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Growth Regulator on Rooting and Development of Cucumber Seedlings (*Cucumis sativus*)

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ABSTRACT

The use of growth regulators is a practice that can stimulate the growth and development of plants, acting on differentiation and cell elongation. Products with this purpose are sold for application by air and seed treatment. This work aimed at evaluating the growth response of cucumber seedlings to the application of different doses of the Stimulate® growth regulator. The experiment was carried out at UNISEP - União de Ensino do Sudoeste do Paraná, DoisVizinhos, in the state of Paraná, Brazil, in protected cultivation. The experiment was conducted in a randomized block design with four replications where five doses of growth regulator: 0.00; 0.25; 0.50; 0.75; and 1.00 L-1 were evaluated. The seeds were sown in expanded polystyrene trays with 200 cells containing commercial substrate, which were later accommodated in protected cultivation. Seedling height, root system length, fresh weight of shoot and root system were evaluated. It was observed that the 0.00 and 0.75 L-1 doses caused significant effects on the development of air and root part, the doses 0.50 and 1.00 L-1, had positive effects on the development of seedlings.

INTRODUCTION

The cucumber (*Cucumis sativus* L.), belongs to the family of cucurbits, along with pumpkins, strawberries, zucchinis, watermelons and melons, being composed of 95% water and much used in culinary. Its origin is still disputed, however, believed to be attributed to India, later its cultivation would have spread to China and European countries. The cucumber usually has a greenish shell (light or dark), cylindrical in shape. Its pulp is light in color with flattened seeds in its surroundings.

One of the main problems for the use of cucumber seeds is the lack of uniformity in germination. With the increasing demand for food in quantity and quality, it is fundamental to adopt new techniques to stimulate production, among them the use of biostimulators, as plant hormones. According to Castro (1998) plant hormone is a group of organic molecules that occurs naturally in plants, which act on the physiological processes of plants, but at low concentrations.

According to Galston& Davies (1972) and Raven *et al*. (2001), plant hormones are present in all processes of plant development, acting as chemical messengers. The use of plant hormones in agriculture has shown good results influencing the increase of productivity and cultural management (VIEIRA & CASTRO, 2002). Growth regulators can be applied directly to stems, leaves, seeds, fruits, and roots (CASTRO & MELOTO, 1989).

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The plant biostimulant still acts efficiently in seed germination, early seedling vigor, root and leaf growth and development, as well as the production of organic compounds (SILVA *et al*., 2014).

Stimulate® is a growth regulator, being one of the most used at the moment. According to Vieira & Castro (2002), Stimulate® is composed of indolbutiric acid (0.05g L-1), kinetin (0.09g L-1) and gibberellic acid (0.05g L-1), they continue that due to the composition, concentration and proportion of their substances, it can stimulate cell division, as well as influence in plant development, making the plants have greater capacity for absorption of water and nutrients.

According to the package label specifications of Stimulate®, the use promotes plant development, mainly the development of the root system, positively influencing the absorption of water and essential nutrients for the plants.

The present work had as objective to evaluate different dosages of growth regulators in the development of cucumber seedlings.

MATERIAL AND METHODS

The experiment was set up in protected cultivation, in the municipality of DoisVizinhos, in the state of Paraná, Brazil, belonging to the UNISEP - União de Ensino do Sudoeste do Paraná, from May 21st to June 12th of 2014.

Five doses of growth regulator (0.005% indolebutyric acid, 0.009% cytokinin and 0.005% gibberellin) were used in the treatment of cucumber seed: 0.00; 0.25; 0.50; 0.75; and 1.00 L-1, for each 500g of seeds. The treatment was carried out manually with the aid of a plastic bag to homogenize the same. The cultivar Aodai, lot 31214 with 90% of germinative potential was used.

Immediately after treatment, the seeds were planted in expanded polystyrene trays with 200 cells containing commercial substrate. Twenty cells were used for each plot.

The trays were accommodated in protected culture, covered with low density polyethylene film of 150 microns, additive and closed at the sides with 75% shading screen.

Five seedlings were collected per plots in three moments, at the second, fourth and sixth days after germination. These were submitted to the evaluation of shoot size and root system, weight of fresh shoot and root mass. For determination of plant height, the measurements were obtained from the lap of the seedling to the apex. To determine the size of the root system, it was measured from the neck of the plant to the tip of the root, with the aid of a digital caliper. In order to obtain the fresh mass data of the aerial part and root system, we used an analytical balance.

The data were submitted to analysis of variance by the F test (α0.05) and the differences between the means of the treatments, compared by the Tukey test (α0.05) through the statistical analysis program SISVAR®.

RESULTS AND DISCUSSION

Treatment at 0.75 L-1 on the second day after germination resulted in a positive result for fresh seedlings, but only differed from the 0.25 L-1 treatment (Table 1). On the fourth day there were no significant differences between treatments. In the sixth day of germination the treatment with 0.75 L-1 obtained superior results compared to the others, while the other results showed small differences between them.

Alleoni *et al*., (2000), evaluating the application of different doses of plant regulator in common bean, in the number of pod/grains, found that there were no statistical differences between treatments applied in relation to the control. However, they affirm that the dosage of 0.75 L-1, applied via single dose foliage increased by 1.7% relative to the control. In relation to the mass yield of 1000 grains, they observed that there were significant differences between the treatments where 0.25 L-1 of growth regulator was applied to the seeds and 0.75 L-1 applied in a single foliar dose, when these results were compared with the control.

Studies carried out by Oliveira *et al*. (1998), applying growth regulators in the bean crop, observed that there was no increase in productivity.

Table 1: Mass of the fresh matter of the aerial part of the plant (g), in different dosages of growth regulator for the production of cucumber seedlings.Unisep - DoisVizinhos - PR.

Doses (L^{-1})	2^{nd}dayaftergermination	4^{th}dayaftergermination^{ns}	6^{th}dayaftergermination*
0,00	0,20 ab	0,73	0,40ab
0,25	0,19b	0,23	0,33 abc
0,50	0,20 ab	0,23	0,31bc
0,75	0,27a	0,23	0,42 a
1,00	0,20ab	0,21	0,28 c
CV (%)	15,94	7,95	12,53

^{ns} Not significant, averages followed by the same letter do not differ from each other,

* Averages followed by distinct letters in the column differ from each other by Tukey test (α=0,05).

For seedling height (Table 2), the results at two and four days after the beginning of germination did not show significant differences between the applied doses, however on the sixth day the treatment in which the product was not used, obtained statistically similar results to the 0.75 L-1 dose. The doses 0.25 and 0.50 L-1 did not differ among themselves and the highest dose had the lowest result. Thus, it can be stated that for seedling growth, there is no need for product use, since the control treatment showed good results.

The use of growth bioregulators in crops in general generates many controversies about their performance. In the soybean crop Bertolin *et al*. (2010), states that the use of Stimulate® increased productivity. Dario *et al*. (2005), using Stimulate® in the same culture did not obtain significant results.

Table 2: Aerial shoot height (cm), in different dosages of growth regulator, for the production of cucumber seedlings.Unisep - DoisVizinhos - PR

Doses (L^{-1})	2ndayaftergermination^{ns}	4thdayaftergermination^{ns}	6thdayaftergermination*
0,00	3,40	7,17	4,60 a
0,25	3,35	6,91	4,15ab
0,50	3,27	7,15	4,37 ab
0,75	3,52	7,92	4,75 a
1,00	3,27	7,35	3,87 b
CV (%)	7,95	9,08	6,73

^{ns} Not significant, averages followed by the same letter do not differ from each other,
* Averages followed by distinct letters in the column differ from each other by Tukey test (α=0,05).

In relation to the fresh matter mass of the root system (Table 3), it can be observed that on the second and fourth day after germination there were no significant differences, on the sixth day the treatments with a dosage of 0.25, 0.50 and 1.00 L-1, did not differentiate between them, the dose 0.75 L-1 and the control treatment presented better results and did not differ from each other. Bernardes *et al*. (2010), Mortele *et al*. (2008) and Baldo *et al*. (2009), evaluated the use of bioregulators in common bean, cotton and soybean, noting that there was no increase in the productivity of these crops when compared to the control.

However, Abrantes *et al*. (2011), Bertolin *et al*. (2010), Albrecht *et al*. (2009) and Palangana *et al*. (2012), affirm that they obtained significant results in productivity increase in cotton, soybean, pepper and common bean crops. Mortele *et al*. (2008), emphasizes that the efficiency of the product depends on the adverse climatic conditions.

Table 3: Mass of the fresh matter of the root system (g) in different dosages of growth regulator, for the production of cucumber seedlings.Unisep - DoisVizinhos - PR.

Doses (L^{-1})	2ndayaftergermination^{ns}	4thdayaftergermination^{ns}	6thdayaftergermination*
0,00	0,067	0,087	0,22 a
0,25	0,057	0,08	0,11 b
0,50	0,067	0,07	0,13b
0,75	0,057	0,09	0,19 a
1,00	0,062	0,07	0,12 b
CV (%)	17,40	12,73	13,73

^{ns} Not significant, averages followed by the same letter do not differ from each other,
* Averages followed by distinct letters in the column differ from each other by Tukey test (α=0,05).

At the second and fourth days after the beginning of germination, the doses did not present significant differences, but on the sixth day after germination, the control treatment showed higher growth of the root system than the others (Table 4). Candido *et al*. (2012), analyzing the use of Stimulate® in canelinha stakes where they were immersed in the solution with a concentration of 5 mL L-1, not obtaining significant results compared to the control, among the variables analyzed by the same dry mass of roots.

In the soybean crop (Glycine max) Cato (2006), with the use of auxins obtained positive results adding weight in the dry mass of roots.

Table 4: Length of the root system (cm), in different dosages of growth regulator, for the production of cucumber seedlings.Unisep - DoisVizinhos - PR.

Doses (L^{-1})	2ndayaftergermination^{ns}	4thdayaftergermination^{ns}	6thdayaftergermination*
0,00	5,80	7,17	9,80 a
0,25	7,30	6,91	7,60 b
0,5	6,65	7,15	8,17 b
0,75	7,22	7,92	9,9 a
1,00	6,30	7,35	8,02 b
CV (%)	14,45	9,08	8,54

^{ns} Not significant, averages followed by the same letter do not differ from each other,
* Averages followed by distinct letters in the column differ from each other by Tukey test (α=0,05).

Conclusion:

The use of growth regulator affected the development of seedlings only on the sixth day after germination, increasing the weight and length of fresh matter of aerial part and root system of cucumber seedlings.

The 0.75 L-1 dose was highlighted for the four variables evaluated.

Future Studies:

Evaluate doses of growth regulators in seedlings of cucumber (Cucumissativus) in function of different types of substrates.

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