

Caladium 75-14, a Spotted, Fancy-leaved Cultivar for Containers and Sunny Landscapes

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As a common pot and landscape plant, caladium (*Caladium xhortulanum* Birdsey, Araceae Juss.) is valued for its colorful leaves and low maintenance requirements (Evans et al., 1992). Commercial caladium plants are grown from tubers. Central Florida growers produce greater than 95% of the tubers for the worldwide market (Bell et al., 1998; Deng et al., 2005). Tuber yield is one of the primary factors determining a caladium cultivar's production value and whether the cultivar will be acceptable to growers and viable in commercial production. Poor tuber yield has been one of the main reasons why many early cultivars were removed from commercial tuber production and many new breeding lines with novel colors or coloration patterns have not become commercialized. Developing caladium cultivars with good tuber yield has been one of the main breeding objectives for the University of Florida's caladium breeding program at the Gulf Coast Research and Education Center since the program began in 1976.

Caladium 75-14 (Figs. 1 and 2) is a new spotted, fancy-leaved cultivar with superior tuber yield. Plants of caladium 75-14 are vigorous and can quickly fill a landscape space. Its leaves are resistant to sunburn, allowing this cultivar to perform well in full-sun landscapes. With its multiple branching habit and plant vigor, caladium 75-14 produces high-quality plants in container forcing.

Origin

Caladium 75-14 was initially selected in 2002 as GCREC-1075-14 out of a population of progeny from a cross made in 2001

between 'Gingerland' and 'Florida Moonlight' (Fig. 3). 'Gingerland' was selected as the seed parent because of its sun tolerance and bright leaf spots. 'Florida Moonlight' was used as the pollen parent for its high tuber yield, multiple branching habit, pure white leaf color, and heart-shaped leaf. 'Florida Moonlight' was a progeny from the cross 'Aaron' × 'Candidum Junior' (Miranda and Harbaugh, 2003). The ancestry of 'Gingerland', 'Aaron', and 'Candidum Junior' are unknown, although 'Candidum Junior' is suspected to be a field mutation of 'Candidum' (Wilfret, 1991).

Description

Color designations for plant parts [e.g., Royal Horticultural Society (RHS) 200B] are based on comparison with the Royal Horticultural Society Colour Chart (RHS, 1986). Plants used for describing color were grown in 11.5-cm containers in a 45% shaded greenhouse from No. 1 (3.8 to 6.4 cm) de-eyed tubers.

Leaves of caladium 75-14 are peltate, sagitate-cordate with green-white (RHS 157A) palmate-pinnate venation. The upper surface has dark green (RHS 141A) margins, 2 to 3 mm wide, bordering the entire leaf except for the basal leaf valley where it is grayed purple (RHS 185A). Interveneal areas are green-white (RHS 157A) near the central main vein and change to dark green (RHS 141A) near the margin. Leaves have a small red-purple blotch (1 to 3 mm diameter) at the petiole attachment and numerous (1 to 40 mm in diameter) grayed purple (RHS 185B) spots. Netted green-white (RHS 157D) venation occurs on the leaf surface. The under-surface has a grayed green (RHS 191B) margin 2 to 3 mm wide. Primary veins are grayed green (RHS 194B), and netted venation is grayed green (RHS 191A). Interveneal areas are green-white (RHS 157A) near the central main and large veins and change to grayed green (RHS 191A) near the margin. Grayed purple spots (RHS 186A) are numerous and scattered between primary veins. Petioles are 3 to 6 mm in diameter and light green (RHS 138D) at the apex, but the colors diffuse into a dark brown (RHS 200B) at the base that is ≈5 to 9 mm in diameter.

Plants of caladium 75-14 grown for ≈4 months in full sun in ground beds had an average height of 40 cm. The largest leaf on plants grown in a 45% shaded greenhouse produced from an intact No. 1 tuber in an 11.4-cm pot averaged 19 cm long and 12 cm wide 8 weeks after planting.

Jumbo-sized (greater than 6.4 cm and less than 8.9 cm in diameter) tubers are multi-segmented, bearing five to six dominant buds. Tuber surfaces are brown (RHS 200C) with the cortical area yellow-orange (RHS 15C).

Performance

Caladium 75-14 was evaluated for tuber production and plant performance at the Gulf Coast Research and Education Center in Wimauma, FL, in 2005 and 2006. The soil was EauGallie fine sand with ≈1% organic matter and pH of 6.2. Plants were grown on plastic-mulched raised beds with a constant water table maintained using a seep irrigation system (Geraldson et al., 1965). In 2005, ground beds were fumigated on 25 Feb. (6 weeks before planting) with a mixture of 67% methyl bromide and 33% chloropicrin (by volume) at the rate of 392 kg·ha⁻¹, and in 2006, the beds were fumigated on 10 Mar., 10 d before planting, with the same fumigant mixture but at 196 kg·ha⁻¹. The beds were 91 cm wide and 20 cm high with 2.54-cm caladium seed pieces (tuber pieces) planted 15 cm apart in three rows. Osmocote 18N-2.6P-10K 8-9 month controlled-release fertilizer (Scotts Co., Marysville, OH) was applied to the bed surface when shoots were emerging from the soil with nitrogen at 336 kg·ha⁻¹. Tubers were harvested in Nov. 2005 and Dec. 2006, respectively. Dried tubers were graded by their maximum diameter: No. 2 (greater than 2.5 cm and less than 3.8 cm), No. 1 (greater than 3.8 cm and less than 6.4 cm), Jumbo (greater than 6.4 cm and less than 8.9 cm), Mammoth (greater than 8.9 cm and less than 11.4 cm), and Super Mammoth



Fig. 1. Caladium 75-14 plant produced by forcing four intact No. 1 tubers (3.6 to 6.4 cm in diameter) in a 20.3-cm pot. Photograph was taken 8 weeks after the tubers were planted.

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Fig. 2. Caladium 75-14 plants grown in a ground bed in full sun and showing excellent vigor and sunburn tolerance.

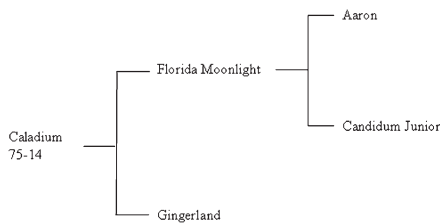


Fig. 3. Pedigree of caladium cultivar caladium 75-14.

(greater than 11.4 cm). A production index (an indicator of economic value of the harvested tubers from each plot) was calculated: $N(\text{No. } 2) + 2N(\text{No. } 1) + 4N(\text{Jumbo}) + 6N(\text{Mammoth}) + 8N(\text{Super Mammoth})$, where N is the number of tubers in the grade.

Field plots were organized in a randomized complete block design consisting of three replications. Each plot was 1.2 m² and was planted with 30 propagules (tuber pieces). Three major commercial cultivars that had a similar coloration pattern (spotted) were also planted in the field as controls to assess the tuber yield and plant performance of caladium 75-14. They were: ‘Galaxy’ (fancy-leaved, vigorous), ‘Gingerland’ (lance-

leaved, prostrate), and ‘Miss Muffet’ (fancy-leaved, dwarf). An analysis of variance was conducted using the GLM procedure in the SAS program followed by mean separation by protected Fisher’s least square difference (SAS Institute, 2003).

Compared with the controls, caladium 75-14 was the most productive in 2005 (Table 1). Its tuber weight was 42%, 77%, and 160% greater and its production index was 51%, 25%, and 115% greater than that of ‘Galaxy’, ‘Gingerland’, and ‘Miss Muffet’, respectively. Caladium 75-14 produced a similar number of marketable tubers as ‘Gingerland’, but produced 69% and 56% more tubers than ‘Galaxy’ and ‘Miss Muffet’, respectively. In 2006, caladium 75-14 was also more productive than ‘Gingerland’ and ‘Miss Muffet’: tuber weight 48% and 220% greater, production index 41% and 126% greater, and number of marketable tubers 78% and 81% greater than that of ‘Gingerland’ and ‘Miss Muffet’, respectively. Tuber weight of caladium 75-14 in 2006 was 27% less than that of ‘Galaxy’, but caladium 75-14 produced 18% more marketable tubers than ‘Galaxy’ and both had the same production index. As much as 80% to 90% of the marketable tubers produced by caladium 75-14 were in the No. 1, Jumbo, Mammoth, and even Super Mammoth categories.

Landscape performance of caladium 75-14 grown under full-sun conditions was evaluated in 2005 and 2006 on the same plots used for assessing tuber production. Plant height, number of leaves, and leaf sizes were recorded ≈ 4 months after planting. Three plants in the center of each plot (with 30 plants) were randomly selected for the objective measurements. Plants in each plot were also evaluated for overall plant quality and leaf sunburn tolerance, three times in the 2005 growing season and two times in the 2006 growing season. The scale for plant quality evaluation was 1 to 5 with 1 being very poor (few leaves and lack of vigor) and 5 being excellent (full plants, numerous leaves,

and bright color display). The scale for leaf sunburn tolerance was also 1 to 5 with 1 being very susceptible to sunburn (leaves having numerous sun-damaged areas or holes) and 5 being resistant to sunburn (no visible sun-damaged areas).

Caladium 75-14 plants were slightly taller (≈ 10 cm) than ‘Galaxy’ and ‘Gingerland’, but ≈ 26 cm taller than ‘Miss Muffet’. Its leaves were smaller than those of ‘Galaxy’ and ‘Gingerland’ but similar in size to those of ‘Miss Muffet’ (Table 2). For overall plant quality, caladium 75-14 received the highest scores among the cultivars tested in both growing seasons (2005 and 2006) and its scores were significantly higher than all controls in three of the five evaluations. The leaf sun tolerance of caladium 75-14 was rated 4 to 5 (good to excellent) in all the evaluations during the two growing seasons. Except for one evaluation in Sept. 2006, caladium 75-14’s sun tolerance ratings were higher than all of the controls.

Caladium 75-14’s performance in container forcing was evaluated by planting No. 1 tubers in 11.4-cm containers. Dry tubers were planted either intact or de-eyed in a peat/vermiculite mix (VerGro Container Mix A; Verlite, Tampa, FL) on 26 Mar. 2007. The tests were performed in a greenhouse with 45% light exclusion during the summer in Wimauma, FL. Average daily temperatures ranged from a low of 16 °C (night) to a high of 29 °C (day) during the tests. Plants were grown on metal benches in the greenhouse and arranged according to a randomized complete block design with 10 replications. Three fancy-leaved commercial cultivars, Candidum Junior (a cultivar commonly used for pot plant production), Galaxy, and Miss Muffet, were included as controls. Plant height, number of leaves, and leaf sizes were recorded 8 weeks after planting. At the same time, each pot plant was rated on a scale of 1 to 5 for quality as pot plants: 1 = very poor, 3 = fair, and 5 = very good (many leaves, bright and full plants). An analysis of variance

Table 1. Tuber weights, production index, and tuber grade distribution of caladium 75-14 and three commercial cultivars (controls) harvested in 2005 and 2006.^a

Cultivar	Tuber			Tuber distribution (%)				
	Wt (kg)	Production index	Marketable (number)	Super Mammoth	Mammoth	Jumbo	No. 1	No. 2
Year 2005								
75-14	8.2 a ^y	247 a	58 a	14 a	22 ab	30	26 a	8 a
Galaxy	5.8 b	163 c	34 b	10 a	32 a	45	9 b	4 b
Gingerland	4.6 c	197 b	59 a	0 b	18 ab	37	30 a	14 a
Miss Muffet	3.2 d	115 d	37 b	0 b	11 b	39	40 a	11 a
<i>P</i> value	<0.001	<0.001	0.004	0.011	0.038	NS	0.029	0.020
Year 2006								
75-14	8.6 b	240 a	70 a	5 b	26 a	16	32	21
Galaxy	11.9 a	240 a	59 a	15 a	21 a	26	17	21
Gingerland	5.8 b	170 b	39 b	13 a	32 a	20	23	13
Miss Muffet	2.7 c	106 c	39 b	0 c	9 b	29	41	21
<i>P</i> value	0.002	<0.001	0.001	<0.001	0.032	NS	NS	NS

The production index is an indicator of economic value of the crop harvested and is calculated as: $N(\text{No. } 2s) + 2N(\text{No. } 1s) + 4N(\text{Jumbos}) + 6N(\text{Mammoth}) + 8N(\text{Super Mammoth})$; where N = number of tubers in each grade. Tuber distribution data (%) were transformed using the formula $\arcsin[\text{square root}(\text{percentage}/100)]$ before analysis of variance and mean separation. Tubers graded by maximum diameter; No. 2 (2.5 to 3.8 cm), No. 1 (3.8 to 6.4 cm), Jumbo (6.4 to 8.9 cm), Mammoth (8.9 to 11.4 cm), and Super Mammoth (greater than 11.4 cm).

^aValues presented are means of three replications with 30 propagules per 1.2-m² plot per year.

^yNumbers in the same column followed by the same letter are not significantly different by protected Fisher’s least significant difference test at $P \leq 0.05$.

NS = nonsignificant at $P \leq 0.10$.

Table 2. Plant and leaf measurements, plant performance ratings, and sunburn tolerance ratings of caladium 75-14 and three commercial cultivars grown in ground beds in full sun (2005 and 2006).

Cultivar	Plant ht (cm)	Leaves (no.)	Leaf length (cm)	Leaf width (cm)	Plant performance rating ^z					Sun tolerance rating ^y				
					06/05	07/05	08/05	08/06	09/06	05/05	07/05	08/05	08/06	09/06
75-14	40 a ^x	40 a	19.7 bc	12.4 b	4.5 a	4.9 a	4.8 a	3.7 a	3.7 a	4.6 a	5.0 a	4.7 a	4.5 a	4.1 b
Galaxy	30 a	40 a	22.7 b	15.2 a	3.6 b	4.1 b	4.5 ab	1.8 b	2.9 a	4.2 a	4.6 b	4.3 b	3.8 b	4.3 ab
Gingerland	31 a	25 b	26.7 a	14.6 a	1.8 c	3.4 c	4.0 b	1.7 b	2.8 a	4.1 ab	4.7 ab	4.4 b	4.3 ab	4.5 a
Miss Muffet	14 b	19 b	16.3 c	10.0 c	1.5 c	1.3 d	2.4 c	1.3 b	1.5 c	3.5 b	4.4 b	4.2 b	4.3 ab	4.2 ab
<i>P</i> value	0.006	0.011	0.002	<0.001	<0.001	<0.001	0.001	0.005	0.011	0.026	0.034	0.020	0.117	0.104

^xPlants were rated on a scale of 1 to 5 with 1 being very poor, 3 fair and acceptable, and 5 being excellent in plant vigor, fullness, and color display in June, July, and Aug. 2005 and Aug. and Sept. 2006, respectively.

^yPlants' sunburn tolerance was rated on a scale of 1 to 5 with 1 being very poor, 3 fair and acceptable, and 5 being excellent without showing any signs of leaf burns or resulting holes on leaf surfaces taken in June, July, and Aug. 2005 and Aug. and Sept. 2006, respectively.

^zMean separation within columns by protected Fisher's least significant difference test at $P \leq 0.05$ unless otherwise indicated in the last row by the *P* values (last two columns under sun tolerance ratings).

Table 3. Plant performance for caladium cultivars grown from No. 1 tubers in 11.4-cm containers in a 45% shaded glasshouse, 2007, Wimauma, FL.^z

Cultivar	Days to sprout ^y		Plant ht (cm)		Leaves (no.)		Leaf length (cm)		Leaf width (cm)		Quality rating	
	Intact	De-eyed	Intact	De-eyed	Intact	De-eyed	Intact	De-eyed	Intact	De-eyed	Intact	De-eyed
75-14	37 a ^x	37 a ^w	27 a ^y	25 a ^x	7	13 b ^x	18.1 b ^w	18.0 ab ^w	12.2 b ^w	11.4 a ^x	3.3 a ^x	4.2 a ^x
Candidum Junior	31 bc	34 ab	19 b	15 b	11	10 bc	20.4 ab	18.4 a	13.2 ab	11.2 a	3.6 a	3.5 b
Galaxy	33 b	36 a	26 a	25 a	7	9 c	22.3 a	18.4 a	14.6 a	12.2 a	2.3 b	3.3 b
Miss Muffet	27 c	30 b	15 b	15 b	9	18 a	19.4 ab	15.4 b	12.5 b	8.6 b	3.1 a	4.4 a
<i>P</i> value	<0.002	0.073	<0.008	<0.001	ns ^v	<0.001	0.059	0.078	0.091	0.006	0.014	<0.001

^zValues represent the means of plants produced from eight intact or 10 de-eyed No. 1 (greater than 3.8 and less than 6.4 cm in diameter) tubers planted individually per container.

^yNumber of days from planting to the first unfurled leaf.

^xMean separation within columns by protected Fisher's least significant difference test at $P \leq 0.05$.

^wSignificant differences shown at the *P* values as indicated in the last row (0.059 to 0.091). Mean separation within columns was by protected Fisher's least significant difference test.

^vNonsignificant at $P \leq 0.10$.

and mean separation were done using the GLM procedure in the SAS program to compare the performance of caladium 75-14 to the controls.

Caladium 75-14 sprouted in 37 d (intact or de-eyed) after planting, similar to 'Galaxy', but 3 to 6 d later than 'Candidum Junior' and 7 to 10 d later than 'Miss Muffet' (Table 3). Caladium 75-14 plants were 27 cm (intact tubers) or 25 cm (de-eyed tubers) tall, similar to 'Galaxy' in height, but were significantly taller than 'Candidum Junior' (8 to 10 cm taller) and 'Miss Muffet' (10 to 12 cm taller), a known dwarf cultivar. Caladium 75-14 had seven leaves on intact plants 8 weeks after planting, similar to 'Galaxy' but less than 'Candidum Junior' or 'Miss Muffet' plants, although the difference was not statistically significant. When tubers were de-eyed, caladium 75-14 produced more leaves (13 per plant). In leaf size (length and width), caladium 75-14 was similar to 'Galaxy' and 'Candidum Junior'. Tuber de-eyeing significantly improved the quality rating of the pot plants, from 3.3 to 4.2. This indicates that caladium 75-14 can be used for forcing in small containers, but tuber de-eyeing will be required to produce high-quality plants.

In summary, caladium 75-14 is a new spotted, fancy-leaved cultivar. It has shown superior tuber production potentials in the replicated field trials. This yield is consistent with growers' trials (T. Cantwell-Bates, personal communication). With its vigorous

growth habit, caladium 75-14 can quickly fill a landscape space with many leaves and resist sunburn. These characteristics allow it to perform well in the landscape in full sun. In container forcing, caladium 75-14 behaves much like 'Galaxy' with similar sprouting time, leaf size, and plant height, but caladium 75-14 produces pot plants of higher quality regardless of tuber treatments (intact or de-eyed). Tuber de-eyeing can improve caladium 75-14's plant quality when forced in small containers (10 cm in diameter), although this practice is not required for producing pot plants in 20-cm or larger containers (Z. Deng, personal observation). For commercial tuber production, growers are encouraged to use preplant hot water treatment (Rhodes, 1964) and standard postharvest treatment (Harbaugh and Tjia, 1985).

Availability

Caladium 75-14 will be trademarked as Berry Patch. A plant patent will be sought from the U.S. Patent and Trademark Office and plant patent rights will be assigned to the University of Florida, Board of Trustees. Propagation and distribution will be licensed by the Florida Foundation Seed Producers, Inc., P.O. Box 110200, Gainesville, FL 32611. Information on tuber availability and propagation agreements can be obtained from the Florida Foundation Seed Producers, Inc.

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