The Effect Of GA₃ Treatment On Cala (*Zantedeschia* 'Picasso') Cultivated In Greenhouse

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ABSTRACT

The species from *Zantedeschia* genus are included in two major sections, *Zantedeschia* and *Aestivae*, differentiated by the type of underground organ, resting period, flowering and color of the spathe. Callas with colored spathe are part of *Aestivae* section. In this paper it is analyzed the influence of gibberellic acid treatments (GA₃) on growth and development of *Zantedeschia sprengeri* cv. 'Picasso' plants, grown in the greenhouse. Evaluation of gibberellins on calla plants (cv. 'Picasso') was carried out in 2012-2014 in an experimental culture established in the greenhouse soil. Tubers were treated by soaking them in GA₃ solution (250 ppm) for 30 min., prior to planting. There have been made determinations and observations regarding the mass tubers and their multiplication ability, the beginning of the vegetation period and the emergence of floriferous stems, plant height and length of flower stems, number of leaves / plant, number of flowers / plant and the flowering period. The results obtained in the treated variant were compared with the control, untreated. Weight and size of the tubers and the start of the vegetation period of the plant were not significantly influenced by GA₃ treatment. Instead, the treatment favored the formation of leaves and flower stems, and determined early emergence of flowers and flowering stems with 10-20 days. It has been shown that the treatment with gibberellins on *Zantedeschia* 'Picasso' tubers caused earlier flowering and the formation of a greater number of flowers and leaves.

Keywords: *Aestivae*, cv. 'Picasso', gibberellic acid

INTRODUCTION

Zantedeschia is a popular plant, which is known and used as a cut flower or as a pot plant. It is grown mainly in the Netherlands, New Zealand and USA. Cultivated area in 2000 was 177 ha (USA not included), the leading producer being the Netherlands, with 100 ha in 2002 (Brown *et al.*, 2005). Production of *Zantedeschia* cut flowers has grown steadily in recent years, in 2012 was reaching 288 ha (including the USA) and it was extended to other countries: Brazil, Zimbabwe, Costa Rica and Israel (Janowska *et al.*, 2012).

Zantedeschia genus consists of eight species, distributed in two sections, *Zantedeschia* and *Aestivae*. *Zantedeschia* section consists of *Z. aethiopica* and *Z. odorata* and *Aestivae* section, also known as the “colored callas”, consisting of *Z. albomaculata*, *Z. elliotiana*, *Z. jucunda*, *Z. pentlandii*,

Z. rehmannii and *Z. valida*. *Z. albomaculata* includes two subspecies *albomaculata* and *macrocarpa* (Singh *et al.*, 1996).

Callas have two different underground storage organs (Funnell *et al.* 1992), *Zantedeschia aethiopica* has rhizomes and other species have tubers. The leaves are integral, compact, carried along the stem. Callas draw attention with their original inflorescences which is formed by a spadix carrying true flowers and it is surrounded by a single handsome spathe (Cantor and Pop, 2005, 2008; Kuehny, 2000).

To increase the flower yield in calla lily cultivars with colorful spathe there can be used different treatments based on chemical or physical methods. Literature mentions numerous studies on the effect of applying the treatments with plant growth regulators on *Zantedeschia* (Corr

and Widmer, 1991; Dennis *et al.*, 1994; Funnell *et al.*, 1992; Funnell and Tjia, 1988; Janowska and Krause, 2001; Janowska and Schroeter, 2002; Janowska and Zakrzewski, 2006; Mortazavi *et al.*, 2011). However, increasing the yield depends on the cultivar and there are currently more than 120 recognized cultivars. Research conducted so far have shown that gibberellic acid treatments have a significant impact on productivity, but have not shown which is the most effective concentration of GA₃ (Ali and Elkiey, 1995; Brooking and Cohen, 2002; Corr and Widmer, 1991; Dennis *et al.*, 1994; Funnell *et al.*, 1992; Funnell and Tjia, 1988; Janowska and Krause, 2001; Janowska and Schroeter, 2002; Janowska and Zakrzewski, 2006; Reiser and Langhans, 1992; Tjia, 1987). But the recommendations for the concentration of gibberellic solution used to treat underground organs by soaking, it holds between 50 and 500 ppm (Corr and Widmer, 1991; Dennis *et al.*, 1994; Funnell and Tjia, 1988).

The paper aims to analyze the influence of growth regulators (gibberellic acid) treatment

on growth and development of callas grown in a greenhouse.

MATERIALS AND METHODS

The research has been carried out in the period 2012-2014. The cultivar used in the study is 'Picasso' and the crop was established in the greenhouse, within the discipline of Floriculture at the University of Agricultural Sciences and Veterinary Medicine Iasi, Romania.

As described by the author, 'Picasso' cultivar belongs to *Zantedeschia sprengeri* species (syn. *Zantedeschia pentlandii*) and it was created in 2004 (<http://www.google.com/patents/USPP15282>). It has bicolor flowers that range from dark purple and forms a white - cream collar (Fig. 1). Funnel shaped flower is actually a thin bract, a spathe that is wrapped around a yellow finger-like flower stalk (spadix). The handsome leaves are broadly arrow-shaped, olive to dark green, and speckled with white. (<http://www.learn2grow.com/plants/zantedeschia-picasso-pp15282/>).

The main biometric characteristics of the plants from the experimental culture (dimensions of leaves and flowers) were within the limits described by the author, some of which are presented in Tab. 1. The comparison of data on the size of the spathe, established that in experimental culture conditions, the average length of the spathe was 7 cm, and its open during full flowering period ranged from 5.0 cm / 5.5 cm. Also, leaf size (length and width of limb, petiole length) is within the standard. Statistical analysis was performed using the analysis of variance (Săulescu and Săulescu, 1967), and statistical processing of the obtained data was performed using Microsoft Excel.

Tubers used for crop establishment were purchased from a specialized manufacturer in the

Fig. 1. The spathe of "Picasso" cultivar (original).

Tab. 1. Biometric characteristics of leaves and flowers in 'Picasso' cultivar.

Specification	Spathe dimensions (full opening)			Leaf dimensions		
	Height (cm)	Max. diameter (cm)	Min. diameter (cm)	Limb length (cm)	Limb width (cm)	Petiole length (cm)
Author description (conf. Brevet US PP15282 P2)	6-9	5-7		20-30	10-15	30-50
Experimental crop	7,0	5.0	5,5	21.1	12,5	35

Netherlands. There were set up two experimental variants with three repetitions, the control variant (V1) using untreated tubers and the V2 variant using tubers which were soaked in GA₃ solution before planting (250 ppm) for 30 min. There have been used 10 tubers for each repetition. They were planted in the greenhouse soil.

During the experiments, measurements and observations were carried out regarding the mass of tubers and their multiplication ability, the vegetation period of the plant and the development of floral stems, plant height and flower stem length, number of leaves / plant, number of flowers / plant, flowering period (Treder, 2005). The weight of the tubers was determined before planting and after the end of the growing season, when they were lifted for the dormancy period. Also, measurements of the plant height, flower stem length, number of leaves / plant, number of flowers / plant were made weekly. The results obtained in the treated variant were compared with the control, untreated.

RESULTS AND DISCUSSION

Weight of underground organs was analyzed in evolution during the three experimental years. In the first year of culture, the tubers weighting between 30 and 50 g, the majority was being between 35-40 g. In the second year of cultivation, tuber weight increased and it was between 50 and 95 g, most of them between 50 and 65 g. In the third year of cultivation, tuber weight varied more, becoming uneven, so that the smallest started from 20 g and the largest reached up to 140 g, the majority being between 50 and 80 g. Thus, it appears that during the three years of experiment, underground organ weights increased 3-4 times. Similar observations made Treder (2005) in 'Black Magic', 'Cameo', 'Pink Persuasion' and 'Florex Gold' cultivars, noting that tuber weight increased on average 3-5 times compared to the initial weight.

Regarding the time between the start of the vegetation and the appearance of flower stems, the number of days increased, both in the control, as well as the one treated with GA₃.

As can be seen in Fig. 2, during the first year crop, floral stems appeared 17 days after the vegetation of plants started to control variant and 2 days earlier to the treated variant. In the second year of crop, the period for floral stem appearance was 2-3 times higher than the first year (after 52

days in the control variant and after 31 days in the treated variant). In the third year, floral stems appeared in 34 days at the control variant and in 30 days at treated variant (double compared to the first year in both versions).

Basically, during the three years crops, treating tubers with gibberellic acid caused earlier floriferous stems. This is in contradiction with the results reported by Janowska and Schroeter (2002), in which case the use of gibberellic acid caused a delay in flowering with 3-4 weeks. A similar path was followed by 'Pink Persuasion' and 'Sensation' cultivars, which flourished a few days later (Janowska and Krause, 2001). A later entry in the flowering period after application of gibberellic acid was also reported by Treder (2003b) at 'Black Magic' and 'Mango' cultivars. In turn, Funnell and Tjia (1988) have obtained earlier flowering in *Zantedeschia* treated with gibberellic acid.

Another aspect refers to the height of the bush. In the Fig. 3 it can be seen that during the three years of experiment, control plants were higher than those in the treated variant.

Also floral stem length was influenced by the applied tuber treatments, namely the treated variant stem length was reduced (Fig. 4). In all three years of experiment, the length of flower stem was kept, in control variant, to about 49 cm, and in the treated variant, between 37 and 42 cm. The difference between the two versions was between 7 and 12 cm.

The specialized literature confirms that the plant response to the gibberellic acid may vary depending on the variety, the application of the treatment as well as on the concentration used.

Regarding the average number of leaves / plant, it has not been significantly affected. Although the treated plants variant recorded an average number of leaves slightly higher compared to the control, the differences are decreasing from the first to the third year (from 21.9% in the first year to 3% in the third year), the average of the three years indicate significant differences (Tab. 2). Corr and Widmer (1991) reported that the number of *Zantedeschia rehmannii* leaves developing from the rhizomes is highly dependent on their size rather than of treatment with gibberellic acid. Similarly, Jerzy and Janowska (2003) stated that gibberellic acid does not affect the number of leaves of *Zantedeschia* species with colored spathes.

Fig. 2. The time between the start of the vegetation period and the appearance of stems (days).

Fig. 4. Evolution of the flower stems length (cm).

Fig. 3. The dynamics of growth in plant height during the three years of experiment (cm).

Tab. 2. Evolution of the number of leaves and flower production during the three experimental years.

Var.	First year		Second year		Third year		Average			
	Val. abs.	% compared to control	Val. abs.	% compared to control	Val. abs.	% compared to control	Val. abs.	% compared to control	± d	Signification
Number of leaves/plant										
V ₁	10.5	100.0	8.7	100.0	8.0	100.0	9.1	100.0	-	control
V ₂	12.8	121.9	10.0	115.0	8.3	103.0	10.4	114.3	+1.3	-
									DL _{5%} =1.4 DL _{1%} =3.2 DL _{0.1%} =10.2	
Number of flowers/plant										
V ₁	2.8	100.0	1.6	100.0	1.5	100.0	1.9	100.0	-	control
V ₂	4.3	153.6	2.6	162.5	2.5	166.7	3.1	163.2	+1.2	xx
									DL _{5%} =0.4 DL _{1%} =1.0 DL _{0.1%} =3.2	

From the analysis of registered flower production in the three experimental years (Tab. 2), it was found that application of GA₃ significantly increased the production of flowers. Flower production decreases from one year to another, and the differences from the control are increasing (from 53.6% in the first year to 66.7% in the third year). By comparing the average values over the three years, there was positive differences significantly distinct comparing with the control. Treder (2005) confirmed that the yield, after the treatments, was 1.6, 1.7, 2.4 and 2.8 times higher than in control plants at "Black Magic", "Florex Gold", "Pink Persuasion" and "Cameo" cultivars. These data confirm earlier observations on *Zantedeschia* (Corr and Widmer, 1987; Dennis *et al.*, 1994; Janowska and Krause, 2001).

CONCLUSION

Finally it was concluded that the treatment with gibberellins (250 ppm, for 30 min.) of *Zantedeschia* 'Picasso' tubers has reduced duration of formation of floriferous stems and also determined the early flowering of the plants. Gibberellic acid negatively influenced floral stem length and average height of the plants, however, favored the production of flowers / plant. Gibberellic acid did not significantly affect the number of leaves/plant.

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