THE EFFECTS OF THE TREATMENTS WITH SUBSTITUTED PHENOXYCARBOXYLIC ACIDS AND ZINC SALTS ON THE GERMINATION PROCESS AT TOMATO PLANTS

EFECTELE TRATAMENTELOR CU ACIZI FENOXIACETICI SUBSTITUIŢI ŞI CU SĂRURI DE ZINC ASUPRA PROCESULUI DE GERMINAŢIE LA PLANTELE DE TOMATE

TROFIN Alina[1], ONISCU C.[2]
[1]University of Agricultural Sciences and Veterinary Medicine Iasi, Romania
[2]"Gh. Asachi" Technical University of Iasi, Romania

Abstract. *The paper is part of a series of researches on the stimulating effects produced by some compounds from the substituted phenoxycarboxylic acids' class on the tomato plants in different stages of growth. In this part of the study we observe the influence of two growth stimulators, conditioned as dimethyl-amine salts, on the germination process of the tomato seeds. The control variants are using distilled water for soaking the seeds, for three and six hours, while the treated variants use seeds soaked in different dilutions of the two considered growth stimulators (20 ppm and 25 ppm), the same period of time, with or without zinc salt added, in concentration of 5 ppm. The periods of treatment were chosen after some previous tests on seeds from the same tomato breed used in this experiment, Buzău 1600. The considered dilutions were also selected after previous experiments, thus to obtain the growth stimulating effect without exceed the concentration from which the herbicide effect of this class's compounds occur.*

Key words: growth stimulators, tomatoes, zinc, phenoxyacetic, germination

Rezumat. *Lucrarea se încadrează într-o serie de cercetări asupra efectelor stimulative produse de unii compuşi din clasa acizilor fenoxi-carboxilici substituiţi asupra plantelor de tomate aflate în diferite stadii de dezvoltare. În această parte a studiului se urmăreşte influenţa a doi biostimulatori, condiţionaţi ca săruri de dimetilamină, asupra germinaţiei la seminţele de tomate. Se folosesc variante martor, în care se utilizează apa distilată pentru înmuierea seminţelor, timp de trei şi şase ore, şi variante tratate, cu seminţe înmuiate aceeaşi perioadă de timp cu diferite diluţii a celor doi biostimulatori (20 ppm şi 25 ppm), cu sau fără adaos de sare de zinc, soluţie de concentraţie 5 ppm. Timpul de tratare a fost ales în urma unor testări prealabile pe seminţe din acelaşi soi utilizat în acest experiment, Buzău 1600. Diluţiile utilizate au fost selectate de asemenea în urma unor experimente anterioare, astfel încât să se obţină efectul stimulator de creştere fără a depăşi concentraţia de la care se manifestă efectul erbicid al acestor compuşi.*

Cuvinte cheie: biostimulatori, tomate, zinc, fenoxiacetic, germinaţie.

INTRODUCTION

Studying the agriculture's development is a real interest for researchers in all domains, especially due to the fact that there are increased demands for agricultural prime matters in the processing industry. Very developed countries

which conduct an intensive agriculture apply large amounts of chemical fertilizers, especially based on nitrogen, inducing the pollution of the environment with nitrites and nitrates. As an alternative to chemical fertilizers in agriculture, bio fertilizers are more and more often used. Sulfonamides represent an important class of chemical products characterized by herbicide or growth regulating auxinic type effect, by lack of toxicity towards the environment and living organisms; these structures contain as support for the sulfonamidic group chloro derivatives of the phenoxyacetic acids because they are biodegradable, do not accumulate in the organism and have no side effects.

The participation of the growth stimulators in the germination and plant development processes intensifies plant's respiration which precedes and makes possible the reserve carbohydrates' hydrolysis in the seeds, their transport and use in the plant's development. Seeds' germination and plant development in a shorter period of time have an important role in plant's further development and obtaining production increases.

MATERIAL AND METHOD

The structures synthesized and tested for their growth stimulating effect are the dimetyl aminic salts of the 4-chloro-2-sulfonamido - phenoxyacetic acid and 2-chloro-4- sulfonamido - phenoxyacetic acid; we also studied, into the frame of the same experiment, the influence of a zinc input, conditioned as zinc acetate solution 5 ppm. We considered an autochthonous semi late tomato cultivar with a mean production yield of 70 – 90 t fruits/ha and multi step ripening period.

As following the preliminary tests we chose an optimal dilution interval in which the growth stimulating effect to occur, avoiding to surpass the concentrations from which the herbicide effect of these compounds may appear. The treating variants use the two bio stimulators in two dilutions (20 ppm and 25 ppm), with or without zinc added. The period of the seeds treatment with the bio stimulators' solutions (or distilled water, for the untreated controls) varied, choosing two time intervals, of 3 and 6 hours. The treated seeds were used in the experiment after a previous air-dry process, at room temperature, on filter paper.

We established the following treated variants:

$m_{3\text{-}H2O}$ – control for 3 hours treatment in distilled water;
$m_{3\text{-}Zn}$ – control for 3 hours treatment in zinc acetate solution 5 ppm;
$m_{6\text{-}H2O}$ – control for 6 hours treatment in distilled water;
$m_{6\text{-}Zn}$ – control for 6 hours treatment in zinc acetate solution 5 ppm;
v_1 – 3 hours treatment with BCO-4 DMA 20 ppm;
v_2 – 3 hours treatment with BCO-4 DMA 25 ppm;
v_3 – 3 hours treatment with BCO-4 DMA 20 ppm + Zn 5 ppm;
v_4 – 3 hours treatment with BCO-4 DMA 25 ppm + Zn 5 ppm;
v_5 – 3 hours treatment with BCO-2 DMA 20 ppm;
v_6 – 3 hours treatment with BCO-2 DMA 25 ppm;
v_7 – 3 hours treatment with BCO-2 DMA 20 ppm + Zn 5 ppm;
v_8 – 3 hours treatment with BCO-2 DMA 25 ppm + Zn 5 ppm;
v_9 – 6 hours treatment with BCO-4 DMA 20 ppm;
v_{10} – 6 hours treatment with BCO-4 DMA 25 ppm;
v_{11} – 6 hours treatment with BCO-4 DMA 20 ppm + Zn 5 ppm;
v_{12} – 6 hours treatment with BCO-4 DMA 25 ppm + Zn 5 ppm;

v_{13} – 6 hours treatment with BCO-2 DMA 20 ppm;
v_{14} – 6 hours treatment with BCO-2 DMA 25 ppm;
v_{15} – 6 hours treatment with BCO-2 DMA 20 ppm + Zn 5 ppm;
v_{16} – 6 hours treatment with BCO-2 DMA 25 ppm + Zn 5 ppm;

The seeds were set for germination at a mean temperature of 18^0C, with 10 hours light/day, in Petri dishes containing each 20 seeds/dish, on a germination bed of filter paper moist daily with boiled and cooled water, 2 – 3 ml per dish.

RESULTS AND DISCUSSIONS

The measured parameters in this experiment were the number of germinated seeds on a dish, the rootlets, gemula and two leaves plantlets' length, for the variants treated with growth stimulators, in two concentrations, compared to the untreated control. We made two measurements (I, II) at four and seven days from the beginning of the experiment. The obtained results were synthesized in table 1:

Table 1

The influence of the growth stimulators on tomato's germination process

	No. of treatment hours	**3 hours**									
	Treatment variants	m_{H2O}	m_{zn}	v_1	v_2	v_3	v_4	v_5	v_6	v_7	v_8
I	No. germinated seeds/20	12	17	15	17	18	19	16	16	16	17
	Rootlets length (cm)	0.96	0.3	0.26	0.42	0.42	0.51	0.37	0.32	0.54	0.34
	No. of treatment hours	**6 hours**									
	Treatment variants	m_{H2O}	m_{zn}	v_9	v_{10}	v_{11}	v_{12}	v_{13}	v_{14}	v_{15}	v_{16}
I	No. germinated seeds/20	17	17	14	9	16	15	15	18	13	17
	Rootlets length (cm)	0.48	0.4	0.17	0.18	0.32	0.48	0.35	0.3	0.4	0.34
	No. of treatment hours	**3 hours**									
	Treatment variants	m_{H2O}	m_{zn}	v_1	v_2	v_3	v_4	v_5	v_6	v_7	v_8
II	No. germinated seeds/20	16	19	19	18	18	20	17	16	19	19
	No. gemula under 1 cm	4	7	9	3	8	6	1	4	7	6
	No. gemula 1 – 2 cm	2	6	3	3	4	4	5	5	4	3
	No. 2 leaves plantlets	6	4	3	11	5	8	11	5	7	8
	No. of treatment hours	**6 hours**									
	Treatment variants	m_{H2O}	m_{zn}	v_9	v_{10}	v_{11}	v_{12}	v_{13}	v_{14}	v_{15}	v_{16}
II	No. germinated seeds/20	17	17	15	15	18	20	17	19	19	18
	No. gemula under 1 cm	3	1	4	4	10	6	4	1	7	4
	No. gemula 1 – 2 cm	2	2	2	2	4	2	2	3	3	6
	No. 2 leaves plantlets	9	13	6	11	3	5	10	15	6	6

The first conducted measurements (I) observed the effect of the applied treatment on the number of the germinated seeds in each dish and on the length of the rootlets developed by the germinated seeds. In what regards the three hours treatment variants, all had superior values compared to the control treated with distilled water, two of the variants having a better behavior: v_3 – 3 hours treatment with BCO-4 DMA 20 ppm + Zn 5 ppm and v_4 – 3 hours treatment with BCO-4 DMA 25 ppm + Zn 5 ppm; the positive effect of the zinc occurred this time only for the combinations with BCO-4 growth stimulator.

For the six hours treatment variants, only two of them (v_{14} – 6 hours treatment with BCO-2 DMA 25 ppm and v_{16} – 6 hours treatment with BCO-2 DMA 25 ppm + Zn 5 ppm) reached the germination percentage of the controls, the rest of the variants having a slower germination process (fig. 1).

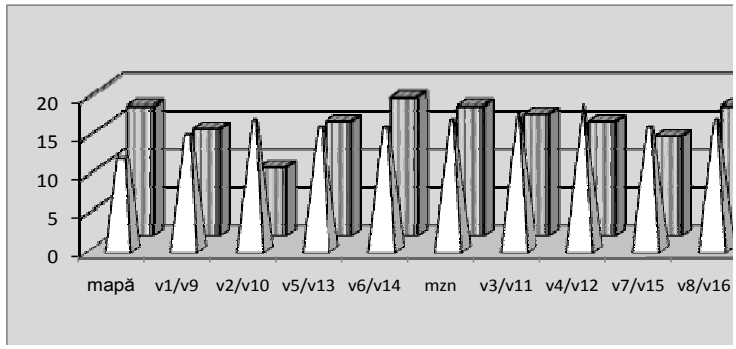

Fig. 1. The variation of the germinated seeds' number with the treatment after 4 days

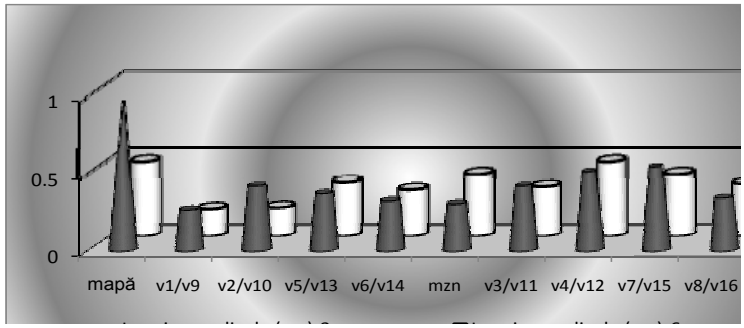

Fig. 2. The variation of the rootlets' length with the treatment after 4 days

As mean values, the treated variants developed shorter rootlets than the controls, no matter the applied growth stimulator's type (fig. 2).

At the end of the experiment, in what regards the number of germinated seeds from a total of 20 for each variant, only two variants had a 100% germination: v_4 – 3 hours treatment with BCO-4 DMA 25 ppm + Zn 5 ppm and v_{12} – 6 hours treatment with BCO-4 DMA 25 ppm + Zn 5 ppm, variants which used the same combination of growth stimulator with a zinc input. In what regards the different development stages of the plantlets related to the treating variant, we observed for the most of the variants the acceleration of the development rhythm, increasing the number of two leaves plantlets, both for three and six hours treatment period, with no zinc input. The effect of the two growth stimulators when zinc was added to their solutions for the six hours treatment did not lead to a more rapid development of the plantlets compared to the zinc control m_{Zn} or to the water control m_{H2O}.

For the variants treated three hours with both growth stimulators' dilutions combined with zinc, we registered values slightly superior to zinc control m_{Zn} for the germinated seeds' percentage as well as for the plantlets development. We registered the following distribution on treatment variants (fig. 3, 4).

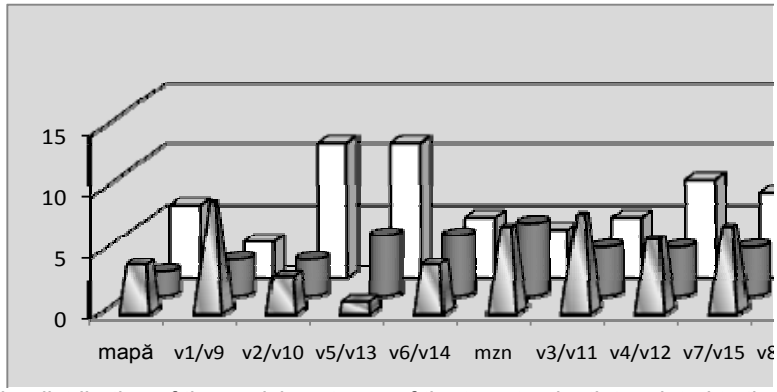

Fig. 3. The distribution of the evolving stages of the tomato plantlets related to the applied treatment for 3 hours

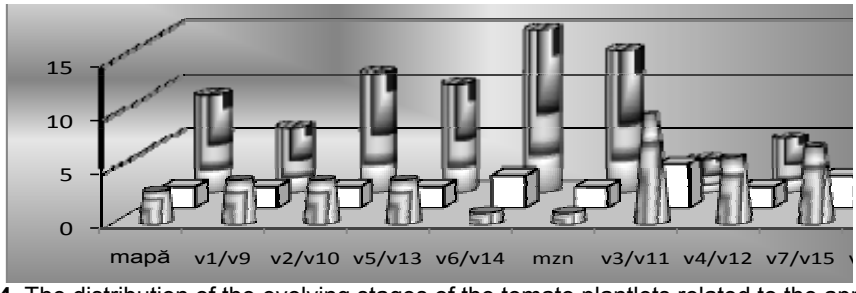

Fig. 4. The distribution of the evolving stages of the tomato plantlets related to the applied treatment for 6 hours

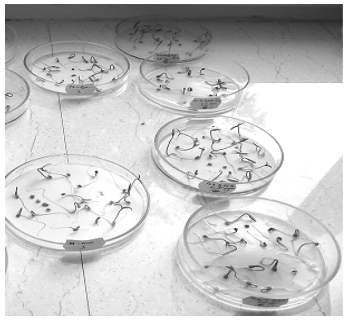

Fig. 5. Variants treated with BCO-4 DMA compared to controls- 3 hours

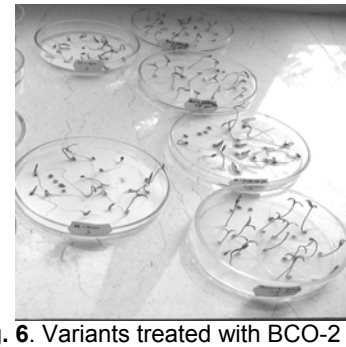

Fig. 6. Variants treated with BCO-2 DMA compared to controls- 3 hours

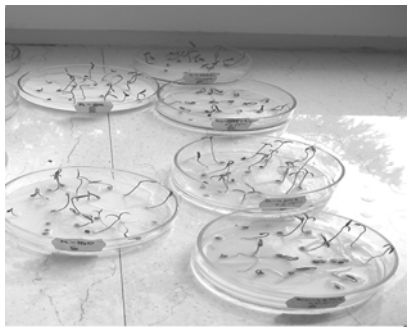

Fig. 7. Variants treated with BCO-4 DMA compared to controls- 6 hours

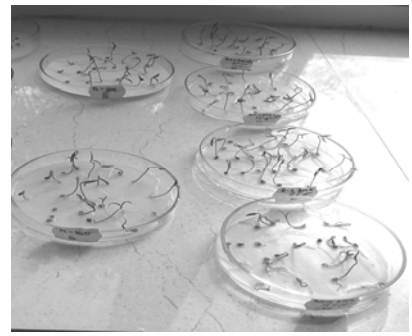

Fig. 8. Variants treated with BCO-2 DMA compared to controls- 6 hours

CONCLUSIONS

1. For the variants with seeds treated for three hours with the two dilutions of the considered growth stimulators, we noticed a slightly higher percentage of germinated seeds on a dish compared to the variants treated for 6 hours;

2. The growth stimulator BCO-4 DMA, in both used dilutions, had a better effect on the germination faculty for the three hours treatment, but BCO-2 DMA lead to better results for the variants treated for six hours;

3. The influence of the zinc salt solution 5 ppm, added to the growth stimulators' dilution, conducted to a more balanced distribution between plantlets' different evolving stages, while at the variants with no zinc added, the plantlets developed more rapidly almost for all combinations;

4. The variants treated with growth stimulators and zinc input conducted to higher percentages of germinated seeds than the variants treated with the same growth stimulators' dilution, even if the plantlets developed slower.

5. Further observations for the effect of these treatment combinations in the next developing stages of the seedlings are necessary, in order to appreciate correctly the influence of the growth stimulators, with or without zinc added, on the general development of the tomato plants.

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