AGRICULTURE DEVELOPMENT OF ROMANIA IN EU INTEGRATION CONDITIONS BY USING UNCONVENTIONAL MEANS OF FERTILIZATION

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Abstract: *Bio-accessibility increase soil nutrients and other natural sources and increase productive use of nutrients in crops, accompanied by decrease the impact of pollutant chemical fertilization on the environment, are major goals of modern agriculture and organic farming by default. The research carried out in the last years on the unconventional fertilization methods and means puts the problem on some new methods to prevent chemical pollution of vegetal production environment. Globally, application of nutrients in the form of dilute solutions by foliar spraying has become a current practice in many cultures, the absorption and translocation of nutrients from the skin of the plant in different plant organs is an undeniable reality. This paper refers to tomatoes grown, Dacia cultivar, in greenhouse (R.I.S.S.A., Bucharest) by an unconventional fertilization method. Tomato represents a basic product in human food, being consumed under both fresh and canned condition. The great number of bell pepper cultivars and varieties constitutes the raw material for producing a large range of culinary products. In this context the main objectives in research carried out were complex agrochemical testing of ecological liquid compositions approved for use in Romania agriculture, two with effect by incorporation in soil (Neb 26 and Stimusoil) and two with foliar applied on plant (Kelpak and Bionat) and quantifying the effect of fertilization of the fertilizers applied on different topsoils of fertilization. Experimentation was conducted in greenhouse of R.I.S.S.A. Bucharest (2004-2007), experiences were placed in Mitscherlich pots, which were introduced 20 kg soil. According to the testing methodology for each experimental combination of factors has ensured a number of 3 repetitions. The analysis of experimental data obtained can be observed that the tested foliar fertilizers were provided, in most cases examined, provided statistical yield increases compared to unfertilized ecological control.*

Key words**:** *tomato, unconventional fertilization methods, environment*

INTRODUCTION

The vegetable crop growing technologies in protected spaces must be applied with the highest care to assure a health growing and development environment that may be achieved by attentive fertilization carried out on the basis of the permanent chemical soil testing, aiming at avoidance of both the depletion and excess of nutrients. These can determine not only the yield loss, but also the particular damage of vegetable quality, that is the assurance of vegetable health.

Under the unconventional technologies, the fertilization during the growing season is carried out with liquid fertilizers applied by fertigation and foliar application.

The fertilization with liquid fertilizers begins after a week from planting of vegetable seedlings and is performed in several applications (3-5) up to 1-1.5 months before harvesting. With the crops having a particular harvesting plan, the fertilizer applications will be programmed in such a way to assure an interval of 8-10 days from the last fertilization to the harvesting „ANTON ET AL., 2007, 2008, 2009".

Under the classic system, the vegetable fertilization is carried out with completely soluble solid fertilizers: ammonium nitrate, calcium nitrate, potassium nitrate, and potassium metaphosphate. The rates of fertilizers are established on the basis of soil testing. Among these systems the foliar fertilization is the most used being applied as a supplementary fertilization mean „CIOROIANU ET AL., 2009, DANA ET AL., 2003".

The foliar fertilization consists in fine spraying (pulverization on plants) of liquid fertilizer solutions with concentration of 0.1-2% (depending on the fertilizer concentration) and at a volume of 1,000-2,000 litters/hectare for each treatment. Depending on the biological and technological features of cultivated species, 3-5 treatments can be applied.

MATERIAL AND METHODS

The influence of unconventional fertilization methods applied to tomatoes was observed in the I.C.P.A. greenhouse. The experiments were organized in Mitscherlich pots with 20 kg of soil per pot.

The experiment soil material was Fundulea Phaeoziom topsoil.

The experiment included two kinds of prepared soil material, that is:

A1 - topsoil plus: N-300 mg/kg of soil, P_2O_5-300 mg/kg of soil, K_2O-300 mg/kg of soil, and 30 g peat/kg of soil; and

A2 - topsoil plus: N-300 mg/kg of soil, P_2O_5-300 mg/kg of soil, K_2O-300 mg/kg of soil.

The used test plant was tomatoes, Dacia cultivar.

Applied treatment fertilizers included: NEB-26, STIMUSOIL for application in soil, and KELPAK, BIONAT for application on plant leaves in three splittings.

The three foliar fertilizations were carried out as follows:

the first fertilization after 10 days from the plantation;

the second and the third fertilization at every 7-8 days between them.

The chemical composition of tested fertilizers is presented in the Table 1. The used solution concentration was 1% and the applied quantity was 30 ml solution/pot for each treatment. Treatments included: V1 - control, V2 - Neb-26, V3 - Stimusoil, V4 - Kelpak and V5 - Bionat.

Table 1

The chemical composition of fertilizers

Components	KELPAK*	BIONAT*	**STIMUSOIL**	**NEB - 26**
		conc./UM		
N org	0.4%	1.28%	0.125%	-
N tot	0.04%	1.28%	0.125%	-
P_2O_5	0.03%	1.37%	0.175%	0.355%
K_2O	0.61%	0.24%	0.278%	0.108%
Fe	2.2 ppm	0.152%	$7.8 \cdot 10^{-4}$ %	14 ppm
Cu	1.8 ppm	0.215%	0.025%	0.048%
Zn	0.9 ppm	0.195%	$6.9 \cdot 10^{-5}$%	2.1 ppm
Mg	56.4 ppm	0.2%	0.03%	0.025%
Mn	0.8 ppm	0.078%	-	1.7 ppm
B	3.2 ppm	-	$7.3 \cdot 10^{-4}$%	2.5 ppm
Mo	-	-	$8.2 \cdot 10^{-6}$%	0.033 ppm
Sodium	0.16%	-		0.017%
Ca	0.02%	-	0.042%	0.03%
Auxin, citokinone	auxin 10.7 ppm citokinone 0.03 ppm	-	-	-
Protein	0.2%	-	0.78%	0.233%
Amino acids	0.1%	-	-	-
Other organic substances	carbohydrates 1.0%	salicylic acid 1% organic extract from plants 10%	20.87%	11%

* - Amounts of organic substances are those declared by the producer

RESULTS AND DISCUSSION

Table 2 presents the influence of fertilization with liquid fertilizers Neb-26, Stimusoil, Kelpak and Bionat on fruit production in crop tomatoes.

The analysis of experimental data obtained can be observed that the tested foliar fertilizers were provided, in most cases examined, provided statistically yield increases compared to unfertilized ecological control.

Table 2

Experimental data on the tomato fruit yields, Dacia cultivar, as a result of the applied ecological fertilizers: NEB 26, STIMUSOIL, KELPAK and BIONAT

Treatment	2004						2005		
	A1*			A2*			A1		
	Production of fruits, g/pot	Yield increases		Production of fruits, g/pot	Yield increases		Production of fruits, g/pot	Yield increases	
		g/pot	%		g/pot	%		g/pot	%
Unfertilized ecological control	1437.20 d	-	-	1225.46 c	-	-	1249.60 b	-	-
NEB-26	1867.55 c	250.35	17	1384.96 b	159.50	13	1671.35 a	421.75	34
STIMUSOIL	1712.23 b	275.03	19	1630.37 a	404.91	33	1429.68 ab	180.08	14
KELPAK	1911.46 a	474.27	33	1620.90 a	395.44	32	1667.85 a	418.25	33
BIONAT	1878.20 c	241.00	17	1627.50 a	402.04	33	1277.45 b	27.85	2

Treatment	2005			2006					
	A2			A1			A2		
	Production of fruits, g/pot	Yield increases		Production of fruits, g/pot	Yield increases		Production of fruits, g/pot	Yield increases	
		g/pot	%		g/pot	%		g/pot	%
Unfertilized ecological control	851.01 b	-	-	1381.60 b	-	-	1199.80 c	-	-
NEB-26	1255.96 ab	404.95	48	2072.90 a	691.30	50	1748.60 a	548.80	46
STIMUSOIL	1660.30 a	809.25	95	2139.10 a	757.50	54	1710.80 a	511.00	43
KELPAK	1407.90 ab	556.89	65	1554.40 b	172.80	13	1451.60 b	251.80	21
BIONAT	1552.41 a	701.48	82	1997.80 a	616.20	45	1715.90 a	516.10	43

Treatment	2007						Average values /total years					
	A1			A2			A1			A2		
	Production of fruits, g/pot	Yield increases		Production of fruits, g/pot	Yield increases		Production of fruits, g/pot	Yield increases		Production of fruits, g/pot	Yield increases	
		g/pot	%		g/pot	%		g/pot	%		g/pot	%
Unfertilized ecological control	1566.75 b	-	-	1372.00 d	-	-	1408.78	-	-	1162.05	-	-
NEB-26	1899.62 a	332.87	21	1745.75 c	373.75	27	1877.85	469.07	33	1533.81	371.76	32
STIMUSOIL	1800.00 a	233.25	15	1891.50 b	519.50	38	1784.00	375.22	27	1723.24	561.19	48
KELPAK	1855.00 a	288.25	18	2081.81 a	709.81	52	1747.17	338.39	24	1640.55	478.50	41
BIONAT	1613.62 b	46.87	3	1392.50 d	20.50	1	1691.76	282.98	20	1572.07	410.02	35

* On topsoil values marked with same letter do not differ statistically from 0.05 significant level, according to Student-Newman-Keuls statistical test.

Thus, on A1 topsoil, from 2004 to 2007, he obtained an average production increase of between 282.98 g/pot (20%) and 469.07 g/pot (33%) and the average production increases on A2 topsoil ranged from 371.76 g/pot (32%) and 561.19 g/pot (48%).

Further to present obtained production results for each experimental year:

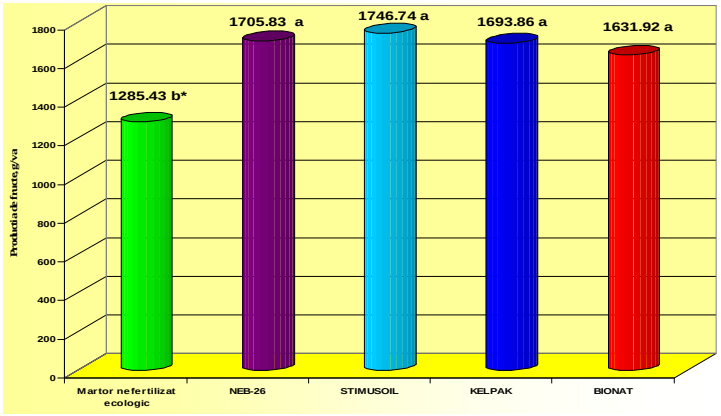
In 2004, yield increases obtained with tested fertilizers were provided statistically for all analyzed variants. The largest yield increases were obtained on A1 topsoil with Stimusoil fertilizer 275.03 g/pot (19%) and Kelpak fertilizer 474.27 (33%). On A2 topsoil, the largest yield increases were obtained with Stimusoil fertilizer 404.91 (33%) and foliar fertilizer Bionat 402.04 (33%);

In 2005 it achieved provided statistically yield increases on A1 topsoil with Kelpak and Neb-26 fertilizers and on A2 topsoil production were significant increases for fertilizers and Stimusoil Bionat. Yield increases this year have ranged between 2% - 34% on A1 topsoil and between 48% - 95% on other topsoil;

In 2006, of statistically, yield increases were secured in all analyzed cases except variant foliar fertilized with Kelpak on A1 topsoil. Were obtained yield increases of between 13% - 54% on topsoil first and between 21% - 46% on the topsoil second.

In 2007 fertilizers applied also caused provided statistically increases on both topsoils except only variant fertilized with Bionat fertilizer on A1 topsoil. There have been increases of between 3% - 21% on topsoil with added peat and 1% - 52% on other topsoil.

To estimate the effect of treatment applied on production was calculated the average fruit production and relative average fruit production on both topsoils and every treatment applied (figures 1 and 2).



* values marked with same letter do not differ statistically of 0.05 significant level, according to Student-Newman-Keuls statistical test

Figure 1: Average production of fruit (g/pot) from the crop tomato, DACIA cultivar, as a result of the fertilizers with ecological features: NEB 26, STIMUSOIL, KELPAK and BIONAT (average data on treatment 2004-2007)

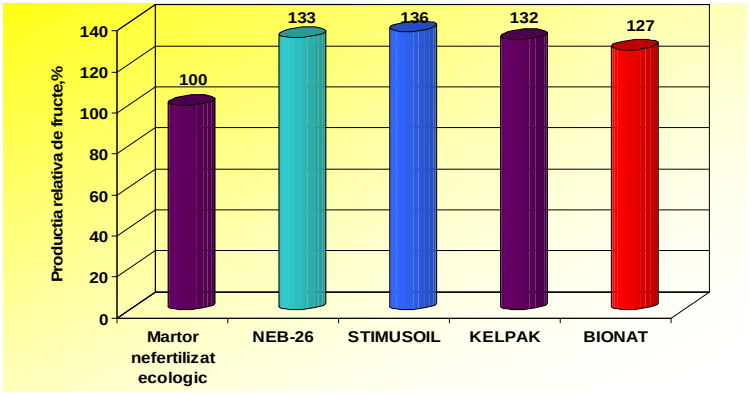


Figure 2: Relative average yields fruit (%) obtained from crop tomato, cultivar DACIA, as a result of the fertilizers with ecological features: NEB 26, STIMUSOIL, KELPAK and BIONAT (average data on treatment 2004-2007)

Analyzing the data presented in figures 1 and 2 may find that the average yield of fruit obtained in variants fertilized with liquid fertilizers Neb. 26, Stimusoil, Bionat, Kelpak was provided statistically compared with the unfertilized ecological control.

Relative average yield increases were recorded 27% for variant fertilized with Bionat fertilizer, 32% for Kelpak; 33% - Neb 26; 36% - Stimusoil; compared with unfertilized ecological control.

As regards the economic efficiency of fertilization applied materialized in physical yield increases (average) crop (fig. 3) may find that fertilizers have determined substantial increases on fruit production between 346.49 g/pot, Bionat - 461.31 g/pot, Stimusoil (average data on 4 years) compared with unfertilized ecological control.

To quantify the topsoils influence on fruit production in tomato crop were assessed average productions on topsoil and all experimental variants also experimental years were considered repetitions (fig. 4).

The data presented in fig. 4 can be found that productions obtained on A1 topsoil, topsoil with added peat, were significantly higher than A2 topsoil by 10%.

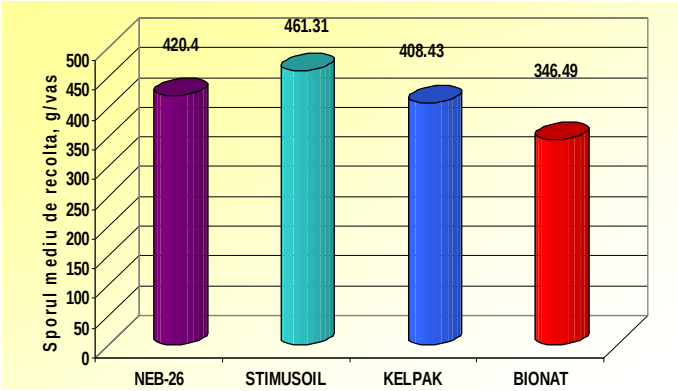
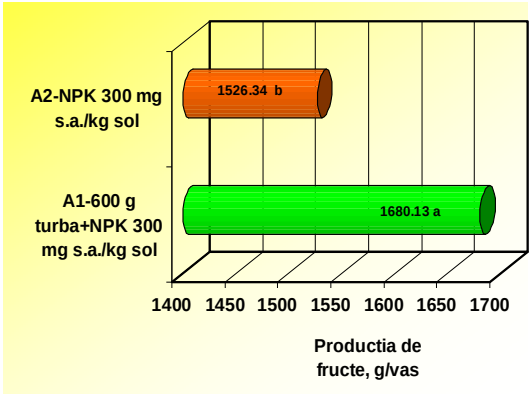


Figure 3: Increase the average harvest (g/pot) from the crop tomato, DACIA cultivar, as a result of the fertilizers with ecological features: NEB 26, STIMUSOIL, KELPAK and BIONAT (average data on treatment 2004-2007)



*average yield obtained on A1 is provided statistical from 0.05 significant level (according to Student-Newman-Keuls statistical test), compared with average yield obtained on A2

Figure 4: Experimental data on the influence of topsoil plus fertilization (A1 and A2) on the yield of fruit produced in tomato crop, cultivar DACIA, (Data on average on topsoil plus 2004-2007)

CONCLUSIONS

Application of this fertilization method and the compositions of liquid fertilizers with tested ecological features, as a method and agrochemical means for fertilization of plants, present a series of advantages:

- Prevention and curative treatment of nutritional deficiencies with crop tomatoes (with minimum costs);
- Mineral composition optimization of fruit by decreasing the mistake content and increasing the content of macro and micronutrients in fruits;
- By their contents in proteins, auxin, the tested fertilizers ensure the increase of plant resistance to the stress caused by various excessive conditions;
- Prevention of environmental chemical pollution phenomena by stimulation of photosynthesis process and increase of root uptake, that has as a result the increase of degree of productive valorization of nutritive elements in the fertilizers applied to sol and soil reserves;
- Reduced cost as compared to the other classical means of fertilization;
- Possibility to apply on plants at the some time with other obliged work included in technologies of plant cropping (herbicidation, treatments to control diseases and pests);
- Chemical and physical compatibility with a large range of insecticides, herbicides, fungicides, that permits their concomitant application and, implicitly, reduced costs of application operations.

BIBLIOGRAPHY

1. ANTON I., DORNEANU A., DANA D., SOARE M., ŞTEFĂNESCU D., OPRICĂ I., 2007 - The influence of some unconventional fertilization methods on bell-pepper crop in the protected space, Lucr. Şt., Anul L, seria Horticultură, vol.1 (50), Ed. Ion Ionescu de la Brad, Iaşi ISSN 1454-7376, p. 811-816.
2. ANTON I., DORNEANU A., NICULIŢĂ P., DANA D., BIREESCU G., OPRICĂ I., 2008 - Results regarding the effects of Fertec fertilizers on tomatoes grown in glasshouse of S.C. SERE S.A., Codlea, Lucr. Şt., seria Agronomie, vol.51, Ed. Ion Ionescu de la Brad, Iaşi, ISSN 1454-7414.
3. ANTON I., DORNEANU A., DANA D., BIREESCU G., ILIE L., COTEŢ V., OPRICĂ I., MIHALACHE D., GRIGORE A., 2009 – Research on ecological protection effect on the environment ensured by fertilization with new range of liquid fertilizers, Scientific Papers, Series A, LII, Agronomy, Bucharest, ISSN 1222-5339.
4. CIOROIANU T., SÎRBU C., DUMITRU M., DORNEANU A., ŞTEFĂNESCU D., 2009 - Îngrăşăminte neconvenţionale – Fertilizanţi lichizi, Ed. EstFalia, ISBN 978-973-7681-30-0.
5. DANA D., GAVRILUŢĂ I., SOARE M., BORLAN Z., BIREESCU L., ISTRATI E., NEBUNELEA D., 2003 - Cercetări privind eficienţa agronomică a unor mijloace neconvenţionale de fertilizare foliară specială aplicată în loturi de hibridare la cultura de porumb, Lucrările celei de a XVI –a Conferinţe Naţionale pentru Ştiinţa Solului, Vol. 30 B, p. 129-135.