THE INFLUENCE OF GIBERELLIC ACID ON CALLAS GROWN IN POTS

INFLUENȚA ACIDULUI GIBERELIC ASUPRA CALELOR CULTIVATE LA GHIVECE

ARHIP (ÎNSURĂȚELU) Ioana Cristina[1], DRAGHIA Lucia[1]
e-mail: ioana.arhip@yahoo.com

Abstract. *This paper presents four Zantedeschia cultivars ('Cameo', 'Black Star', 'Picasso', 'Black Eyed Beauty') grown in pots, to which determinations and observations were made on the effect of treatment with gibberellins. Treatments were applied to the tubers, before planting, with 250 ppm GA_3 solution. The results revealed that treatment with GA_3 had different impact on the studied cultivars: at the cv. 'Cameo' the emergence of floral stem was delayed, the growing season was shortened and the length of floriferous stems was shorter; at the cv. 'Picasso' they shortened the vegetation period and increased the number of flowers / plant; at the cv. 'Black Star' they led to early flowering, shortening the growing season and increasing the number of flowers / plant; at the cv. 'Black Eyed Beauty' they caused earlier flowering and shorten the length of the flower stems.*
Keywords: *Zantedeschia, pot cultivation, GA_3*

Rezumat. *În această lucrare sunt prezentate patru cultivare de Zantedeschia ('Cameo', 'Black Star', 'Picasso', 'Black Eyed Beauty') cultivate la ghivece asupra cărora s-au făcut determinări şi observaţii privind efectul tratamentelor cu gibereline. Tratamentele s-au aplicat tuberculilor, înainte de plantare, cu soluţii 250 ppm GA3. Rezultatele obţinute au scos în evidenţă faptul că tratamentele cu GA_3 au avut influenţă diferită asupra cultivarelor studiate: la cv. 'Cameo' au determinat întârzierea apariţiei tijelor florale, scurtarea perioadei de vegetaţie şi scurtarea lungimii tijelor florifere; la cv. 'Picasso' au scurtat perioada de vegetaţie şi au mărit numărul de flori/plantă; la 'Black Star' au dus la timpurietatea înfloririi, scurtarea perioadei de vegetaţie şi creţterea numărului de flori/plantă; la cv. 'Black Eyed Beauty' a determinat înflorirea mai timpurie şi scurtarea lungimii tijelor florale.*
Cuvinte cheie*: Zantedeschia, cultură la ghivece, GA_3*

INTRODUCTION

Zantedeschia is a tropical plant native to South Africa. The genus *Zantedeschia,* which belongs to the Araceae family, was given to callas by Sprengel, in 1826, in honor of the Italian botanist Giovanni Zantedeschi (Letty, 1973). The genus *Zantedeschia* consists of eight species distributed in two sections, *Zantedeschia* and *Aestivae*. Section *Zantedeschia* consists of *Z. aethiopica* and *Z. odorata*, and *Section Aestivae* also found under the name of

[1] University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania

"colored callas" consisting of *Z. albomaculata* (with two subspecies: *albomaculata* and *macrocarpa*), *Z. elliotiana*, *Z . jucunda*, *Z.pentlandii, Z. valida* and *Z. rehmannii*. (Singh et al., 1996).

Callas, which are characterized by their beautiful inflorescence, but also by their imposing leaves, are often used as cut flowers for special events, as plants grown in pots or as ornamental plants in gardens, ensuring early summer decor. The flower is formed by a modified leaf called spathe, which unfolds around a "column" called spadix, which has the real flowers. The inflorescences are yellow, pink, red, orange, purple, white or a combination of colors, depending on the species and cultivar (http://www.learn2grow.com/plants/zantedeschia-care-and-maintenance/).

To increase the production of flowers at colored callas there can be used different treatments based on chemical or physical methods. The literature mentions several studies on the effect of the treatments with plant growth regulators applied on Zantedeschia (Funnell and Tjia, 1988; Corr and Widmer, 1991; Funnell et al., 1992; Dennis et al., 1994; Janowska and Krause, 2001; Janowska and Schroeter, 2002; Janowska and Zakrzewski, 2006; Mortazavi et al., 2011). However, increasing the yield depends on the variety, currently existing more than 120 recognized varieties.

MATERIAL AND METHOD

The study was made in 2013, at a Calla culture grown in pots, that includes four cultivars 'Cameo', 'Picasso', 'Black Eyed Beauty', 'Black Star', established in the Floriculture discipline greenhouse, from University of Agricultural Sciences and Veterinary Medicine Iasi, Romania.

Cultivar 'Cameo' (fig. 1a) has apricot color flowers, which is intensified towards the center, reaching bright orange. Their colors are accentuated by their graceful leaves with countless macules (http://www.digthedirt.com/plants/14938-calla-lilies-zantedeschia-cameo).

a) **b)** **c)** **d)**

Fig. 1 - The studied *Zantedeschia* cultivars: a) 'Cameo'; b) 'Picasso'; c) 'Black Eyed Beauty'; d) 'Black Star' (original)

Cultivar 'Picasso' (fig. 1b) has bicolored flowers that range from dark purple and forms a white - cream collar. Floriferous stems have medium height and appear from late spring until late summer. Leaves have sagittal shaped, color palette starts from

olive to dark green and they have many white macules (http://www.learn2grow.com/plants/zantedeschia-picasso-pp15282/).

Cultivar 'Black Eyed Beauty' (fig. 1c) has upright growing leaves, sagittal form, with many white macules and they are almost as handsome as its flowers. Flowers, white to yellowish, have a big, black, "eye", located centrally on the inside of the spathe, at base of the spadix (http://www.learn2grow.com/plants/zantedeschia-black-eyed-beauty/).

Cultivar 'Black Star' (fig. 1d) is well named because the spathe creates the impression that is black; but actually has a dark blood-red color. The spathe appears in late spring, above the compact bush, contrasting with lush leaves that have white macules; the plant has medium size (Hanneke van Dijk, Mineke Kurpershoek, 2001).

Experimental cultures were established with tubers purchased from a specialized firm from the Netherlands. There were set up two experimental variants with three repetitions, the control variant (V_1) using untreated tubers and V2 variant where tubers were immersed in a solution of gibberellic acid (GA_3), 250 ppm for 30 min, before planting.

The substrate used for the establishment of the cultures, to all four cultivars, both variants was constituted of a mixture consisting of garden soil, flower soil (Florisol), peat and sand in volume ratio of 2:2:1:0,05. Culture was established in plastic pots of 20 cm diameter (5 L), on 30 of April 2013.

The organization of the experience was made by the randomized blocks method with three replications. Determinations and observation were made on the starting of the vegetation period, emergence of the floral stems and the end of the growing season, the number of flowers / plant and the floral stems length. The data were interpreted statistically by the analysis of variance; the results were compared with the control value (V1) from each cultivar.

RESULTS AND DISCUSSIONS

The main technical and phenological data which were recorded at Calla crops grown in pots are shown in table 1. With the exception of cv. 'Cameo', where the start of the vegetation period was delayed by GA_3 treatment with approx. one week, at the other cultivars the start of the vegetation period was achieved without differences between variants.

Table1

Technological and phenological data

Cultivar	Crop establishment	Start of the vegetation period		Appearance of the floral steams		End of vegetation period	
		V1	V2	V1	V2	V1	V2
‚Cameo'	30th of April	12th of May	20th of May	15th of June	19th of June	20th of August	14th of August
‚Picasso'	30th of April	14th of May	14th of May	5th of June	5th of June	10th of Sep.	5h of Sep.
‚Black-Eyed-Beauty'	30th of April	19th of May	19th of May	23rd of June	19th of June	17th of Sep.	17th of Sep.
‚Black Star'	30th of April	12th of May	12th of May	8th of June	5th of June	16th of Sep.	10th of Sep.

Comparing the differences between varieties it can be observed a gradual vegetation start, over a period of 12 to 20 days, the earliest being 'Cameo' (V_1) and 'Black Star,' and the belatedly 'Black Eyed Beauty', to which is added the 'Cameo' V_2 variant. Regarding the appearance of floral stems and the end of the vegetation period it is observed that they were influenced by the treatment of tubers as well as by the cultivar.

Table 2 presents comparative results regarding the length of time from planting to emergence of floriferous stem, and from the star of the vegetation period until the end of it. Comparisons were made between both variants of the same cultivar and between cultivars, by comparison to the average of all variants (8 variants). It is noted that treatment with GA_3 applied to the tubers had influenced differently the time from the planting to the appearance of the floral stems, depending on the cultivar. At cv 'Black Star' and 'Black Eyed Beauty', the stems emergence was performed 3-4 days earlier at treated variants (V_2) compared to control (V_1), the differences being significant negative, while at the cv. 'Cameo' the period was extended with 3 days (significant positive differences). At 'Picasso' the appearance of floriferous stems was recorded at similar time intervals at both variants. Compared with the mean value of all variants (43.3 days), the earliest were remarked to be the treated variants, and the belated were the variants with untreated tubers.

Table 2

Length of time until the appearance of floral stems and the end of the vegetation period (days)

Cultivars	Var.	The appearance of floral stems (from planting)			The vegetation period (from the start of vegetation)		
		Absolute	d± (V_2-V_1)	d± (compared to average)	Absolute	d± (V_2-V_1)	d± (compared to average)
‚Cameo'	V_1	46	control	+2.7 xxx	100	control	-13.6 000
	V_2	49	+3 x	-7.3 000	86	-14 00	-27.6 000
‚Picasso'	V_1	36	control	+10.7 xxx	119	control	+5.4 xxx
	V_2	36	0	-4.3 000	114	-3 0	+0.4
‚Black-Eyed-Beauty'	V_1	54	control	+5.7 xxx	121	control	+7.4 xxx
	V_2	50	-4 0	-7.3 000	121	0	+7.4 xxx
‚Black Star'	V_1	39	control	+6.7 xxx	127	control	+13.4 xxx
	V_2	36	-3 0	-7.3 000	121	-6 0	+7.4 xxx
Media		**43.3**	**-**	**control**	**113.6**	**-**	**control**
LSD 5%				1.3			2.1
LSD 1%				1.8			2.9
LSD 0,1%				2.4			4.0

The duration of the vegetation period was calculated from the start of the vegetation until the end of it and ranged between 86 and 127 days with an average for all cultivars and all variants of 113.6 days (tab. 2). Compared to this average, cv. 'Cameo' recorded the shortest vegetation period, at V_1 (100 days) and at V_2 (86 days),

and the differences being very significant negative. With above average and very significant positive differences were variants from all the other cultivars, except V_2 variant of cv. 'Picasso' (with positive differences, but statistically uninsured).

Within each cultivar, it was found that at the variants with treated tuber of 'Cameo', 'Picasso' and 'Black Star' tendency was shortening the period from the start of the vegetation by the end the it, the most obvious, with 14 days, being 'Cameo'. At 'Black Eyed Beauty' duration of the vegetation was identical in both variants (tab. 2).

Important indicators in defining the decorative value of plant and how to use them are their flower production (number of flowers / plant) and the length of the floral stems. In table 3 are shown the values obtained from the four cultivars and differences arising between the variants.

Table 3

Results regarding the number of flowers/plant and the length of floriferous stems

Cultivars	Var.	No. of flowers/plant			The length of floriferous stems (cm)		
		Absolute	d± (V_2-V_1)	Signif.	Absolute	d± (V_2-V_1)	Signif.
‚Cameo'	V_1	1.7	control	-	54.5	control	-
	V_2	1.5	-0.2	-	50.0	-4.5	0
	LSD 5%=0.2 LSD 1%=0.6 LSD 0,1%=0.8				LSD 5%=3.9 LSD 1%=9.0 LSD 0,1%=28.7		
‚Picasso'	V_1	1.3	control	-	39.6	control	-
	V_2	2.4	+1.2	xx	36.8	-2.8	-
	LSD 5%=0.4 LSD 1%=1.0 LSD 0,1%=3.2				LSD 5%=3.4 LSD 1%=8.0 LSD 0,1%=25.4		
‚Black-Eyed-Beauty'	V_1	1.2	control	-	51.4	control	-
	V_2	1.4	+0.2	-	37.9	-13.5	00
	LSD 5%=0.2 LSD 1%=0.6 LSD 0,1%=0.8				LSD 5%=2.8 LSD 1%=6.5 LSD 0,1%=20.6		
‚Black Star'	V_1	1.1	control	-	41.5	control	-
	V_2	1.4	+0.3	x	42.5	+1.0	-
	LSD 5%=0.1 LSD 1%=0.3 LSD 0,1%=1.1				LSD 5%=3.7 LSD 1%=7.2 LSD 0,1%=22.8		

The only cultivar where the number of flowers/plant was negatively influenced by treatment with gibberellins is 'Cameo', but the differences are not statistically assured. Larger differences are observed at the cultivar 'Picasso', where the difference of 1.2 flowers / plant in favor of the treated variant appears as significant. And at "Black Star", the differences are significant positive compared to control. Floral stems length had a downward trend in plants treated with gibberellins at cv. 'Cameo', 'Picasso' and 'Black Eyed Beauty', but the differences were statistically assured at 'Cameo' (significant) and 'Black Eyed

Beauty' (significantly distinct). At cv. 'Black Star', although it has a slight decrease in stems length, 1 cm difference is not statistically assured.

CONCLUSIONS

1. At plants variants treated with GA_3, emergence of floriferous stems was delayed at cv. 'Cameo', but they appeared earlier at cv. 'Black Eyed Beauty' and 'Black Star' (at 'Picasso' there were no changes), and the vegetation period was shortened in all cultivars except cv. 'Black Eyed Beauty'.

2. The number of flowers / plant tended to increase at plants whose tubers were treated with gibberellins, at cultivars 'Picasso', 'Black Star' and 'Black Eyed Beauty', but a downward trend was noted at cv. 'Cameo'. The differences were statistically assured only at 'Picasso' and 'Black Star'.

3. The length of floriferous stems had a tendency to decrease, with statistically assured differences only at cultivars 'Cameo' and 'Black Eyed Beauty'.

REFERENCES

1. **Corr B.E., Widmer R.E., 1991** - *Paclobutrazol, gibberellic acid and rhizome size affect growth and flowering of Zantedeschia*. Hort Science, 26, pp. 133–135
2. **Dennis D., Doreen D.J., Ohteki T., 1994 -** *Effect of a gibberellic acid 'quick-dip' and storage on the yield and quality of blooms from hybrid Zantedeschia tubers*. Scientia Horticulturae, 57, pp. 133–142.
3. **Funnell K.A., MacKay B.R., Lawoko C.R.O., 1992 -** *Comparative effects of promalin and GA3 on flowering and development of Zantedeschia 'Galaxy'*. Acta Hort. 292:, pp.173–179.
4. **Funnell K.A., Tjia B.O., 1988 -** *Effect of storage temperature, duration and gibberellic acid on the flowering of Zantedeschia elliottiana and Z. 'Pink Satin'*. Journal of the American Society for Horticultural Science, 113, pp. 860–863
5. **Hanneke van Dijk, Mineke Kurpershoek, 2001** – *The complete encyclopedia of bulbs and tubers*, Rebo Publishers, Lisse, The Netherlands
6. **Janowska B., Schroeter A., 2002** - *The influences of gibberellic acid on flowering of Zantedeschia elliottiana (W. Wats.) Engl. 'Black Magic'*. Zeszyty Problemowe Postępów Nauk Rolniczych, 483, pp. 93–99.
7. **Janowska B., Zakrzewski P., 2006** - *The effect of gibberellic acid and rhizome treatment on flowering of calla lily (Zantedeschia Spreng.)*. Zeszyty Problemowe Postępów Nauk Rolniczych, 510, pp. 223–233.
8. **Janowska B.,Krause J., 2001 -** *The influence of tuber treatment by gibberellic acid on the flowering of Zantedeschia,* Roczniki Akademii Rolniczej w Poznaniu. Ogrodnictwo, 33, pp. 61–67.
9. **Letty C., 1973 -** *The genus Zantedeschia*. Bothalia 11, 1 and 2, pp. 5–26
10. **Mortazavi N., Naderi R. A., Majidian N., Naderi B. and Yavar Sharafi Y., 2011 -** *The effect of GA3 and BA on the quantitative and qualitative characteristics of calla lily (Zantedeschia aethiopica cv. Childsiana)*. African Journal of Microbiology Research Vol. 5(24), pp. 4190-4196.
11. **Singh Y., Van Wyk A.E., Baijnath H., 1996** - *Taxonomic notes on the genus Zantedeschia Spreng. (Araceae) in southern Africa*. S. Afr. J. Bot. 62(6), pp. 321-324.
12. ******* http://www.learn2grow.com/plants/zantedeschia-care-and-maintenance/
13. ******* http://www.learn2grow.com/plants/zantedeschia-picasso-pp15282/
14. ******* http://www.learn2grow.com/plants/zantedeschia-black-eyed-beauty/
15. ******* http://www.digthedirt.com/plants/14938-calla-lilies-zantedeschia-cameo