertilization of the front of the unfertilized.For variations of tomato that had extraradicular fertilizer applied on an agrofond without fertilization, export macronutrienti with tomates production was between 0.97 ÷ 1.17 g N / plant (Fert1 ÷ ECO Fert 1F), 0.48 ÷ 0.78 g P_2O_5 / Plants (ECO 2R ÷ Fert 2) and 2.25 ÷ 2.67 g K_2O/planta (ECO 2R ÷ Fert 2).

When experiments carried out on a fertilized agrofond, exporting nutrients ranged from 1.6 ÷ 2.28 g N / plant (ECO 2R ÷ Fert 2), 0.54 ÷ 0.81 g P_2O_5/planta (ECO 1F ÷ Fert 1) and that 2.6 ÷ 3.5 g K_2O/planta (ECO 2R ÷ Fert 1).

In experiments conducted with a agrofond basic fertilization, exporting most of macronutrienti (N, P, K) was obtained from experimental fertilizer application Fert 1, followed by Fert 2 and 4. Exports macronutrienti over M0 witness for witness M0F is 15.2% higher in case of nitrogen, 25.4% to 26.7% for phosphorus and potassium.

CONCLUSIONS

1. In the experimental work were obtained and characterized physico-chemical fertilizers to be applied to fertilization extraradiculara. These fertilizers are distinguished by a complex composition by associating a type matrix NPK, NK, or N, with micronutrients Fe, Cu, Zn, Mn, Mg and protein hydrolysates with chelated and biostimulator role.

2. When Agrochemical experiments conducted in the house of vegetation on tomato variety Dacia - Pontica, found an upward trend of production increases in order of M0, ECO 2R (0.61 - 3.61%), ECO 1F (1.44 - 4.41%), Fert 1 (6.49 - 9.82%), Fert 4 (7.33 - 11.12%) and Fert 2 (9.62 - 14.73%).

3. Exports of macro-nutrients (N + P + K) with fruit harvest, compared to M0 witness, for experiments conducted on a soil without fertilization, is an upward trend in the order ECO 2R (10.52%), Fert 1 (12.76%) , Fert 4 (14.3%), ECO 1F (21.24%) and Fert 2 (39.32%).

4. When experiments carried out on a soil with fertilization, the export of nutrients (N+P+K), the fruit harvest had the following upward trend ECO 2R (12.62%), ECO 1F (13.86%), Fert 4 (22.94%) , Fert 2 (36.35%) and Fert 1(41.03%).

5. It was found that no matter soil fertilized, the largest increases in production, and high levels of export of nutrients, were obtained by application of fertilizer experimental extraradiculara Fert Fert 1 and 2 containing organic substances such as protein hydrolysates.

BIBLIOGRAPHY

1. Carmen, Sirbu, Cioroianu, T., Dumitru, M., Dorneanu, A., Maria, Negrila, Daniela, Mihalache, Letitia, Angelescu, 2008 - *New structures of biofertilizers with chelate proteinic substances with role of biostimulator and protection for sustainable agriculture*. Lucrari Stiintifice USAMV Iasi, Seria Agronomie, vol. 51 (2), pag. 189-194.

2. Ashmed, H.H. Hsu, H.H., 1985 - *U.S. Patent 4491464 /1985, Potassium polyphosphate protein hydrolysate fertilize.*
3. Carmen, Sirbu, Cioroianu, T., Dumitru, M., Dorneanu, A., Daniela, Mihalache, Letitia, Angelescu**,** 2007 – *Fertilizanti continand hidrolizate proteice chelatante cu aplicatii in agricultura* - Simpozionul International "Reconstructia ecologic si necesarul de ingrasaminte in zona gorjului, Tg. Jiu, 4-5 oct.. Ed. New Agris, 467– 474.
4. GU, J.L., Lee, E.S., 2009 **-** *U.S., Patent no. 0062181*, 5.03.2009.
5. Trandafir V., Popescu G., Albu M.G., Iovu H., Georgescu M**.**, 2007 - The Bioproducts based on collagen", Ed. ARS DOCENDI, Bucureşti.
6. Dorneanu, A., Dumitru, M., Cioroianu, T., Dorneanu, E., Sirbu, C. 2008 - *RO,* Patent no. 121814, 30.05.2008.