STUDY ON THE APPLICATION OF BIOREGULATORY SUBSTANCES IN ORGANIC TOMATO CROP

STUDIU PRIVIND UTILIZAREA SUBSTANTELOR BIOREGULATOARE IN CULTURA DE TOMATE ECOLOGICĂ

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Abstract. *In the present study, we analyze the influence of bio-active substances (stimulants) to increase the quantity and quality of tomatoes fruit. Early and total tomato yield in 2013, varied at Margarita cultivar, according to the treatment and concentration of the substances applied, yields have been statistically provided of 95%. The content of nitrates and nitrites, regardless of experimental variant was below the maximum allowed by legislation.*
Key words*: bioactive substance, organic tomato yield, quality*

Rezumat. *În lucrarea de față ne-am propus să analizăm influența unor substanțe bioregulatoare de creștere (stimulatoare) asupra cantității și calității fructelor la o cultură de tomate. Producția timpurie si totala de tomate în anul 2013 a variat în cazul cultivarului de tomate Margarita F1 in functie substantele utilizate si de concentratia tratamentului aplicat, producțiile fiind asigurate statistic în procent de 95%. Continutul de nitrati si nitriti, indiferent de varianta experimentala este sub limita maxima admisa de legislatia in vigoare.*
Cuvinte cheie*: substanțe bioactive, tomate ecologice, recoltă, calitate*

INTRODUCTION

One of the objectives of agriculture in general, and specifically vegetable is to increase production per hectare by using specific measures and technological means. Among the measures that may increase output per hectare can include: choice of cultivar, fertilization and chemical processing intensive mechanization, combating diseases, pests and weeds (Stoleru, 2013).

This hypothesis stated above shall not apply to organic systems as synthetic chemicals are banned and in the application of products to combat diseases and pests their number is relatively small. Therefore, the increase of the production per hectare may be achieved by means of measures and environmentally friendly (Mustea et al., 2009 , Munteanu et al., 2009).

Using growth regulators is recommended as an alternative method to increase the effectiveness of traditional soil fertilization. Although the efficacy was assessed through an impressive number of studies, only a small fraction of them have highlighted the positive effects of the use of growth regulators on the

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quantity and quality of production (Stan et al., 1996; Chintea et al., 1998; Stoleru et al., 2013).

Some natural bioactive substances extracted from specific parts of the plant species known as: *Capsicum annuum*, *Hipophae rhamnoides*, *Lycopersicum esculentum* or *Digitalis purpurea* have been tested in the past in vegetable growing, but not in organic crops (Stan et al., 1996, Toma and Jitareanu, 2007, Munteanu et al., 2009, Avasiloaie et al., 2012).

Not the least, the accumulation of bioactive substances in plants vegetable is much influenced by the activity of bacteria PGPR (Stefan, 2013).

In the present study we aimed to analyze the influence of bioregulatory substances (stimulants) to increase the production and quality of tomato fruits.

MATERIAL AND METHOD

To achieve the goal, to be considered, agro-productive characterization (early and total yield) and qualitative evaluation of production in terms of nitrate and nitrite content.

The research was carried out at the "V. Adamachi "- farm from Iaşi, during 2013. The trial was organized in a split plot design, with three replications. A plot has a surface of 3.6m^2.

As biological material was used a hybrid cultivar produced by Hazeraas Margarita F1, and two bioactive substances allowed in organic farming such Pavstim and Ecostim (tab. 1), as two concentration, obtained at the Institute for Plant Physiology from Chisinau (Chintea et al., 1998)

Table 1

The bioactive substances used in the experiment

Comercial name	Origin	Utilized concentration	Chemical compozition
Ecostim	*Lycopersicon esculentum*	0,01-0,05 %	Glycoside-steroidal structure-
Pavstim	*Digitalis purpurea*	0,01-0,05 %	Glycoside-steroidal structure-

Treatments were applied as follows: a treatment applied at the seedling stage and five treatments applied during the vegetation period at intervals of 2 weeks. The control was sprayed with distilled water at the same time as treatment with bioactive substances.

The biological material was represented by Margarita F1 cultivar, indeterminate, with medium sized fruit, recommended primarily for protected crops. It has qualities such as earliness, red dark fruit, undamaged, spherical and tasty. The cultivar has good advantage in adverse conditions - low or high temperatures, large temperature differential day - night.

The planting was carried out from April 15 to 16, using the product seedling pots with a diameter of 8.5 cm of 50 days old.

Establishment of crop was based on a bad design with two rows per bad, the plants being run by a single strain. The work of preparing the soil and space were carried out in accordance with appropriate technology of organic crops (Stoleru, 2013).

Tomato production was analyzed for each experimental variant in dynamics since June 10 and ending with the October 10, 2013.

Early production for the NE of Romania is considered that production is carried out by 31 July of the current year, when production is carried out in the field.

Determinations of chemical analysis for nitrate and nitrite were carried out at the National Authority for Veterinary Sanitar and Food Safety (NAVSFS) Iași.

The harvesting of fruit to come into effect with the rules set out the NAVSFS, while the sample mean for each experimental variant was 1 kg. Fruits were harvested from the levels 2, 4, 6 and 8 and kept in the freezer at - 14 ° C.

Experimental data processing was carried out using analysis of variance (ANOVA), which established limits of probability for each treatment compared with control.

Determination of nitrite and nitrate consists of ions dosing by measuring the color intensity nitrogen compounds formed by the reaction of diazotization of sulfanilic acid and nitrite from the aqueous extract of the sample and coupling with alfanaftilamina. Upon further portion of aqueous extract reduces nitrates to nitrites using cadmium and determine the content of total nitrite (Hura, 2006).

RESULT AND DISCUSSION

A. Results on early tomato production

The results of early tomato production are presented in Table 2. Early production of tomatoes produced organically during 2013 ranged from 17.15 t/ha in control to 22.50 t/ha for treated variant with Pavstim in 0.05% which indicates a difference very positive significantly than martor.

Table 2

Early production and significance of differences than control

Treatment	Early production (kg/ha)	Difference to control (%)	Difference than control (t/ha)	Significance of differences
Ecostim 0,01%	18266	106,5	1,11	-
Ecostim 0,05%	19156	111,7	1,99	*
Pavstim 0,01%	20305	118,4	3,15	**
Pavstim 0,05%	22504	131,2	5,35	***
Control (Mt)	17158	100,0	0,00	

LSD 5%=1,72 LSD 1%=2,69 LSD 0.1%=4,23

Significant results, statistically assured with p <0.05% have been obtained also in treated variants with Ecostim 0.05% and Pavstim 0.01%. From economic perspective, earlier hybrids is positive as production value per unit area,

increasing benefit per kilogram of product, and roughly the same cost of production.

B. Results on the total production of tomatoes

Total yield of tomatoes produced in the experience are shown in Table 3. This varied within wide limits, given the crop, the hybrid organic plasticity, and the type of growth. Total production of tomatoes in 2013 ranged from 64.41 t / ha in Margarita F1 untreated to 72.43 t / ha in Margarita F1 variant treated with Pavstim 0.05%.

In terms of total production, significant differences were obtained for variant, Margarita treated with Pavstim 0.05%, which is 8.02 t / ha compared to the control.

Table 3

Total production and significance of differences than control

Treatment	Total produc-tion (kg/ha)	Difference than control (%)	Difference than control (t/ha)	Significance of differences
Ecostim 0,01%	67511	104,8	3,10	-
Ecostim 0,05%	69214	107,5	4,80	*
Pavstim 0,01%	68047	105,6	3,63	-
Pavstim 0,05%	72433	112,5	8,02	**
Control (Mt)	64414	100,0	0,00	

LSD 5%=4,67 t/ha LSD 1%=7,59 t/ha LSD 0.1%=12,30 t/ha

C. Results concerning the nitrate and nitrite content in tomato fruits

In tomato fruits nitrites have been undetectable and nitrates varies from 80.31 mg/kg fresh weight (Margarita F1 x untreated) to 188.54 mg/kg fresh weight (Margarita F1 x Ecostim 0.05%) allowed within maximum limit for greenhouse tomatoes where the maximum limit is 300 mg/kg fresh weight.

Nitrate accumulation in protected crop is significantly higher than in the open field, this is explained by the lower activity of nitro-reductase under protected cultivation due to lower light intensity, but also high levels of organic matter and high activity nitrate ion in the soil, as well as too high densities.

Table 4

Nitrite and nitrate content from tomato fruits (mg / kg fresh weight)

Treatment	Nitrates (mg/kg)	Nitrites (mg/kg)
Ecostim 0,01%	152,93	Nd
Ecostim 0,05%	188,54	Nd
Pavstim 0,01%	98,03	Nd
Pavstim 0,05%	101,52	Nd
Control(Mt)	80,31	Nd

CONCLUSIONS

The best results for early production have been obtained in the variant treated with Pavstim 0.05%, where production was 22.50 t/ha. Early production growth achieved in all treated variants was superior to the control, being statistically assured three of the four variants.

Total production ranged between 64.41 t/ha for control and 72.43 t/ha for the same treatment with Pavstim 0.05%.

The content of nitrate in tomato samples was below the limit set by Reg. 631/1995, indicating that the variants treated with 0.05% content was higher due to a more intense metabolic activity.

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