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NUTRIENT CONTENT AND GROWTH OF BEGONIA TRANSPLANTS (Begonia semperflorens L.) UNDER THE INFLUENCE OF BIOSTIMULANT APPLICATION

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SUMMARY

In this research the effect of biostimulant on the Begonia transplants roots and above-ground mass growth and development and on the nutrients contents was investigated. The results showed that biostimulant application significantly improved root and above-ground mass growth and development compared to untreated plants. Also, there has been a statistically significant difference in nutrient concentration where higher N and K concentrations were found in treated plants. However, in the root of the untreated plants the higher P concentration occurred. At the end, it can be concluded that biostimulant treatment helps the nutrient uptake in the young Begonia plants together with improving their growth and development.

Key words: begonia, biostimulant, root mass, above-ground mass, nutrient content

INTRODUCTION

In Bosnia and Herzegovina, more attention has been paid recently to the decoration of parks and commons. To that purpose a great number of different flowering plant species and cultivars are being used. Consequentially, there is an increasing demand for production of ornamentals suitable for decorative greening of public areas, house lots and balconies.

One of the most widely used is the Begonia (*Begonia semperflorens* L.). Begonia belongs to the group of annual seasonal flowers, which in our climatic conditions begins with flowering in the beginning of May and continues into the late fall, i.e. until the first winter frosts. Begonia production is based on growing it from transplants, which should be cultivated in optimal conditions to have the required vigour as a pre-condition for development of highly productive plants. It is well known that plants during the process of transplantation go through certain abiotic stress as a result of deviation in the

environmental conditions from the optimum (M e n a – P e t i t e et al., 2006; K i j n e et al., 2006). Also, the application of biostimulants ceases the stress in the case of adverse temperatures and increases the yield, and the consequences are diminished in case of drought, freezing, mechanical and chemical damages as well as in the case of viral plant infection (M a i n i , 2006).

With the application of biostimulants in the phase of plantlets growth and development, it is possible to create better conditions by adding active substances such as polysaccharides, proteins, amino acids and glycosides directly. Positive influence of biostimulants, amino acids and different slow-release fertilizers during growth and development of different plant species has been confirmed by V e r n i e r i et al. (2002), J e l a č i ć et al. (2007), V u j o š e v i ć et al. (2007) and B e a t o v i ć et al. (2006).

The aim of this research was to determine the nutrient content in the root and the above-ground mass of the Begonia (*Begonia semperflorens* L.) under the influence of applied biostimulant, as well as to determine the growth and development of the roots and above-ground parts.

MATERIAL AND METHODS

The research was conducted during 2008 in "Lotus" greenhouses in Banja Luka, BiH. The seeds of Begonia cultivar "*Olympia Red"* were used as material. The seeds were sown on 6th January, 2008 year in polystyrene containers using the *Klasmann-Deilmann* substrate with pH value of 5.5-6.5. Plants were kept in the greenhouse i.e. "multiplier" where daily temperatures were 18-20°C, and nightly 15-18°C with a relative air humidity of 60-65%. The greenhouse was regularly ventilated so that disease development would not occur. The seedlings emerged within 14 days. Two months after sowing plants were transplanted in plastic pots of 10.5 cm diameter. After transplanting, the plants were placed in the greenhouse for the usual cultivation in a lower temperature where the average daily temperature were around 15°C, and during the night 12°C. At the same time, biostimulant Radifarm® (Valagro s.p.a. Italy) was applied, which contains polysaccharides, glycosides and proteins, and it is enriched with amino acids (arginine and asparagine), vitamins and micro-elements (Fe and Zn). It is used for mass increment and lateral root development during the first phase of plant growth, and then it stimulates formation and extension of new roots and root hairs. In this way it helps faster rooting of plantlets and recovery from stress of transplantation. Radifarm® was applied by watering in the concentration of 0.25%.

Experiment was set according to split plot method in 4 repetitions with 10 plants per repetition: plants treated with biostimulant were transplanted in plastic pots of 10.5 cm (A2) diameter and associated control (A1).

In order to determine growth and development of Begonia under the influence of biostimulant, plants were 9 weeks after transplantation to plastic pots and biostimulant treatment, which coincides with the moment of transplantation into the outdoors, taken out of the containers. The root was cleaned of the substrate and washed out with

distilled water and then dried with paper towels after which the measuring of the above-ground and root fresh mass of every plant separately was taken. Weighed above-ground parts and roots of the Begonia were packed in separate paper bags, neatly marked, and put to dry in dry-kiln. Drying of the plant material at 70°C lasted up to the point of achieving constant mass, after which the weighing of the above-ground and root was done. Dried plant mass was ground into fine powder using an electric mill, after which the nutrient content (N, P, K) was determined. The contents of nitrogen (N) was analyzed using the method of wet digestion by Kjeldahl, the contents of phosphorus (P) with spectrophotometer, and the contents of potassium (K) with flame spectrometry. Fresh and dry mass of above-ground part and roots have been weighed with precision of two decimal places and expressed in grams (g) as average mass plant^{-1}.

Obtained data were statistically analysed with two-way (bi-factorial) analysis of variance with the application of statistical tests (LSD, F-test, t-test), using computer standard programs.

RESULTS AND DISCUSSION

With the aim of determining growth, development and nutrient content of Begonia, through the mass of root and above-ground part of the plant the following results were obtained.

Table 1 Fresh and dry mass of begonia above-ground part under the influence of biostimulant treatment

Tablica 1. Svježa i suha masa nadzemnog dijela begonije pod utjecajem tretmana s biostimulatorom

Treatment variant(A) *Varijanta tretiranja (A)*	Fresh above-ground mass (g) *Svježa masa nadzemnog dijela (g)*	Dry above-ground mass (g) *Suha masa nadzemnog dijela (g)*
Control (A1) *Kontrola (A1)*	44.64	1.49
Treatment (A2) *Tretman (A2)*	47.46	1.61
Average *Prosjek*	46.05	1.55
LSD	Fresh above-ground mass (g) *Svježa masa nadzemnog dijela (g)*	Dry above-ground mass (g) *Suha masa nadzemnog dijela (g)*
0.05	1.0311	0.0514
0.01	1.5621	0.0779

Fresh above-ground mass, as well as the dry above-ground mass, were under very significant influence of biostimulant treatment (P≤0.01).

The highest average fresh above-ground mass was 47.46 g which belonged to treated plants (A2), whereas significantly lower (P≤0.01) fresh above-ground mass was recorded in control plants (A1, 44.64 g). The highest average mass of dry above-ground part recorded was 1.61 g in treated plants compared to significantly lower mass of 1.49 g in control plants (table 1). Generally, significantly higher average mass of both fresh and dry above-ground part had plants treated with biostimulant in reference to the same control plants (table 1).

The mass of fresh and dry roots were under significant influence of the biostimulant treatment (P≤0.01). Treatment gave highest average mass of fresh roots which was 3.51 g and was significantly higher compared to 2.88 g in control plants. Same was with dry roots mass which had been significantly higher (P≤0.01) in respect to the same control plants (Table 2.)

Nitrogen and potassium content was under significant influence (P≤0.01) of biostimulant treatment in both roots and above-ground part dry matter. Treated plants in both cases had higher concentrations of these elements in roots and above-ground part. Concerning phosphorus concentration, it was significantly higher (P≤0.01) in roots of control plants, whereas treatment hadn't significantly influenced on its concentration in above-ground part although it was somewhat higher in treated plants (Table 3).

Table 2 Fresh and dry root mass of begonia under the influence of biostimulant treatment
Tablica 2. Svježa i suha masa korijena begonije pod utjecajem tretmana s biostimulatorom

Treatment variant (A) *Varijanta tretiranja (A)*	Fresh root mass (g) *Svježa masa korijena (g)*	Dry root mass (g) *Suha masa korijena (g)*
Control (A1) *Kontrola (A1)*	2.88	0.32
Treatment (A2) *Tretman (A2)*	3.51	0.35
Average *Prosjek*	3.19	0.33
LSD	Fresh root mass (g) *Svježa masa korijena (g)*	Dry root mass (g) *Suha masa korijena (g)*
0.05	0.1526	0.0154
0.01	0.2312	0.0233

Table 3 Nutrient content (%) in dry matter of begonia above-ground part under the influence of biostimulant treatment

Tablica 3. Sadržaj hranjiva (%) u suhoj tvari nadzemnog dijela i korijena begonije pod utjecajem tretmana s biostimulatorom

Treatment variant (A) *Varijanta tretiranja (A)*	Nutrient content (%) *Sadržaj hraniva (%)*					
	Dry above-ground mass *Suha tvar nadzemnog dijela*			Dry roots *Suha tvar korijena*		
	N	P	K	N	P	K
Control (A1) *Kontrola (A1)*	3.47	0.56	4.2	2.13	0.39	1.65
Treatment (A2) *Tretman (A2)*	3.64	0.57	4.63	2.21	0.31	2.07
Average *Prosjek*	3.56	0.57	4.41	2.17	0.35	1.86
LSD	Nutrient content (%) *Sadržaj hraniva (%)*					
	Dry above-ground mass *Suha tvar nadzemnog dijela*			Dry roots *Suha tvar korijena*		
	N	P	K	N	P	K
0.05	0.0646	ns	0.2522	0.0271	0.0274	0.0829
0.01	0.0978	ns	0.3821	0.0411	0.0414	0.1256

Positive influence of biostimulants in Begonia production was already confirmed by Zeljković et al. (2009[a]). Also, biostimulants positively affects the growth and development of Scarlet Sage roots (Zeljković et al., 2009). Similar to results obtained in this investigation, application of biostimulants in tomato production resulted in higher root, stem and leaves fresh and dry mass as reported by Parađiković et al. (2008), Parađiković et al. (2009) and Vinković et al. (2009).

Improvement of nutrient uptake can be explained due to certain content of humic acids in biostimulant applied. Namely, humic acids can improve nutrient uptake and their transport in plants (Adani et al., 1998). Better root development and in the same time higher nitrogen content of Begonia roots and above-ground part in this research is possibly due to addition of amino acid arginine via biostimulant Radifarm®. Arginine is proved to be NO precursor (Jubault et al., 2008) which can indirectly stimulate root

growth in soybean, growth of lateral roots in tomato, root hairs in Arabidopsis and adventitious roots in cucumber (reviewed in Flores et al., 2008).

At the end, significantly higher phosphorus concentration in roots of control plants has been observed. Possible reason for this is significantly higher root mass in treated plants and therefore lower phosphorus concentration. Also, taking into the fact higher concentration in the above-ground part of treated plants, better phosphorus transport in these plants can be considered which can be aim of some future investigations.

CONCLUSION

Biostimulant application gave good results in this research which can be seen through the enlargement of the roots and the above-ground part of the ever-flowering Begonia transplants. Fresh and dry mass of above-ground part was higher under the influence of the treatment with biostimulant, and that by 7% with fresh mass and by 8% with dry mass of the above-ground part in reference to the same mass of the control plants. Also, the mass of fresh and dry root was higher in treated plants compared to control plants up to 22% with fresh root mass and up to 10 % of dry root mass. It can be concluded that application of biostimulant Radifarm® positively affects the growth and development of Begonia transplants. It is highly recommendable to use it in transplants production ensuring that way development of more robust stress-resistant plants for future use in outdoors.

SADRŽAJ HRANJIVA I RAST PRESADNICA BEGONIJE (*Begonia semperflorens* L.) POD UTJECAJEM BIOSTIMULATORA

SAŽETAK

U ovom istraživanju ispitan je utjecaj tretmana s biostimulatorom na rast i razvoj te sadržaj hranjiva presadnica begonije. Obradom rezultata utvrđeno je da primjena biostimulatora značajno poboljšava rast i razvoj korijena i nadzemnog dijela presadnica begonije u usporedbi s netretiranim biljkama. Isto tako, pojavila se značajna razlika između tretiranih i netretiranih biljaka u sadržaju makroelemenata ishrane. Sadržaj N i K bio je značajno veći u korijenu i nadzemnom dijelu tretiranih biljaka. Ipak, značajno veći sadržaj fosfora utvrđen je u korijenu netretiranih biljaka, a u nadzemnom dijelu je bio veći kod tretiranih biljaka. Na kraju se može zaključiti da je tretman s biostimulatorom u ovom istraživanju pozitivno utjecao na ispitivane parametre djelujući na poboljšan rast i razvoj korijena i nadzemnog dijela kao i na usvajanje makroelemenata.

Ključne riječi: begonija, biostimulator, korijen, nadzemna masa, sadržaj hraniva

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