# INFLUENCE OF CONTAINER VOLUME ON THE PLANTS QUALITY IN THE PRODUCTION OF SOME BEGONIA L. SPECIES

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## ABSTRACT

The plant size, growth rate and the degree of branching represent important criteria for determining the stage of commercial plant. This paper aimed to study the behaviour of plants belonging to the species Begonia masoniana and Begonia rex depending on the volume of substrate, in order to obtain plants for sale. The plant material, obtained from leaf cuttings, was planted in a mixture of peat and perlite (2:1), in pots of different sizes: 8 cm (0,32 l), 10 cm (0,4 l), 12 cm (0,7 l). The observations and determinations were focused on: the average height of the plant, the average diameter of the plant, the average length and width of the leaf, the average number of leaves. In order to obtain in a short period of time plants with rich shrubs for sale, it is recommended in the case of the Begonia masoniana species to use pots with a diameter of 8 cm, respectively a small volume of substrate. The main morphological characteristics of Begonia rex 'Inca Fire', express the best performance of plants in the larger volume container (12 cm diameter).

## INTRODUCTION

The genus *Begonia* Linnaeus (Begoniaceae) is one of the largest genera of flowering plants and more than 1890 species are currently accepted, native to tropical and subtropical regions of America, Asia and South Africa (Ardi et al. 2018; Espino et al., 2004). A large number of *Begonia* species are widely cultivated as ornamental houseplants, mainly for their showy flowers and colorful leaves (Tebbitt, 2005). They are used as garden plants and potted plants, in hanging baskets, and as greenhouse flowers in many parts of the world (Buyun et al. 2018, Kaviani et al. 2015). Some species are commonly grown as ornamental houseplants for their bright colorful leaves, which are often variously marked or variegated, usually asymmetric (unequal-sided) (David and Frodin, 2004).

Given the wide diversity of species and varieties within the *Begonia* genus, the knowledge of the biological characteristics of plants and their response to various environmental and agro-technical works are essential in the design and application of the advanced technologies (Selaru Elena, 2000).

The modern flower production is based on flower transplants production in different container systems (Latimer, 1991), usage of specialized substrates and application of different controlled release fertilizers, growth biostimulants (Nelson, 2003). The effects of substrate volume and space partitioning on plant growth, and the mechanisms involved, are still not fully understood (Semchenko, et al. 2007).

The introspection in the literature shows that for the cultivation of decorative begonias for leaves, grown in pots, there are no recommendations on the optimal volume of substrate for obtaining vigorous, compact plants in a short time. As a result, this paper aims to

establish the appropriate volume of substrate for obtaining plants for sale in a short time.

## MATERIAL AND METHOD

The experiment was established in 2018 in the didactic greenhouse of the Floriculture discipline within the Faculty of Horticulture, with the aim of studying the influence of pot size, respectively the nutrient volume on the growth and development of begonia plants.

The initial biological material consisted of plants of Begonia masoniana and *Begonia x rex* 'Inca Fire', found in the collection of the Floriculture discipline of the Faculty of Horticulture in Craiova.

*Begonia masoniana* Irmsch., native to China, is distinguished by large cordiform leaves (16-20 cm long and 10-12 cm wide), with red hairs at the tip of the folds and a brown pattern on the line of the main star-shaped ribs.

*Begonia x rex* Putz. 'Inca Fire' has oblique-asymmetrical leaves, slightly corrugated, 12-14 cm long and 8-10 cm wide. The upper part of the leaf has a metallic luster, the colour of the leaf is red. The petiole is red and covered with pink hairs.

The plant material, obtained from leaf cuttings, was planted in a mixture of peat and perlite (1:1), in pots of different sizes: 8 cm (0,32 l), 10 cm (0,4 l), 12 cm (0,7 l), resulting in the following experimental variants: V11-*Begonia masoniana*/12 cm; V12-*B. masoniana*/10 cm; V13 – *B. masoniana*/8 cm; V21 - *Begonia rex* 'Inca Fire'/12 cm; V22 – *B. rex* 'Inca Fire'/10 cm; V23 – *B. rex* 'Inca Fire'/8 cm. The control plant was established according to the recommendations in the literature on the size of the pots.

In the greenhouse experiments were carried out with experimental design of random blocks, with three replications. There was observed the rhythm of vegetative growth in the begonia plants under the influence of the substrate volume for one year from the establishment of the experiment.

The observations and determinations were conducted between 2018 and 2019 and focused on: the average height of the plant, the average diameter of the plant, the average length and width of the leaf, the average number of leaves. The data collected was the mean of values from three replicates.

## RESULTS AND DISCUSSIONS

Varying container size alters the rooting volume of the plants, which can greatly affect plant growth (Scott and Duval, 1998). This paper aimed to study the behaviour of plants belonging to the species *Begonia masoniana* and *Begonia rex* depending on the volume of substrate, in order to obtain plants for sale.

Analyzing the average values of the 3 variants of *Begonia masoniana*, it is observed that the height of the plants recorded the highest values when they were cultivated in pots of 12 cm (14,56 cm) and the lowest values were obtained for plants grown in 8 cm pots (13,2 cm) (table 1).

The variants of *Begonia rex* 'Inca Fire' recorded close values for the 10 cm and 12 cm pots (18,66 cm, respectively 18,46 cm), and the lowest values were obtained for the plants grown in 8 cm pots (16,36 cm).

The analysis of the variants shows that restricting root volume determined negative insignificant differences compared to the control variant in both species. Some studies show that the decrease in container volume causes growth restriction of the roots system and, consequently, causes significant decrease of hight the plants (Scott NeSmith and Duval, 1998), as observed for *Eucalyptus grandis* (Gomes et al., 2003), *Cryptomeria japonica* (Santos et al., 2000), *Salvia splendens* (Zeljković, et al. 2010) however, this was not verified in the present study.

The average values of the diameter of the plants recorded the same evolution registered at the last determination; the best results in this respect were obtained in both species in 12 cm pots, where the average diameter was 32.23 cm in *Begonia masoniana* and 29,6 cm in *Begonia rex* 'Inca Fire' compared to the plants grown in 8 cm pots which recorded as in the case of height, minimum values (31,00 cm for *Begonia masoniana*, respectively 26,73 cm for *Begonia rex* 'Inca Fire') (table 2).

Comparing the two species, it is observed that the reduction of the substrate volume had a insignificant influence on the height and the average diameter of the plants in both species.

Analyzing the table 3, it is found that the volume of substrate influenced the growth of plants in terms of average length and average width of leaves. The average values of leaf length recorded significant differences in *Begonia masoniana*, the values ranging between 9,3 cm (pots of 8 cm) and 12,56 cm (pots of 12 cm). The average values of leaf length of *Begonia rex* 'Inca Fire' ranged between 9,93 cm (pots of 8 cm) and 11,2 cm (pots of 12 cm).

In terms of the average width of the leaves, depending on the volume of substrate, there are significant differences between the 3 variants of *Begonia masoniana*, the values ranging between 8,76 cm (pots of 8 cm) and 11,3 cm (pots of 12 cm). In contrast, the values of this parameter in *Begonia rex* 'Inca Fire' were very close at the end of the experimental period, ranging between 8,06 and 8,7 cm (table 4).

Regarding the average number of leaves, the table 5 shows that this parameter in *Begonia masoniana* was influenced differently by the volume of substrate, recording minimum values for plants grown in pots of 0,7 l cm (9 leaves) and the maximum value (11 leaves) corresponds to the variant in which the plants benefited from a minimum container volume (pots of 0,32 l). Thus, the plants grown in 8 cm pots (V13) recorded positive significant differences than the plants grown in 12 cm pots (V1).

The volume of substrate had a significant influence in *Begonia rex* on the average number of leaves, the values ranging between 16,36 cm (8 cm pots) and 18,46 cm (12 cm pots).

## CONCLUSIONS

In order to obtain in a short period of time plants with rich shrubs for sale, it is recommended in the case of the Begonia masoniana species to use pots with a diameter of 8 cm (0.32 l), respectively a small volume of substrate. It is noteworthy that the *B. masoniana* plants grown in 0.32 l pots recorded higher values of the average number of leaves than those of the plants grown in 0,7 l cm pots.

Analyzing the influence of the substrate volume on the main morphological characteristics of *Begonia rex* 'Inca Fire', it results that the average values of these parameters were directly proportional to the nutrient volume that the plants had available.The number of leaf per plant express the best performance of plants in the larger volume container (0,7 l), corresponding to the best development for Begonia rex'Inca Fire'.

## BIBLIOGRAPHY

1. **Ardi, W. H., Chikmawati, T., Witono, J. R., & Thomas, D. C.**, 2018 - *A synopsis of Begonia (Begoniaceae) of Southeastern Sulawesi including four new species. Phytotaxa*, 381(1), 27-50.

2. **Buyun, L., Tkachenko, H., & Osadowski, Z.,** 2018 - *In Vitro Assessment of antioxidant effect of begonia rex putz. leaf extract on oxidative stress biomarkers in the equine erythrocytes model.* Agrobiodiversity for Improving Nutrition, *Health and Life Quality*, (2).

3. **David G. Frodin**, 2004 - *History and concepts of big plant genera. Taxon* 53(3), 753–776.

4. **Gasparin, E., de Avila, A. L., Araujo, M. M., Dorneles, D. U., & Foltz, D. R. B.**, 2014 - *Influence of substrate and container volume on the quality of Cabralea canjerana (Vell.) Mart. seedlings in nursery and field. Ciência Florestal,* 24(3), 553-563.
5. **GOMES, J. M. et al.,** 2003 - *Crescimento de mudas de Eucalyptus grandis em diferentes tamanhos de tubetes e fertilização N-P-K. Revista Árvore,* Viçosa, v. 27, n. 2, p. 113-127
6. **Hughes, M., Peng, C.I., Lin, C.-W., Rubite, R.R., Blanc, P., Chung, K.-F.**, 2018 - *Chloroplast and nuclear DNA exchanges among Begonia sect. Baryandra species (Begoniaceae) from Palawan Island, Philippines, and descriptions of five new species.* In PLoS One, vol. 13(5),
7. **Kaviani, B., Hashemabadi, D., Khodabakhsh, H., Onsinejad, R., Ansari, M. H., & Haghighat, N.**, 2015 - *Micropropagation of Begonia rex Putz. by 6-benzyladenine and α-naphthalene acetic acid. International Journal of Biosciences (IJB)*, 6(5), 8-15.
8. **Latimer, J.G.**, 1991 - *Container size and shape influence growth and landscape performance of marigold seedlings. Hort Science* 26(2):124-126.
9. **Selaru Elena**, 2000 - *Plante de apartament*, Editura Ceres, Bucuresti
10. **Semchenko, M., Hutchings, M. J., & John, E. A.**, 2007 - *Challenging the tragedy of the commons in root competition: confounding effects of neighbour presence and substrate volume. Journal of Ecology,* 95(2), 252-260.
11. **Tebbitt C.Mark**, 2005 - *Begonias: cultivation, identification and natural history*, Published by Timber Press.
12. **Santos, C. B.; Longhi, S. J.; Hoppe, J. M**., 2000 - *Efeito do volume de tubetes e tipos de substratos na qualidade de mudas de Cryptomerica japônica (L.F.) D.* Don. Ciência Florestal, Santa Maria, v. 10, n. 2, p. 1-15, 2000.
13. **Scott NeSmith, D., Duval J.R.**, 1998 - *The effect of container size. Hort Technology* 8(4):495-498.
14. **Zeljković, S. B., Parađiković, N. A., Babić, T. S., Đurić, G. D., Oljača, R. M., Vinković, T. M., & Tkalec, M. B.**, 2010 - *Influence of biostimulant and substrate volume on root growth and development of scarlet sage (Salvia splendens L.) transplants. Journal of Agricultural Sciences*, Belgrade, 55(1), 29-36.).

***Table 1***

**The influence of the substrate volume on the average height of plants of *Begonia masoniana* and *B. rex 'Inca Fire'***

| Treatments | *Begonia masoniana* | | | *Begonia rex 'Inca Fire'* | | |
|---|---|---|---|---|---|---|
| | Height plant (cm) | Difference | Signif. | Height plant (cm) | Difference | Signif. |
| 12 cm (Co) | 14,56 | - | | 18,46 | - | |
| 10 cm | 13,13 | - 1,43 | NS | 18,66 | +0,20 | NS |
| 8 cm | 13,20 | -1,36 | NS | 16,36 | -2,10 | NS |
| | DL 5%= 1,44; DL 1%=2,37; DL 0.1%= 4,45 | | | DL 5%=2.22; DL 1%=3,68; DL 0.1%=6,89 | | |

***Table 2***

**The influence of the substrate volume on the average plant diameter of *Begonia masoniana* and *B. rex 'Inca Fire'***

| Treatments | *Begonia masoniana* | | | *Begonia rex 'Inca Fire'* | | |
|---|---|---|---|---|---|---|
| | Plant diameter (cm) | Difference | Signif. | Plant diameter (cm) | Difference | Signif. |
| 12 cm (Co) | 32,23 | - | | 29,60 | - | |
| 10 cm | 31,40 | -0,83 | NS | 27,83 | -1,77 | NS |
| 8 cm | 31,00 | -1,23 | NS | 26,73 | -2,87 | * |
| | DL 5%= 0,77; DL 1%=1,28; DL 0.1%= 2,39 | | | DL 5%=2.25; DL 1%=3,72; DL 0.1%=6,97 | | |

***Table 3***

**The influence of the substrate volume on the leaf length in *Begonia masoniana* and *B. rex 'Inca Fire'***

| Treatments | *Begonia masoniana* | | | *Begonia rex 'Inca Fire'* | | |
|---|---|---|---|---|---|---|
| | Leaf length (cm) | Difference | Signif. | Leaf length (cm) | Difference | Signif. |
| 12 cm (Co) | 12,56 | - | | 11,20 | - | |
| 10 cm | 12,10 | -0,46 | NS | 10,20 | -1,00 | NS |
| 8 cm | 9,30 | -3,26 | ** | 9,93 | -1,27 | NS |
| | DL 5%=1.31; DL 1%=2.17; DL 0.1%= 4.06 | | | DL 5%=1.48; DL 1%=2.46; DL 0.1%=4.60 | | |

***Table 4***

**The influence of the substrate volume on the leaf width in *Begonia masoniana* and *B. rex 'Inca Fire'***

| Treatments | *Begonia masoniana* | | | *Begonia rex 'Inca Fire'* | | |
|---|---|---|---|---|---|---|
| | Leaf width (cm) | Difference | Signif. | Leaf width (cm) | Difference | Signif. |
| 12 cm (Co) | 11,30 | - | | 8,86 | - | |
| 10 cm | 10,50 | -0,80 | * | 8,70 | -0,16 | NS |
| 8 cm | 8,76 | -2,54 | *** | 8,06 | -0,80 | NS |

| | | |
|---|---|---|
| | DL 5%=0,58; DL 1%=0,95; DL 0.1%= 1,79 | DL 5%=0,78; DL 1%=1,30; DL 0.1%=2,44 |

***Table 5***

**The influence of the substrate volume on the number of leaves in *Begonia masoniana* and *B. rex 'Inca Fire'***

| Treatments | *Begonia masoniana* | | | *Begonia rex 'Inca Fire'* | | |
|---|---|---|---|---|---|---|
| | No. of leaves/pl. | Difference | Signif. | No. of leaves/pl. | Difference | Signif. |
| 12 cm (Co) | 9,00 | - | | 15,00 | - | |
| 10 cm | 9.66 | +0,66 | NS | 12,66 | -2.34 | ** |
| 8 cm | 11,00 | +2 | ** | 7,66 | -7.34 | *** |
| | DL 5%=0,95; DL 1%=1,57; DL 0.1%= 2,95 | | | DL 5%=1,16; DL 1%=1,93; DL 0.1%=3,61 | | |