THE INFLUENCE OF DIFFERENT TYPES OF ECOLOGICAL FERTILIZERS ON THE AGROPRODUCTIVE CAPACITY OF FIVE TOMATO CULTIVARS

INFLUENȚA DIFERITELOR TIPURI DE FERTILIZANȚI ECOLOGICI ASUPRA CAPACITĂȚII AGROPRODUCTIVE LA CINCI CULTIVARE DE TOMATE

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Abstract. *The purpose of this paper is to evaluate the influence of the application of fertilizers allowed in organic farming to an assortment of autumn tomatoes. The research was conducted in the didactic and experimental field of the Vegetable growing discipline, at U.S.A.M.V. Iaşi. The experiment was of a bifactorial type, testing the influence of the cultivar with five graduations (Perra D`Abruzzo, Firmus F1, Raluca; Bilbo F1 and Rio Grande) and of the fertilization with three graduations (unfertilized, organic fertilization with Humic and the application of a product based on microorganisms, namely Micoseeds MB) under the conditions of the crop year 2019. The crop was established by seedlings of 45 days, in strips of two rows, the distance between the strips being 90 cm, and between rows, of 50 cm. The distance between plants in a row was 25 cm, resulting in a density of about 57 thousand plants per hectare. The results obtained demonstrate the efficiency of the products used, the yields obtained in the case of fertilized variants being higher compared to the non-fertilized variant, for all five cultivars used.*
Key words: cultivar, fertilization, yields, chlorophyll pigments.

Rezumat. *Scopul lucrării de față este de a evalua influența aplicării unor fertilizanți admişi în agricultura ecologică la un sortiment de tomate de toamnă. Cercetările au fost efectuate în câmpul didactic şi experimental al disciplinei de Legumicultură, U.S.A.M.V. Iaşi. Experiența a fost de tip bifactorial, fiind testată influența cultivarului cu cinci graduări (Perra D`Abruzzo, Firmus F1, Raluca; Bilbo F1 and Rio Grande) şi a fertilizării cu trei graduări (nefertilizat, fertilizare organică cu Humic şi aplicarea unui produs pe bază de microorganisme, respectiv Micoseeds MB) în condițiile anului agricol 2019. Cultura a fost înființată prin răsad de 55 de zile, în benzi de câte două rânduri, distanța dintre benzi fiind de 90 cm, iar dintre rânduri de 50 cm. Distanța dintre plante pe rând a fost de 25 cm, rezultând o densitate de aproximativ 57 mii plante pe hectar. Rezultatele obținute demonstrează eficiența produselor*

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utilizate, producțiile obținute în cazul variantelor fertilizate fiind mai ridicate comparativ cu varianta nefertilizată, pentru toate cele cinci cultivare utilizate.
Cuvinte cheie: cultivar, fertilizare, producții, pigmenți clorofilieni

INTRODUCTION

The tomato crop ranks first in terms of cultivation area and yield, both in our country and in the world. Among the most important factors that ensure the productivity of a crop, the judicious choice of cultivar (variety) and fertilization play a significant role in achieving this goal.

The use of synthetic chemicals has a significant effect of increasing yield, but it has been found that these substances can endanger human health (Caruso *et al*., 2019a).

The success of a tomato crop, managed according to the principles of organic farming, depends on the adequate supply of water and nutrients (Babik and Elkner, 2002; De Oliveira *et al*., 2016), specific fertilizations applied at key moments contributing substantially to high yields. Nowadays, the range of fertilizers that can be applied is very diverse, and its choice can make it difficult for the organic vegetable farmer, especially since some products contain different amino acids or different microorganisms useful for organic farming.

Under these circumstances, the purpose of this research is to evaluate the influence of fertilization on five autumn tomato crops, managed according to the rules of organic farming.

MATERIALS AND METHOD

The research was carried out under the experimental conditions of the year 2019, at the Didactic Station of U.S.A.M.V. Iaşi, the V. Adamachi Horticultural Farm, "Ion Ionescu de la Brad" University of Agricultural Sciences and Veterinary Medicine of Iaşi. The experiment was organized on a medium leached chernozem soil type, with a medium supply of nutrients, with 3% organic matter (Teliban *et al*., 2020) and pH = 6.5. The meteorological conditions in the experimental period were moderately favorable for this species.

The experimental protocol dictated the organization of a bifactorial experiment organized in the form of subdivided plots, with three repetitions, in which the influence of two experimental factors, the cultivar and fertilization, was studied, on an autumn tomato crop:

Factor A – the Cultivar, with five graduations: a_1 = Perra D`Abruzzo, a_2 = Firmus F1, a_3 = Raluca; a_4 = Bilbo F1 and a_5 = Rio Grande F1;

Factor B – the fertilization of the crop with three graduations: b_1 = unfertilized variant, b_2 = fertilization with Humic (12 l/ha) and b_3 = application of microorganisms, where Micoseeds MB was used (80 kg/ha).

The tomato crop was established using seedlings of 45 days, on June 1st, in strips of 2 rows, the distance between the strips being 90 cm, and between rows, of 50 cm. The distance between plants in a row was 25 cm, resulting in a density of about 57 thousand plants / hectare. The works carried out during the vegetation period were those recommended by the literature (Munteanu, 2003) and consisted mainly of drip irrigation, weed control and fertilization carried out in two installments, in

the doses appropriate for each type of fertilizer. The first fertilization was carried out 15 days after planting, and the second one in the phase of formation of the first fruits.

In order to determine the influence of fertilization on the five tomato crops studied, the determinations performed were focused on evaluating the yield resulted from each experimental plot and on determining the total chlorophyll pigment content, which was done before harvest, using the CCM-200 plus (Chlorophyll Content Meter).

The experimental data was processed by appropriate statistical-mathematical methods (Jitareanu, 1999; Leonte and Simioniuc, 2018). The least significant differences (LSD) test was used for the yields, and the Tukey test for chlorophyll content (Caruso *et al*., 2019b).

RESULTS AND DISCUSSIONS

The yields obtained according to the first factor studied – the cultivar - are presented in table 1. They varied from 38.0 t/ha, yield obtained by the Perra D'Abruzzo cultivar, up to 50.0 t/ha in the case of the Firmus F1 cultivar.

In the case of the Firmus F1 cultivar, distinctly significant positive differences were obtained compared to the Rio Grande cultivar taken as a control, namely a difference of 10.13%. The Bilbo variety also recorded a 5.07% yield increase, which is considered to be statistically significant.

Very significant negative differences compared to the control were obtained in the case of the Perra D'Abruzzo cultivar. The Raluca cultivar registered distinctly significant negative differences.

Table 1

Results obtained regarding the influence of cultivar on the tomato yield

No.	Cultivar	Yield			Difference significance
		t/ha	% compared to the Control	Difference compared to the Control	
1.	Perra D`Abruzzo	38.0	83.70	-7.14	ooo
2.	Firmus F1	50.0	110.13	4.6	**
3.	Raluca	40.6	89.43	-4.8	oo
4.	Bilbo F1	47.7	105.07	2.3	**
5.	Rio Grande F1	45.4	100	0.0	C

LSD 5% = 2.3 t/ha; LSD 1% = 3.4 t/ha; LSD 0.1% = 5.1 t/ha

The yields obtained in the case of the fertilization regime varied from 39.2 t/ha in the unfertilized graduation, to 47.9 t/ha, at the Micoseeds MB graduation. There was a yield difference of 2.0 t/ha between Micoseeds MB and Humic graduations (tab. 2).

For the Humic and Micoseeds MB variants, the yield increases recorded were very significantly positive compared to the unfertilized control. These exceeded the control of the experiment by 17.9% in the case of the variant

fertilized with Humic, respectively by 22.19%, in the case of the application of microorganisms, namely Micoseeds MB. This demonstrates that fertilization has had a positive influence on yield.

Table 2

Results obtained regarding the influence of fertilization on the tomato yield

No.	Treatment	Yield			Difference significance
		t/ha	% compared to the Control	Difference compared to the Control	
1.	Unfertilized	39.2	100	0.0	C
2.	Humic	45.9	117.09	6.7	***
3.	Micoseeds MB	47.9	122.19	8.7	***

LSD 5% = 3.1 t/ha; LSD 1% = 4.2 t/ha; LSD 0.1% = 5.6 t/ha

The fertilization carried out with Micoseeds MB had a strong influence on the yield, registering a difference of 8.7 t/ha compared to the control. Also, in the case of the fertilization with Humic, the difference compared to the control was of 6.7 t/ha.

The yield results determined by the graduations between the combinations of the two factors, cultivar and fertilization regime, are presented in table 3.

Table 3

Results regarding the influence of the cultivar x fertilization combination on the tomato yield

No.	Variant	Yield			Difference significance
		t/ha	% compared to the Ct	Difference compared to the Ct	
1.	Perra D`Abruzzo x unfertilized	32.8	84.32	-6.1	-
2.	Perra D`Abruzzo x Humic	38.9	100	0.0	-
3.	Perra D`Abruzzo x Micoseeds MB	42.4	109.00	3.5	-
4.	Firmus F1 x unfertilized	45.7	117.48	6.8	-
5.	Firmus F1 x Humic	51.7	132.90	12.8	***
6.	Firmus F1 x Micoseeds MB	52.7	135.48	13.8	***
7.	Raluca x unfertilized	34.6	88.95	-4.3	-
8.	Raluca x Humic	43.2	111.05	4.3	-
9.	Raluca x Micoseeds MB	44.1	113.37	5.2	-
10.	Bilbo F1 x unfertilized	44.0	113.1	5.1	-
11.	Bilbo F1 x Humic	48.6	124.94	9.7	**
12.	Bilbo F1 x Micoseeds MB	50.4	129.56	11.5	**
13.	Rio Grande F1 x unfertilized	38.9	100	0.0	C
14.	Rio Grande F1 x Humic	47.2	121.34	8.3	*
15.	Rio Grande F1 x Micoseeds MB	50.0	128.53	11.1	**

LSD 5% = 6.8 t/ha; LSD 1% = 9.3 t/ha; LSD 0.1% = 12.6 t/ha

The yields resulted in this case ranged from 32.8 t/ha (Perra D'Abruzzo x unfertilized) to 52.7 t/ha (Firmus F1 x Micoseeds MB), while the control of the experiment recorded a yield of 38.9 t/ha.

Following the combination of the two factors, cultivar and fertilization, very significant positive differences were highlighted in the case of the combination: Firmus F1 x Humic and Firmus F1 x Micoseeds MB with an increase compared to the control of 32.9% and 35.48%, respectively. There were also distinctly significant positive differences in the case of Bilbo F1 x Micoseeds MB, Rio Grande x Micoseeds MB and Bilbo F1 x Humic, thus resulting in increases of 29.56%, 28.53% and 24.94%, respectively. The Rio Grande x Humic variant obtained a significant positive difference compared to the control, with an increase of 21.34%. Results with values below the control of the experiment were recorded by the variants Perra D'Abruzzo x unfertilized and Raluca x unfertilized with 15.68% and 11.05%, respectively.

Following the combination of the two factors, cultivar and fertilization regime, the best results were obtained with the Firmus F1 hybrid fertilized with Micoseeds MB and with Humic, and the lowest yield was obtained with the Perra D'Abruzzo x unfertilized cultivar.

The chlorophyll pigments content, determined with the portable device CCM 200 plus, varied within quite large limits, from 9.1 CCI (Raluca x Humic) to 24.6 CCI (Bilbo F1 x Micoseeds MB).

In the case of the Bilbo and Firmus cultivars, the content of chlorophyll pigments was the highest for all the graduations of the fertilization factor, this correlating positively with the high yields obtained in the case of these two combinations. A low content of assimilating pigments was recorded by the Raluca variety and in this case the yields obtained were relatively small (fig. 1).

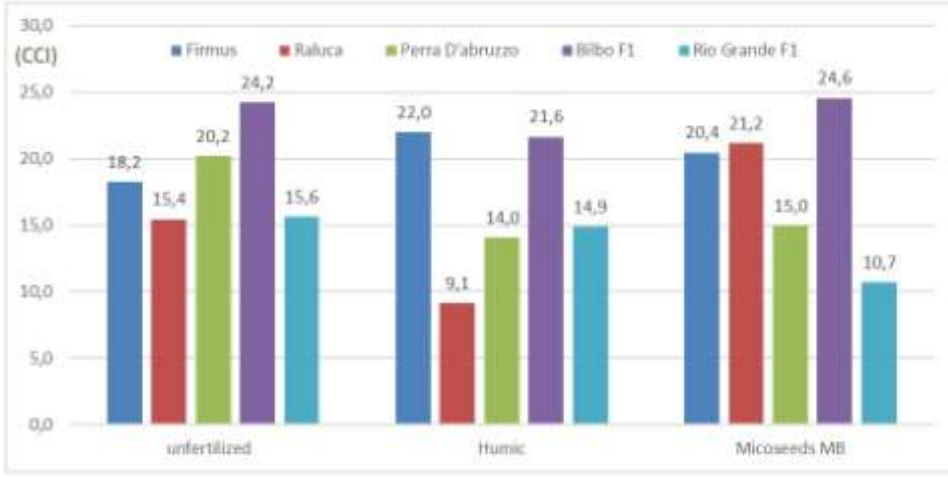

Fig. 1 The content of assimilating pigments
for the combination of variety x fertilization factors

CONCLUSIONS

1. The highest yields for the autumn tomato crop were registered by the hybrids Bilbo F1 and Firmus F1, which recorded distinctly significant yield increases compared to the control of the experiment, namely Rio Grande.

2. The results obtained demonstrate the efficiency of the products used, the yields obtained in the case of fertilized variants being higher compared to the unfertilized variant, for all five cultivars used.

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