



RESEARCH NEWSLETTER



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Dept. of Horticulture Cornell University
134 Plant Science Building
Ithaca, NY 14853, USA
Phone: + 1 0016072272780
Fax: + 1 0016072559998
wbm8@cornell.edu



Weeresteinstraat 12
P.O Box 170
2180 AD Hillegom
Phone: +31 252 53 50 80
Fax: +31 252 53 50 88
secretariaat@anthos.org
www.anthos.org

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Evaluations of planting mix, planting depth and growth regulators on forcing of Dutch grown calla lilies (*Zantedeschia*)

Chad T. Miller and William B. Miller

Cornell University, Ithaca NY, USA

Zantedeschia, or calla lily, is a popular cut-flower and flowering pot plant in the floriculture industry. Cut callas have been typically used for funeral arrangements, but recently, more are being used in wedding bouquets, due to the ever-increasing selection of colors available on the market. *Zantedeschia* is also increasing in popularity as a flowering pot crop as breeding efforts have produced plants more suitable for pot production. With increasing production of both cut and pot calla, there are opportunities to evaluate growth and development of these newer cultivars. As a part of the Flower Bulb Research Program at Cornell University, we recently conducted three different experiments evaluating 1) the effect of planting depth on growth and development; 2) potting media type on growth and development; and 3) the effects of paclobutrazol (Bonzi) and flurprimidol (Topflor) on growth and development of calla lily.

For all of the experiments, tubers were supplied and received from the Netherlands by airfreight on 13 March 2008. Tubers were stored at 15-17 °C until planting. Tubers had a minimum grade of 20+ cm, with the cultivar Red Sox having a grade of 20/22 cm. Twelve cultivars, some classified as cut-flower varieties, pot plant varieties, or both (Table 1) were used in the studies. All tubers were planted in 15 cm pots on 4 April, 2008 and grown under greenhouse conditions at 20 °C constant temperature and fertilized with 150 ppm nitrogen from 15-5-13.

Table 1. Dutch grown calla lily cultivar characteristics used in the experiments.

Cultivar	Color	Use for pots?	Use for cut flowers?
Captain Aguila	Yellow	Yes	Yes
Captain Amigo	Orange/Yellow	Yes	Yes
Captain Eskimo	Crème	Yes	No
Captain Reno	Purple	Yes	Yes
Captain Rosette	Soft Pink	Yes	Yes
Captain Safari	Orange	No	Yes
Hotshot	Yellow/Orange	Yes	Yes
Mozart	Orange/Yellow	Yes	Yes
Picasso	White/Purple	Yes	No
Pot of Gold	Yellow	Yes	Yes
Red Sox	Soft Red	Yes	Yes
Schwarzwalder	Black-red	No	Yes

Planting depth and calla forcing

Previous studies conducted at Cornell University with bareroot herbaceous perennials clearly demonstrate that there is an optimum planting depth for ideal plant growth and development (see Research Newsletter, Nov. 2003). However, it is unclear whether planting depth has an effect on calla growth and development. To test effects of planting depth, 6 cultivars were used: Captain Reno, Captain Rosette, Captain Eskimo, Captain Aguila, Captain Amigo, and Hotshot. One tuber was planted per 15 cm standard pot using MetroMix 360 media. Tubers were planted with the eyes at one of three depths: 1) at the surface, 2) 2.5 to 4 cm below the surface, or 3) 5 to 6.5 cm below the surface. There were six plants of each planting depth for each cultivar. Data collected included date of first flower (when the first flower showed color), height of first flower, and height of leaves at first flower. In addition, the number of shoots was counted at the end of the experiment.

Results, planting depth

Planting depth had no effect on most cultivars (Table 2, Fig. 1). Few differences were observed in the number of days to flower for any planting depth treatment in any of the cultivars, with the exception of Captain Eskimo, where tubers planted at the surface flowered 14 days earlier than tubers planted 2.5 to 4 cm below the media surface. Flower height was similar for all planting depths in cultivars Hotshot, Captain Reno, and Captain Eskimo. However, Captain Amigo planted 2.5 to 4 cm and 5 to 6.5 cm and Captain Rosette planted 5 to 6.5 cm below the soil level had flower stem lengths that were 7 cm longer than tubers planted at the media surface. This increased length would be beneficial for cut flower purposes and could result in an increased stem price. Interestingly, Captain Aguila tubers planted 5 to 6.5 cm deep produced stems that were 7 cm shorter than the other planting depths. Tuber planting depth had no effect on leaf length and total number of flowers produced. Planting depth had no effect on the number of shoots or growing units observed except in cultivars Captain Eskimo and Captain Reno: There were more shoots with deeper planting in Captain Eskimo, and the opposite with Captain Reno. However, it is important to note that data were not collected on the number of pre-existing eyes on the tubers before planting.

Potting media type and calla forcing

Planting media type or formulation can have a significant influence on growth and development of greenhouse grown plants. The abilities to hold water, supply

nutrients, permit gas exchange in the root system, and provide plant support are all influenced by the media components. The objective of this experiment was to assess several commercially available mixes for forcing of Dutch-grown calla lilies in 25 cm pots. Six cultivars were tested, Captain Safari, Mozart, Picasso, Pot of Gold, Red Sox, and Shwarzwalder. One tuber was planted with the eye 2.5 cm deep in one of the following media types: Sungrow MetroMix 360 (MM360), Sungrow MetroMix 560 with Coir (MM56), Sungrow MetroMix 300 (MM300), SunGro Perennial Mix and Sunshine LC1 and Fafard 1-PV. There were 6 replications of each media for each cultivar. Data collected included date of first flower, height of first flower color, and the height of the leaves at first flower.

Results, media type

The different potting mixes had only minimal effects on flower height, leaf height, and the number of days to flower in the cultivars tested (Table 3, Fig. 2). Results showed significant increases in flower stem length in

Pot of Gold grown in MM 300 and 560, LC1, and the perennial mix but this trend was not observed in all cultivars. The root balls of each media treatment were observed but no visual differences in root growth were seen. Each media produced plants with strong, vigorous roots. The results obtained in this study show that excellent callas can be grown with any of the mixes used.

Plant growth regulators: Effects of paclobutrazol (Bonzi) and flurprimidol (Topflor) on calla forcing

Plant growth regulators (PGRs) are often applied during greenhouse production of floricultural crops to control growth and development to enhance the aesthetic appeal of the plant. Gibberellins are plant hormones involved in shoot elongation and stimulate flower development. Anti-gibberellins on the other hand, are frequently used to reduce shoot elongation at a specific stage of growth in some plant species. Two common commercially applied anti-gibberellins are paclobutrazol (Bonzi) and flurprimidol (Topflor). Depending on the crop, each PGR might have an optimum application method (spray, soil drench, bulb soak), application rate, and timing.

Table 2. Planting depth effects on growth and development of six Dutch calla lily cultivars.

Cultivar	Planting depth	Days to flower (no.)	Flower height (cm)	Leaf length (cm)	Growing units (no.)	Flowers (no.)	Erwinia infection by flowering (%)
Captain Aguila	Surface	31	50	42	9	9	0
	2.5 - 4 cm	32	50	45	8	9	
	5 - 6.5 cm	33	43	44	8	9	
Captain Amigo	Surface	37	31	39	5	8	50
	2.5 - 4 cm	33	44	43	8	9	
	5 - 6.5 cm	33	44	43	8	9	
Captain Eskimo	Surface	34	40	42	7	9	5
	2.5 - 4 cm	48	38	47	12	9	
	5 - 6.5 cm	48	37	48	11	7	
Captain Reno	Surface	49	22	37	14	7	0
	2.5 - 4 cm	49	24	38	10	4	
	5 - 6.5 cm	48	27	44	9	5	
Captain Rosette	Surface	38	45	45	6	8	5
	2.5 - 4 cm	34	46	46	6	8	
	5 - 6.5 cm	36	51	51	5	7	
Hot Shot	Surface	44	40	40	6	7	0
	2.5 - 4 cm	42	51	51	8	9	
	5 - 6.5 cm	41	49	49	7	8	

Table 3. Media effects on growth and development of six Dutch calla lily cultivars.

Cultivar	Media	Flower height (cm)	Leaf height (cm)	Days to flower
Captain Safari	MM 360	45	47	39
	1-PV	42	42	32
	MM 560	47	48	36
	MM300	43	49	36
	LC1	46	47	32
	Perennial mix	49	49	34
Mozart	MM 360	54	63	49
	1-PV	61	69	55
	MM 560	60	71	56
	MM300	53	62	49
	LC1	61	65	53
	Perennial mix	58	65	51
Picasso	MM 360	46	61	47
	1-PV	49	56	47
	MM 560	47	59	47
	MM300	46	60	49
	LC1	46	57	44
	Perennial mix	42	57	51
Pot of Gold	MM 360	45	46	41
	1-PV	47	42	39
	MM 560	59	49	42
	MM300	56	51	43
	LC1	57	46	40
	Perennial mix	55	48	41
Red Sox	MM 360	46	63	52
	1-PV	49	62	49
	MM 560	51	65	49
	MM300	43	55	46
	LC1	53	61	49
	Perennial mix	49	63	51
Schwarzwald	MM 360	34	51	53
	1-PV	43	52	48
	MM 560	39	51	53
	MM300	34	47	52
	LC1	35	52	51
	Perennial mix	34	48	50

For callas, media drenches and application at an early growth stage are keys to effective height control. The goal of this study was to evaluate the effectiveness of paclobutrazol and flurprimidol on height control of 12 cultivars of calla lily. One tuber was planted with the eyes 2.5 cm deep in MetroMix 360. Growth regulator drench applications (in a volume of 120 ml) were applied when shoots were 2.5 to 7.5 cm in height, at 14 or 30 days after planting, depending on the cultivar. Five treatments included the control, Bonzi drenches of 1.5 mg or 3 mg, and Topflor at 0.5 mg or 1 mg were used. There were 6 replications of each treatment per cultivar. Data collected included date of first flower color, height of first flower, and height of leaves at first flower.

Results, growth regulators

Minimal effectiveness was observed with any drench concentration of Bonzi and Topflor. This was unexpected as both are common commercial PGRs that are typically highly effective as drenches and are known to be effective on callas. In most cases, treated plants were just as tall or slightly shorter than the controls, and in a few cases, treated plants were actually taller than control plants. Similar results were observed with leaf height. Time to flower was not significantly affected by PGR drenches.

Erwinia

Soft rot or *Erwinia carotovora* subsp. *carotovora* is a major pathogen that can be a serious problem during greenhouse production. Pretreatment and careful crop observation during production can reduce the amount of infection. In the trials conducted, cultivars showed differences in the amount of *Erwinia* infection (Table 2). However, the susceptibility to *Erwinia* cannot be determined from a single experiment, and the possibility of wounding or mishandling from outside sources cannot be discounted.

Overall conclusions

Overall, significant growth and development responses to planting depth, media type and growth regulators were not observed with the calla lily cultivars tested in this study. It is unclear as to why there was a lack of response. Callas are commonly pretreated with gibberellin to increase the number of viable eyes, shoots and flowers, to give them a more suitable habit for pot production. The full interactions of GA pretreatment and PGR (Bonzi or Topflor) are not known. It would be worthwhile to conduct trials looking at GA pretreated and non-pretreated tubers to learn more about potential interactions with growth regulators in these cultivars. Moreover, the tubers used in the study were quite large, thus perhaps requiring different and/or higher doses of PGRs, in order to have an effect on growth and development.

Table 4. Bonzi and Topflor effects on growth and development of twelve Dutch calla lily cultivars.

Cultivar	PGR treatment	Flower height (cm)	Leaf height (cm)	Days to flower
Captain Aguila	Control	53	49	39
	1.5 ppm Bonzi	45	41	34
	3 ppm Bonzi	49	43	39
	0.5 ppm Topflor	47	41	35
	1 ppm Topflor	46	43	37
Captain Amigo	Control	31	41	42
	1.5 ppm Bonzi	34	41	42
	3 ppm Bonzi	28	34	41
	0.5 ppm Topflor	38	43	44
	1 ppm Topflor	35	45	45
Captain Eskimo	Control	38	49	55
	1.5 ppm Bonzi	38	46	55
	3 ppm Bonzi	38	46	51
	0.5 ppm Topflor	35	45	54
	1 ppm Topflor	35	44	55
Captain Reno	Control	29	45	55
	1.5 ppm Bonzi	25	41	54
	3 ppm Bonzi	25	42	55
	0.5 ppm Topflor	29	42	52
	1 ppm Topflor	29	44	55
Captain Rosette	Control	44	55	43
	1.5 ppm Bonzi	48	55	48
	3 ppm Bonzi	37	40	37
	0.5 ppm Topflor	44	47	41
	1 ppm Topflor	47	45	42
Captain Safari	Control	44	48	38
	1.5 ppm Bonzi	46	44	41
	3 ppm Bonzi	44	44	39
	0.5 ppm Topflor	45	47	38
	1 ppm Topflor	43	44	39
Hot Shot	Control	47	49	44
	1.5 ppm Bonzi	47	44	48
	3 ppm Bonzi	46	42	45
	0.5 ppm Topflor	49	44	46
	1 ppm Topflor	50	45	48
Mozart	Control	57	68	58
	1.5 ppm Bonzi	54	61	56
	3 ppm Bonzi	53	57	53
	0.5 ppm Topflor	59	62	55
	1 ppm Topflor	54	57	54
Picasso	Control	43	57	49
	1.5 ppm Bonzi	37	51	49
	3 ppm Bonzi	40	50	49
	0.5 ppm Topflor	42	52	47
	1 ppm Topflor	35	49	47
Pot of Gold	Control	49	50	43
	1.5 ppm Bonzi	46	45	40
	3 ppm Bonzi	49	43	42
	0.5 ppm Topflor	55	47	44
	1 ppm Topflor	54	46	44
Red Sox	Control	50	63	51
	1.5 ppm Bonzi	46	58	52
	3 ppm Bonzi	49	60	53
	0.5 ppm Topflor	53	60	51
	1 ppm Topflor	47	60	52
Schwarzwald	Control	33	45	52
	1.5 ppm Bonzi	32	43	53
	3 ppm Bonzi	34	43	52
	0.5 ppm Topflor	31	45	51
	1 ppm Topflor	33	44	52

While we do not have a good explanation of the lack of PGR response, we believe there could be a fantastic opportunity to market many of these cultivars in large pots, as most cultivars (tuber size mainly 20/+) were very large. Three to five tubers in a 36 to 40 cm patio pot would be a very high end and unique item for the consumer. These could be positioned as mid-summer patio containers. The plant stature from larger tubers lends them to use in larger mixed summer containers. On the other hand, by using smaller tubers (such as 12 to 15 cm size), very nice 6" pots can be produced.

Regarding planting depth, the lack of any differences in plant growth in planting depth is a positive result, due to the fact that many tubers may be hand planted for greenhouse production and variation in actual planting depth is likely to occur. Within reason, growers and producers do not need to worry about adverse effects on plant growth and development if tubers are planted too deep or shallow.

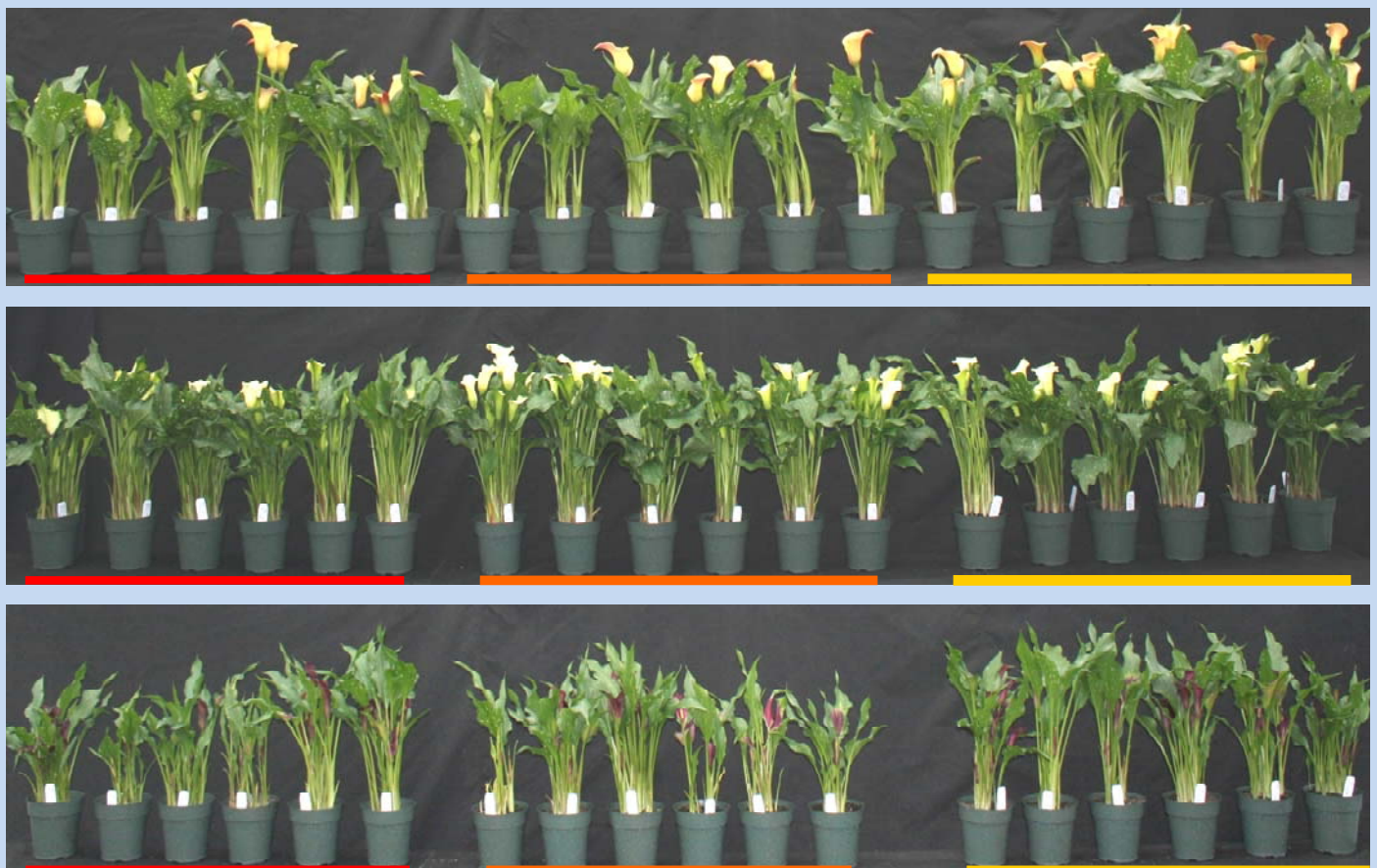


Figure 1. Effects of planting depth on three calla lily cultivars. Top to bottom: 'Captain Amigo', 'Captain Eskimo' and 'Captain Reno'. Planting depths at the surface (red line); 2.5 to 4 cm below the surface (orange line); or 5 to 6.5 cm below the surface (yellow line). All 6 plants per treatment are shown.

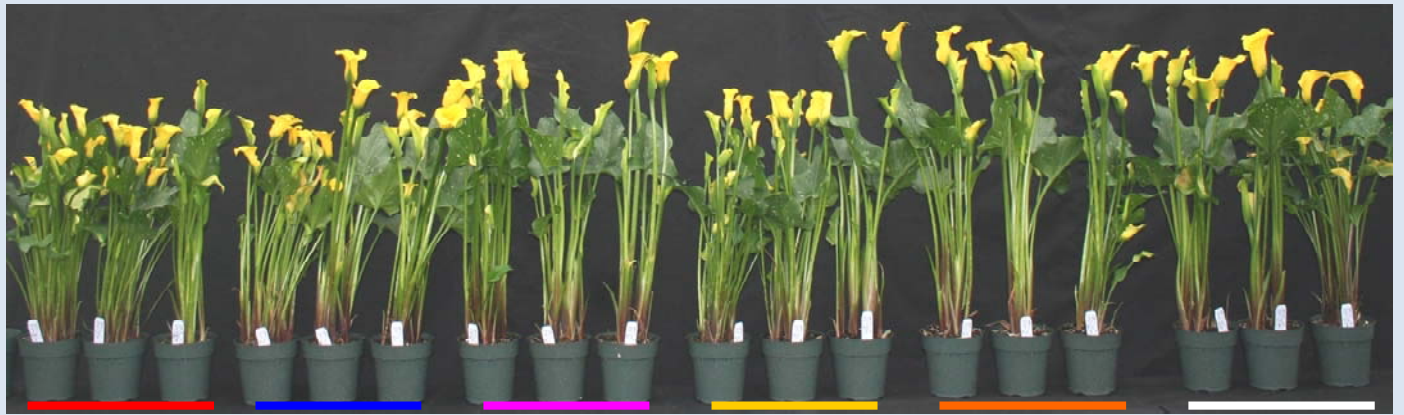


Figure 2. Effects of media type on 'Red Sox'. Left to right: MM360 (control; red), 1-PV (blue), Perennial Mix (purple), LC1 (yellow), MM560 (orange), and MM300 (white). Three representative plants of each treatment are shown.

Left to Right Control, 0.5ppm Topflor, 1 ppm Topflor, 1.5ppm Bonzi, and 3 ppm Bonzi. One representative plant from each treatment is shown.



Figure 3. Effects of PGRs on 'Mozart'.



Figure 4. Effects of PGRs on 'Hot Shot'.



Figure 5. Effects of PGRs on 'Picasso'.



Figure 6. Effects of PGRs on 'Captain Eskimo'.