THE PRODUCTION INCREASE FOR TOMATOES IN FIELD CROPS UNDER THE INFLUENCE OF TREATMENTS WITH GROWTH STIMULATORS

CREŞTEREA PRODUCŢIEI LA TOMATE ÎN CULTURĂ DE CÂMP SUB INFLUENŢA TRATAMENTELOR CU STIMULATORI DE CREŞTERE

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Abstract. *The work is part of a three-year study on the influence of treatments with growth promoters on tomatoes in various stages of development. This part presents data on the effect of treatments applied on tomato production in field crops. We used two growth promoters, conditioned as potassium and dimethylamine salts, in two dilutions, with and without added solution of zinc acetate. Three treatments were applied and followed the general development and production - average yield per plant (g) and average production in tones per hectare. Treatments applied to tomatoes in field culture led to higher output compared to control sprinkled with distilled water and compared with the variant treated with zinc acetate solution 5 ppm. The variant with the highest production this year was the one treated with the stimulator BCO 4 K - 20 ppm followed by BCO 4 K + -20 ppm Zn, with production increases of 41.6 respectively 38.9 t / ha.*

Key words: tomato, production, growth stimulators, phenoxyacetic.

Rezumat. *Lucrarea face parte dintr-un studiu pe trei ani privind influenţa unor tratamente cu stimulatori de creştere asupra tomatelor în diferite stadii de dezvoltare. In această parte se prezintă datele privind efectul tratamentelor aplicate asupra producţiei la tomate în cultura de câmp. Au fost utilizaţi doi stimulatori de creştere, conditionaţi ca săruri de potasiu şi de dimetilamină, în două diluţii, cu şi fără adaos de soluţie de acetat de zinc. Au fost aplicate trei tratamente şi s-a urmărit dezvoltarea generală a plantelor şi producţia medie pe plantă (g) şi producţia medie în tone/hectar. Tratamentele aplicate la tomate în cultura de câmp au condus la producţii mai mari comparativ cu martorul stropit cu apă distilată, dar şi comparativ cu varianta tratată cu soluţie de acetat de zinc 5 ppm. Varianta cu cea mai mare producţie a fost anul acesta cea tratată cu primul stimulator BCO 4 K – 20 ppm urmată de BCO 4 K+Zn –20 ppm, cu sporuri de 41.6, respectiv 38.9 t/ha.*

Cuvinte cheie: tomate, producţie, stimulatori de creştere, fenoxiacetic.

INTRODUCTION

Sulphonamydes represent an important class of chemical compounds characterized by an herbicide or growth regulator and auxinic effect auxinic and by the lack of toxicity. The sulphonamydes' main feature is represented by the fact that introducing the sulphonamydic group into an aromatic or heterocyclic ring, their toxicity is profoundly decreased. We chose as support for the sulphonamydic group chloro-derivatives of the phenoxyacetic acids because they

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have reduced toxicity, are biodegradable and don't have cumulative properties in the organism or side effects. Seeds' germination and plantlets development in a shorter period of time is very important in their future development and in order to obtain production increases (Finck A., 1982; Garcia R.L., Hanway J.J., 1976).

As an alternative to chemical fertilizers in agriculture, growth stimulators are more and more used. Synthesizing and experimenting new chemical structures from the sulphonamydes' class, used as innovative growth regulating substances, represents the preoccupation of many researchers in this field (Bireescu L. et. al., 1999; Mansaur F.A. et. al., 1994; Oniscu C. et al., 2005)

MATERIAL AND METHOD

The tested compounds, 4-chloro, 2-sulphonamidic phenoxyacetic acid (BCO 4) and 2- chloro, 4-sulphonamidic phenoxyacetic acid (BCO 2), were previously conditioned as potassium and dimethylamine salts. Preliminary tests were performed in order to select an optimal dilution interval that induces the growth stimulating effect, avoiding the concentration threshold from which the herbicide effect of these compounds start to manifest. As a result, we chose two dilutions – 20 ppm and 25 ppm, for the seeds treatments as well as for the foliar applications for the more developed stages of the plants (Trofin Alina, 2003).

For the tomato plants cultivated in field, three treatments were applied and we observed in the mean time their general development. Variants were randomly placed, in three repetitions for each treated variant, with five plants for each repetition. In order to avoid the interferences between different variants, they were separated by a row of buffer plants, which were not treated or measured (Trofin Alina, 2003). The considered variants were the following (table 1).

Table 1

Variants used for the foliar treatments

Variant	Treatment solution	Variant	Treatment solution
m_{apa}	Control boiled water	V_8	BCO 4 DMA+Zn –25 ppm
m_{Zn}	Control zinc salt	V_9	BCO 2 K – 20 ppm
V_1	BCO 4 K – 20 ppm	V_{10}	BCO 2 K – 25 ppm
V_2	BCO 4 K – 25 ppm	V_{11}	BCO 2 K+Zn –20 ppm
V_2	BCO 4 K+Zn –20 ppm	V_{12}	BCO 2 K+Zn –25 ppm
V_4	BCO 4 K+Zn –25 ppm	V_{13}	BCO 2 DMA – 20 ppm
V_5	BCO 4 DMA – 20 ppm	V_{14}	BCO 2 DMA – 25 ppm
V_6	BCO 4 DMA – 25 ppm	V_{15}	BCO 2 DMA+Zn –20 ppm
V_7	BCO 4 DMA+Zn –20 ppm	V_{16}	BCO 2 DMA+Zn –25 ppm

The control variants were treated with boiled and cooled water, and the others with the selected dilutions for the tested compound; the first foliar treatment was applied at 15 days from the plantlets' sowing, the second one, after the next 15 days, and the third one after one more month, with 15 ml of growth stimulator solution for each plant and each application.

Irrigation was assured daily during the dry periods, and between, related to the required water necessities of the used tomato cultivar.

RESULTS AND DISCUSSIONS

In what regards the general development of the plants, we noticed a bigger number of flowers, respectively bonded fruits on all four permitted floors for each plant for the variants treated with BCO 4, with a slightly bigger number for the variants where zinc salt was added. Even if the second growth stimulator obtained smaller valued in what regards the number of bonded fruits, they were anyway superior to the considered controls. From the two used dilutions, the 20 ppm one gave better results, for the variants without zinc salt added compared to the variants treated with the 25 ppm dilution, as well as compared to controls. The BCO 2 growth stimulator lead to more uniform plants in what regards height and even slightly taller for most of the variants.

The observations regarding production were made separately for the first two floors, then for floors 3 and 4, measuring the average production on a plant (g) and the average production in tones/hectare. Finally we combined the results for the observations on the total production of the four floors for each treated variant (table 2).

For the 1st and 2nd floor we obtained the biggest differences between controls and treated variants. The data regarding the production of the 3rd and 4th floor registered smaller differences compared to controls, but all treated variants had better results than both control variants. Some plants from some variants' repetitions suffered a viral attack, they did not properly develop and as consequence, the productions of all four floors diminished for those specific repetitions (figure 1).

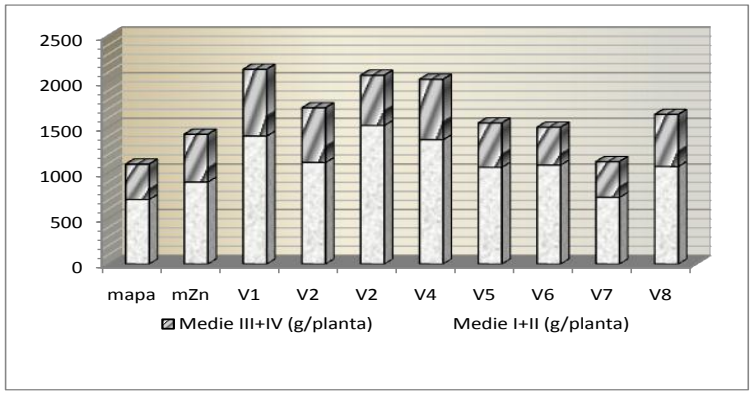

Fig. 1 - Average production on a plant for the variants treated with BCO 4

The average production on a plant registered as well bigger values for the treated variants, different for the two growth stimulators: BCO 4 gave again better results, for both dilutions, with or without zinc salt added, compared to BCO 2, but the second growth stimulator also lead to superior results compared to control

variants (figure 2). The potassium salt determined bigger production yields than the dimethylamine one, for all four floors of the plants.

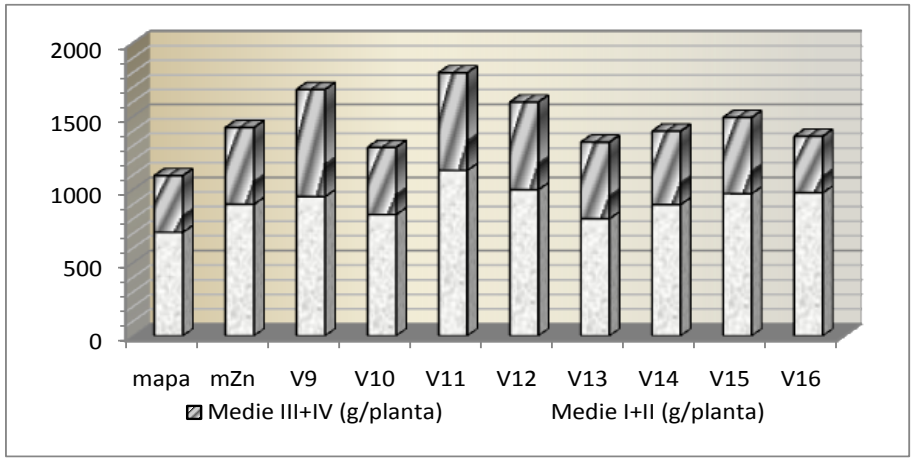

Fig. 2 - Average production on a plant for the variants treated with BCO 2

We calculated in the end the total production yield for tomatoes in field culture in tones/ha, as average value for three repetitions, considering a surface cultivated with 40 000 plants/ha.

Table 2

Total production for tomatoes in field culture related to the applied treatment - tones/ha (40 000 plants / ha)

Variant	Total production (t/ha)			
	R_1	R_2	R_3	Average
m_{apa}	42.84	43.04	45.4	**43.76**
m_{Zn}	53.96	61.16	55.6	**56.907**
V_1	82.8	91.28	82	**85.36**
V_2	68.24	68.36	68.8	**68.466**
V_3	76.16	87.36	84.68	**82.733**
V_4	77.28	84.84	80.76	**80.96**
V_5	61.84	62.72	60.92	**61.827**
V_6	53.12	62.04	64.84	**60.0**
V_7	50.84	60.08	23.68	**44.867**
V_8	59.04	67.04	70.64	**65.573**
V_9	63.72	72.8	65.44	**67.32**
V_{10}	58.36	30.56	65.6	**51.506**
V_{11}	67.76	77.24	70.72	**71.906**
V_{12}	60.96	69.48	61.2	**63.88**
V_{13}	28.76	60.48	69.52	**52.92**
V_{14}	51.88	58	57.8	**55.893**
V_{15}	61.48	63.2	54.28	**59.654**
V_{16}	57.16	51.2	55.24	**59.907**

We observed significant production increases for the treated variants compared to controls, but even so, the variants did not overcome the cultivar's production capacity, of 70 – 90 t/ha. The climate conditions registered in the experimental field were not very favorable; the extended drought periods were followed by extremely abundant rainfalls.

Most of the fruits presented a scared inferior half, and for a part of them, this part rot.

Even so, considering all conditions, the treated variants overcame the production of the control variant sprinkled with water and excepting five variants, the production of the control variant treated with zinc acetate.

The influence of the different considered factors was appreciated by statistic calculus, using the randomized blocks method with limit difference. We obtained the following results (table 3):

Table 3

The influence of the applied treatment on total production for tomatoes in field culture (40 000 plants/ha)

Variant	Production	% comp. control	Differences	Significance
BCO 4 K – 20 ppm	85.36	194.98	41.6	xxx
BCO 4 K+Zn –20 ppm	82.73	188.81	38.9	xxx
BCO 4 K+Zn –25 ppm	80.96	184.93	37.2	xxx
BCO 2 K+Zn –20 ppm	71.9	164.16	28.1	xxx
BCO 4 K – 25 ppm	68.46	156.39	24.7	xx
BCO 2 K – 20 ppm	67.3	153.65	23.5	xx
BCO 4 DMA+Zn –25 ppm	65.57	149.77	21.8	xx
BCO 2 K+Zn –25 ppm	63.88	145.89	20.1	xx
BCO 4 DMA – 20 ppm	61.83	141.10	18.0	x
BCO 4 DMA – 25 ppm	60.0	136.99	16.2	x
BCO 2 DMA+Zn –20 ppm	59.65	136.30	15.9	x
Control zinc acetate 5 ppm	56.91	129.91	13.1	
BCO 2 DMA – 25 ppm	55.89	127.63	12.1	
BCO 2 DMA+Zn –25 ppm	54.5	124.43	10.7	
BCO 2 DMA – 20 ppm	52.92	120.78	9.1	
BCO 2 K – 25 ppm	51.5	117.58	7.7	
BCO 4 DMA+Zn –20 ppm	44.87	102.51	1.1	
Control water	43.76	100.00	0.0	Control
DL 5% : 14.5 t/ha DL 1% : 19.5 t/ha DL 0.1% : 25.7 t/ha				

CONCLUSIONS

1. The growth stimulators applied to tomatoes in field culture lead to bigger production yields compared to control variant sprinkled with water but also compared to control variant treated with zinc acetate 5 ppm;

2. Between the two considered growth stimulators, the best results were obtained using BCO 4, followed by BCO 2;

3. Generally speaking, the 20 ppm dilution determined bigger production yields than the 25 ppm dilution;

4. The added zinc salt solution 5 ppm increased production for most of the variants where it was combined with the growth stimulator, and the control variant treated only with this solution had production yields bigger than five treated variants and the control variant sprinkled with water;

5. The treatment combinations with very significant results, according to the statistic calculus, were: BCO 4 K 20 ppm; BCO 4 K 20 ppm + Zn acetate; BCO 4 K 25 ppm + Zn acetate and BCO 2 K 20 ppm + Zn acetate.

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