

# Four New Caladium Cultivars, UF-R1410, UF-15-21, UF-15-441, and UF-16-597, for Containers and Landscapes

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Caladiums (*Caladium* × *hortulanum* Birdsey, Araceae Juss.) are ornamental aroids often used as container or landscape plants (Evans et al., 1992). They are valued for their variably shaped, bright foliage. Most commercial caladium plants are produced by forcing tubers in containers. Florida growers produce essentially all the caladium tubers used in the United States and in the world for pot plant production and tuber sales (Bell et al., 1998; Deng et al., 2008b). Roughly, two-thirds of Florida-produced caladium tubers are used to produce pot plants, and one-third are used for direct planting in the landscape. Commercial caladium cultivars are broadly classified into eight groups based on leaf type (fancy and lance-leaved) and leaf color (white, red, pink, and multicolored) (Bell et al., 1998). Generally speaking, fancy-

leaved caladium plants are taller and produce more and larger tubers than the lance-leaved caladiums. Leaves of fancy-leaved cultivars are also larger. Most commercial cultivars are fancy-leaved; however, the demand for lance-leaved cultivars has been on rise during the past 2 or 3 decades. Florida caladium growers planted >50% more acres for this group of cultivars in 2003 than in 1998 (Bell et al., 1998; Deng et al., 2008b). Combinations or recombinations of different colors on leaf veins, interveinal areas, spots, and/or blotches have resulted in diverse and intriguing coloration patterns on caladium leaves. Continuous introduction of caladium cultivars with novel leaf colors or coloration patterns are important to Florida caladium growers as well as greenhouse growers and nurseries that intend to produce prefinished and finished caladium plants in containers.

Since 1976, the University of Florida (UF) has supported a caladium breeding program at the Gulf Coast Research and Education Center to meet the need of the Florida caladium industry and the environmental horticulture industry for new caladium cultivars. The program's main breeding objectives have been to develop new and novel cultivars that can produce attractive and robust plants with many bright, colorful leaves and have high tuber yield potential. The main breeding approach used has been hybridization of commercial caladium cultivars and breeding lines followed by multiyear, rigorous selection and evaluation. New caladium cultivars introduced from this program have played an important role in sustaining the Florida caladium industry and meeting the environmental horticulture industry's needs. In response to growers' request, this program released four new lance-leaved cultivars in 2020 and 2021.

These new cultivars have novel colors or coloration patterns and are also improved in tuber yield potential, sunburn tolerance, and/or leaf health. This article describes the origin of these cultivars, their tuber yield potential, and their performance in replicated container and ground bed trials.

## Origin

'UF-R1410' was progeny of selfed Miss Muffet, a nonpatent commercial cultivar. The selfing was done in Bradenton, FL, in 2004 with the intent to investigate the inheritance of leaf spots on 'Miss Muffet' plants. The initial selection was made in Spring 2007.

'UF-15-21' was from a cross between two proprietary caladium breeding lines UF-477 and UF-89 that was made in Wimauma, FL, in Summer 2012 (Fig. 1). UF-477 was progeny of a cross between two commercial cultivars Florida Sunrise (Wilfret, 1993) and Florida Sweetheart (Wilfret, 1991a) that was made in Summer 2003. Breeding line UF-89 originated from a cross between 'Florida Fantasy' (Wilfret, 1991b) and 'Red Flash' that was made in Summer 2003. 'UF-15-21' was initially selected in Sept. 2015.

'UF-15-441' originated from a cross between 'Aaron' and 'White Wing' that was made in Wimauma, FL, in Summer 2012 (Fig. 1). Both Aaron and White Wing are non-patented commercial cultivars. 'UF-15-441' was initially selected in Sept. 2015.

'UF-16-597' was from a cross between 'Tricolor Butterfly' and the proprietary caladium breeding line UF-317 that was made in Wimauma, FL, in Aug. 2013 (Fig. 1). UF-317 was progeny of a cross between two commercial cultivars Florida Sweetheart (Wilfret, 1991a) and Miss Muffet that was made in Summer 2003. 'UF-16-597' was initially selected in Sept. 2016.

The ancestry of 'Florida Fantasy', 'Florida Sunrise', 'Florida Sweetheart', and 'Tricolor Butterfly' (Deng et al., 2008a) is shown in Fig. 1. Florida Fantasy and Florida Sunrise are nonpatent cultivars, whereas Florida Sweetheart was a patented cultivar (PP8,526) but its patent expired. 'Tricolor Butterfly', patented under UF331 (PP22,055), originated from a cross between 'Florida Sweetheart' and 'Florida Fantasy'. The ancestry of 'Aaron', 'Miss Muffet', 'Red Flash', and 'White Wing' is unknown. 'Miss Muffet' was developed by Frank M. Joyner (T. Bates, personal communication) in Tampa, FL, probably in the 1940s or early 1950s (Carnathan, 2012).

First asexual propagation of 'UF-R1410' occurred in Wimauma, FL, in Spring 2007; since then, it has been asexually propagated through tuber division for more than 10 generations. First asexual propagation of 'UF-15-21', 'UF-15-441', and 'UF-16-597' occurred in Wimauma, FL, in Spring 2014 or 2015; since then, they have been asexually propagated through tuber division for six or more generations. Plant, foliar, and growth characteristics of 'UF-R1410', 'UF-15-21', 'UF-15-441', and 'UF-16-597' have been stable and consistent during asexual propagation.

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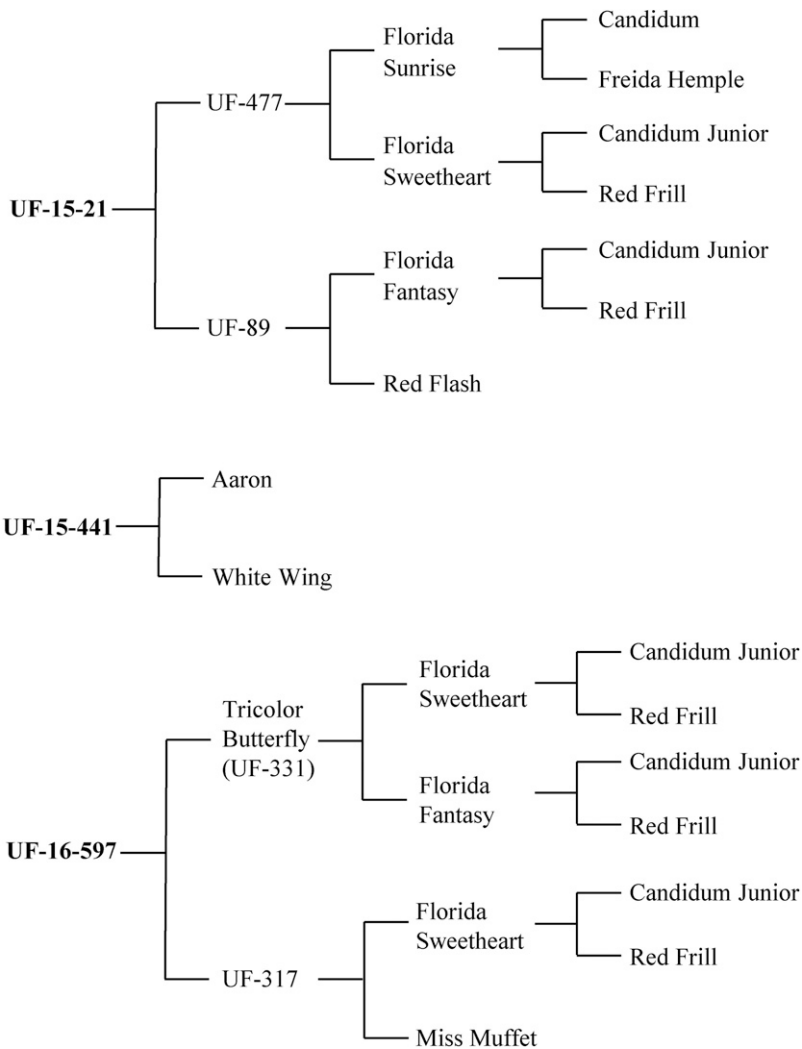


Fig. 1. Pedigree of 'UF-15-21', 'UF-15-441', and 'UF-16-597' caladiums.

### Description

Description of color for plant parts was based on comparison with the Royal Horticultural Society Color Chart [Royal Horticultural Society (RHS), 1986]. Plants used for color descriptions were grown from intact (non-de-eyed) No. 1 tubers (four per container) in 20.3-cm containers in a shaded greenhouse with  $\approx 30\%$  light exclusion. The containers were filled with the commercial potting mix Jolly Gardener Proline Hydrafiber C/B (Oldcastle Lawn & Garden, Inc., Atlanta, GA) amended with the commercial controlled-release fertilizer Osmocote (15N-3.9P-10K, 5-6 months; Scotts Co., Marysville, OH) at the rate of  $4.3 \text{ kg}\cdot\text{m}^{-3}$  and MicroMax micronutrients (Everris, Geldermalsen, The Netherlands) at the rate of  $0.48 \text{ kg}\cdot\text{m}^{-3}$ .

'UF-R1410'. Plants are  $\approx 37$  cm tall and 59 cm wide and produce upright, outwardly arching leaves. Mature leaves have an average size of 24 cm (length)  $\times$  16 cm (width). Leaves have a sagittate-cordate base, a slightly undulate margin, an acuminate to acute apex, and a pinnate venation pattern. The upper surface has a green (RHS 137A/B) margin bordering the

entire leaf except for the basal leaf valley formed by the two lobes where it is red-purple (RHS 59A/B or 60A/B). The midrib and primary veins are yellow-white (RHS 158C) and streaked with green (RHS 137B). Irregular blotches or spots of light red-purple (RHS 65C, 69A/B/C, or 73D) are distributed throughout the leaf surface against a green background (RHS 135B or 137A/B). Further, irregular, small light red-purple (RHS 65C, 69A/B/C, or 73D) mottling and/or blotching is present along the leaf margin. The underside surface has grayed-green (RHS 191A) margins, up to 15 mm wide, and a light green (RHS 137D) center and grayed-green (RHS 193D) midrib and primary veins. Petioles are grayed-green (RHS 188D, 189D, 190D, 191D, or 197B) with short streaks of brown (RHS 200B). Tuber surfaces are grayed-orange (RHS 165B) with spots of 165B, with the cortical area being yellow (RHS 11B/C/D) with spots of 11A in the center. A typical plant of 'UF-R1410' grown in full sun is shown in Fig. 2.

'UF-15-21'. On average, plants are 41 cm tall and 72 cm wide (Fig. 3). Mature leaves have an average size of 21.0 cm (length)  $\times$  14.0 cm (width). Mature leaves are sagittate,



Fig. 2. Typical leaves of 'UF-R1410' caladium grown in the ground bed in full sun in Wimauma, FL (photo by K. Druffel).

lobate to cordate, and slightly undulate with a yellow-green (RHS 155D) pinnate venation. Each leaf has two obvious lobes, up to one-fifth of the leaf length. The upper surface has a green (RHS 137B) margin, to 10 mm wide, bordering the entire leaf except for the basal leaf valley formed by the two lobes. The basal notch is red-purple (RHS 58A), which often bleeds into the basal part of the midrib and primary veins to red-purple (RHS 58B/C). The midrib veins are yellow-green (RHS 150C) with a few streaks and blotches of green (RHS 137D) and red-purple (RHS 58D), whereas the primary veins are grayed-green (RHS 195A) with a few streaks of green (RHS 137D) and red-purple (RHS 58D). Interveneal areas generally are grayed-white (RHS 156BC) to light red-purple (RHS 65B/C) except for the areas near the margin, where irregular grayed-green (RHS 189A/B) mottling is present. A 1- to 2-mm grayed-purple line (RHS 187A) is present on the basal leaf collar at the petiole apex. The underside surface has a grayed-green (RHS 189A) margin, up to 25 mm wide, and primary veins of grayed-green (RHS N189A/B/C) streaked with grayed-orange (RHS 177A/B). Secondary veins are grayed-green (RHS 189A/B) and netted. Interveneal areas are grayed-white (RHS 156A/B). Petioles are  $\approx 6$  mm and dark brown (RHS 200B/C) at the apex, but the



Fig. 3. A typical plant of 'UF-15-21' (35-day-old) caladium forced from four No. 1 (3.8 to 6.4 cm diameter) tubers in a 20.3-cm container (photo by K. Druffel).



Fig. 4. A typical plant of ‘UF-15-441’ (≈93-day-old) caladium forced from four No. 1 (3.8 to 6.4 cm diameter) tubers in a 20.3-cm container (photo by K. Druffel).

colors diffuse into a darker brown (RHS 200A) to black (RHS 203D) at the base that is ≈12 mm in diameter. Tuber surfaces are brown (RHS 200C/D) with the cortical area yellow-orange (RHS 10B/C/D, mostly 10B).

‘UF-15-441’. Plants are ≈31 cm tall and 56 cm wide and produce upright, outwardly arching leaves (Fig. 4). Mature leaves have an average size of 19.6 cm (length) × 13.1 cm (width). Leaves are sagittate-cordate, 17 to 22 cm long and 11 to 16 cm wide, and slightly undulate with green-white (RHS 157A) penniform venation. The upper surface has green (RHS 137B) margins, up to 5 mm wide, bordering the entire leaf. The basal leaf valley formed by the two lobes is green-white (RHS 137). Occasionally, a red-purple (RHS 59D) small basal notch may be present in the basal leaf valley. The central vein is green-white (RHS 157A/B/C/D, and primary veins are grayed-green (RHS 194C/D). Interveneal leaf areas are green-white (RHS 193B/C/D to 194D) except for the areas near the margins where irregular grayed-green (RHS 193C/D) mottling and blotching of green (RHS 137A/B) is present. The abaxial surface has green (RHS 137B) margins, up to 10 mm wide, and a green-white (RHS 157C/D) center with blotching of green (RHS 138A/B) toward the margins. The central vein is yellow-green (RHS 146D), and primary veins are yellow-green (RHS 146D). Petioles are ≈4 mm and yellow-green (RHS 145A/B) at the apex, but the color diffuses into brown (RHS 200A) with many patches of grayed-purple (RHS 186C) near the base, which is ≈6 mm in diameter. Jumbo-size tubers are multisegmented, bearing five to nine dominant buds. Tuber surfaces are brown (RHS 200C/D), with the cortical area being yellow (RHS 9C).

‘UF-16-597’. Plants have an average height of 39 cm and average width of 62 cm. Fully expanded mature leaves (Fig. 5) have an average size of 22.3 cm (length) × 15.0 cm (width). Leaves are lanceolate with a sagittate-cordate base and a broad acuminate tip, 18 to 26 cm long and 12 to 17 cm wide, undulate with green (RHS 137B) penniform venation. The upper surface has dark green–white



Fig. 5. Typical leaves of ‘UF-16-597’ caladium (≈51-day-old) grown under shade in Wimauma, FL (photo by K. Druffel).

(RHS 157A) margin, 1 to 2 mm wide, with splashes of red-purple (RHS 58C/D), bordering the entire leaf except for the basal leaf valley where it is grayed-purple (RHS 187A). The leaf center is green-white (RHS 157B or 159B) with many red-purple (RHS 59A) spots. Leaves have a thick (3 to 5 mm wide) central main vein in dark green (RHS 137A/B) and numerous (up to 15) large primary veins (up to 4-mm wide) in green (RHS 137C) radiating from the central vein. These large veins connect marginally with a thinner (1 to 2 mm wide) green vein (RHS 137C) that roughly parallels the leaf margin and the peripheral thin green (RHS 137C) vein. A small green (RHS 137B) vein is located between and parallel to the leaf margin and the peripheral vein. Netted secondary veins are green (RHS 137C). The interveneal area is variable, from green-white (RHS 157B) to red-purple (RHS 59D), depending on light conditions and leaf maturity. Leaves have many red-purple spots (RHS 59A) and a large (up to 1.5 cm) red-purple (RHS 59A) to black (RHS 202A) blotch at the petiole attachment, covering a small portion of the central and large veins. The undersurface has a narrow (1 to 2 mm) yellow-green (RHS 144A/B) margin. The mid vein is green-white (157A) with slight streaking of red-purple (RHS 59C), and the primary veins are green (RHS 137B/C). Interveneal areas are variable, green (137D) to green-white (157A), with many red-purple (RHS 59A) irregular spots. Petioles are 4 to 7 mm in diameter and light brown (RHS 200C/D) at the apex, but the colors diffuse into dark brown (RHS 200A) to black (RHS 202A) at the base that is 5 to 11 mm in diameter. Streaks of red (RHS 50D) often extend along the petioles. Jumbo-size tubers (6.4 to 8.9 cm in diameter) are multisegmented, bearing four to seven dominant buds. Tuber surfaces

are brown (RHS 200D) with the cortical area yellow (RHS 9C).

### Tuber Yield Potential

‘UF-R1401’, ‘UF-15-21’, ‘UF-15-441’, and ‘UF-16-597’ were evaluated for tuber yield potential in replicated experimental field plots in Wimauma, FL, in 2014, 2015, 2019, and/or 2020. The soil was EauGallie fine sand with ≈1% organic matter and a pH between 6.2 and 7.4. Caladium plants were grown in the field plots using a white plastic-mulched raised-bed system (Deng and Harbaugh, 2006). In the 2014 evaluation, beds (81 cm wide, 20 cm high) were fumigated on 9 Jan. with Pic-Clor 60 (39.0% 1,3-dichloropropene and 59.6% chloropicrin) at 448 kg·ha<sup>-1</sup>. Plantacote Pluss, a controlled-release fertilizer (14N–3.9P–12.5K, 12 months, X-Calibur Plant Health Company, LLC, Summerville, SC), was incorporated into the bed at 336 kg·ha<sup>-1</sup>. Caladium seed tubers were treated in hot water (50 °C) for 30 min (Rhodes, 1964) and then manually cut into pieces (chips) (≈2.5 × 2.5 × 2.5 cm), and seed pieces were planted on 16 April at ≈15-cm spacing between rows and in rows. Irrigation was by seepage (Geraldson et al., 1965), which maintained a relatively consistent water table below the covered beds. Caladium plants were fertilized with 600 ppm of nitrogen with a commercial water-soluble fertilizer (20N–8.7P–16.6K; Southern Agricultural Insecticides, Inc., Palmetto, FL) on 18 Sept. and 1 Oct. Tubers were dug on 1 Dec. Dried tubers from each experimental field plot were weighed, graded, and counted on 11 Jan., as described by Deng and Harbaugh (2006). Tuber grading was by the maximum diameter: Super Mammoth (larger than 11.4 cm), Mammoth (8.9 to 11.4 cm), Jumbo (6.4 to 8.9 cm), No. 1 (3.8 to 6.4 cm), and No. 2 (2.5 to 3.8 cm). Tuber grades and counts were converted into a production index to show the relative economic value of the harvested tubers per field plot: Production index = 8n (Super Mammoth) + 6n (Mammoth) + 4n (Jumbo) + 2n (No. 1) + 1n (No. 2), where n = number of tubers in the grade. The relative values assigned to the five tuber grades in calculating production index were based on the relative market prices provided by Florida caladium tuber producers.

In the 2015 season, ground beds were fumigated on 23 Feb. with Pic-Clor 60 at 448 kg·ha<sup>-1</sup>. Seed tuber pieces were dusted with a biological fungicide RootShield Plus WP (BioWorks, Victor, NY) and planted manually on 14 Apr., at the same in-row and between-row spacing as in 2014. Irrigation was through a seepage system as described previously. Approximately 7 g of Osmocote (15N–2.6P–10K, 5–6 months) was applied to each plant on 30 April and again on 28 July. New crop tubers were dug and washed on 7 to 8 Dec. and air-dried for ≈30 d inside a greenhouse before they were weighed, graded, and counted as described previously.

In the 2019 evaluation, beds were fumigated on 24 Feb. with Pic-Clor 60 at 448 kg·ha<sup>-1</sup>. Seed tuber pieces were dusted with RootShield Plus WP and planted manually on 4 Apr. Fifty



pounds of granular nitrogen (50 N) per acre was incorporated into the soil before bedding. Two drip tapes were buried under the plastic mulch along the raised beds, which provided the irrigation water and fertilization. Fertigation began on 1 June, by injecting a commercial liquid fertilizer (5N-0.87P-6.64K, Chemical Dynamics, Plant City, FL) at 0.454 kg of nitrogen an acre a day. The fertilization rate was increased to 0.908 kg of nitrogen an acre a day on 24 July and ended on 31 Oct. Tubers were dug and washed on 9 Dec., dried in the greenhouse for  $\approx$ 45 d, and weighed, graded, and counted on 21 Jan. 2020, as described previously.

In the 2020 season, ground beds were fumigated on 12 Feb. with Pic-Clor 60 at 448 kg-ha<sup>-1</sup>. Seed tuber pieces were dusted with RootShield Plus WP and planted manually on 15 Apr. with the same in-row and between-row spacing as in 2014. Fertigation began on 28 May, injecting a commercial liquid fertilizer (5N-0.87P-6.64K) at the rate of 0.454 kg of nitrogen an acre a day, and ended on 30 Oct. Tubers were dug and washed on 1 to 2 Dec., dried in the greenhouse for  $\approx$ 63 d, and weighed, graded, and counted on 3 Feb. 2021 as described previously.

In all growing seasons, field plots were arranged in a randomized complete block design with three replicates. The plot size was 1.2 m<sup>2</sup> and was planted with 30 caladium

propagules (tuber pieces). ‘Gingerland’, ‘Icicle’, ‘Tricolor Butterfly’, ‘White Butterfly’, and/or ‘White Wing’ were included in the field trials as standards to assess the tuber yield potential and plant performance of the new cultivars. Analysis of variance was conducted using the JMP Pro 15.0.0 program, followed by means comparisons using the Tukey-Kramer honestly significant difference test (The SAS Institute, Inc., Cary, NC).

‘UF-R1410’. The tuber weight and production index of ‘UF-R1410’ were significantly greater than that of ‘Gingerland’ in both 2014 and 2015 (Table 1). The tuber weight of ‘UF-R1410’ was 185% greater than the tuber weight of ‘Gingerland’ in 2014 and 211% greater in 2015 (Table 1). The production index of ‘UF-R1410’ was 155% greater than that of ‘Gingerland’ in 2014 and 49% greater in 2015 (Table 1). ‘UF-R1410’ and ‘Gingerland’ were not significantly different in the number of marketable tubers, producing  $\approx$ 26 to 36 marketable tubers per experimental plot in 2014 and 2015. The primary grade of tubers produced by ‘UF-R1410’ was Jumbo (46.9% in 2014 and 56.2% in 2015), followed by No. 1 (25.9% in 2014 and 25.7% in 2015) and No. 2 (14.2% in 2014 and 12.4% in 2015). ‘UF-R1410’ produced more Jumbos and fewer No. 1- and

No. 2-sized tubers than ‘Gingerland’ in 2014 and 2015 (Table 1).

‘UF-15-21’. This caladium cultivar showed different tuber yield potential in 2019 and 2020. The tuber weight, marketable tuber, and production index of ‘UF-15-21’ in the 2019 growing season were 3.5 kg, 75.3, and 126.0, respectively (Table 1). Its tuber weight was 111% or 143% greater than the tuber weight of ‘White Butterfly’ and ‘Icicle’, the number of marketable tubers was 49% or 75% larger than the marketable tubers of ‘White Butterfly’ and ‘Icicle’, and the production index was 68% or 108% greater than the production index of ‘White Butterfly’ and ‘Icicle’. However, in the 2020 growing season, ‘UF-15-21’ produced fewer and lighter tubers and was not significantly different from ‘White Butterfly’ or ‘White Wing’ (Table 1). The primary grades of tubers were No. 1 (51.5% and 31.8% in 2019 and 2020, respectively) or No. 2 (43.1% and 67.3% in 2019 and 2020, respectively), with 5% to 9% of tubers in Jumbos (Table 1).

‘UF-15-441’. Its tuber weight and production index in the 2019 growing season were 2.5 kg and 94.3, respectively (Table 1). The tuber weight was 78.6% or 47.1% greater than the tuber weight of ‘Icicle’ and ‘White Butterfly’, and the production index was 55.3% or 25.7% greater than the production index of

Table 1. Tuber weight, number of marketable tubers, production index, and grade distribution of ‘UF-R1410’, ‘UF-15-21’, ‘UF-15-441’, ‘UF-16-597’, and commercial caladium cultivars (checks) in replicated experimental field plots in Wimauma, FL, in 2014, 2015, 2019, and/or 2020. Values presented are means of three plots with 30 propagules planted in a plot of 1.2 m<sup>2</sup>.

Cultivars	Tuber			Tuber grade distribution (%)				
	Wt (kg)	Marketable (no.)	Production index <sup>z</sup>	Super-mammoth	Mammoth	Jumbo	No. 1	No. 2
				2014				
UF-R1410	3.7 a <sup>y</sup>	32.7	107.3 a		13.0	46.9 a	25.9	14.2
Gingerland	1.3 b	26.7	42.0 b		0	0 b	60.2	39.8
<i>P</i> value	0.0295	0.3235	0.0075		0.2046	0.0017	0.0589	0.1980
				2015				
UF-R1410	3.6 a	35.0	113.0 a		5.7 a	56.2	25.7	12.4 b
Gingerland	1.7 b	35.7	76.0 b		0 b	19.5	54.3	26.2 a
<i>P</i> value	0.0307	0.1835	0.0477		0.0235	0.0825	0.0817	0.0075
				2019				
UF-15-21	3.5 a	75.3 a	126.0 a		0 b	5.4 ab	51.5 a	43.1 ab
UF-15-441	2.5 ab	41.7 b	94.3 ab		3.4 a	23.2 a	43.5 ab	29.9 b
Icicle	1.4 b	43.0 b	60.7 b		0 b	1.6 b	36.7 b	61.9 a
White Butterfly	1.7 b	50.7 b	75.0 b		0 b	3.8 ab	36.2 b	60.0 a
<i>P</i> value	0.0058	0.0101	0.0068		<0.0001	0.0030	0.0113	0.0051
				2020				
UF-16-597	4.1 a	53.0 a	129.7 a	0.5	4.3	23.5 a	48.3 a	23.3 b
Gingerland	0.7 b	23.7 b	29.3 b	0	0	1.2 b	19.6 b	79.2 a
<i>P</i> value	0.0175	0.0276	0.0192	0.4226	0.0639	0.0054	0.0126	0.0092
				2020				
UF-15-21	1.2 b	41.3 b	55.7 b		0	8.5	31.8	67.3 a
UF-15-441	2.5 a	74.0 a	110.7 a		0.5	5.4	31.3	62.8 ab
White Butterfly	1.3 b	54.3 ab	67.0 b		0	0	23.5	76.5 a
White Wing	1.5 b	38.7 b	61.3 b		0.9	3.4	44.2	51.6 b
<i>P</i> value	0.0014	0.0044	0.0026		0.6272	0.2371	0.0515	0.0069
				2020				
UF-16-597	4.0 a	51.0 a	111.3 a		4.0	20.3 a	37.9 a	37.8 b
Gingerland	0.7 b	13.7 b	18.7 b		0	4.9 ab	22.0 b	73.1 a
Tricolor Butterfly	1.1 b	41.3 a	56.0 b		0	1.5 b	30.5 a	68.0 a
<i>P</i> value	0.0066	0.0008	0.0026		0.1796	0.0407	0.0062	0.0244

<sup>z</sup>The production index is an indicator of the economic value of tubers harvested per plot and is calculated as follows: N (No. 2s) + 2N (No. 1s) + 4N (Jumbos) + 6N (Mammoth) + 8N (Super Mammoth), where N = number of tubers in each grade. 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 (>11.4 cm). Tuber grade distribution data were transformed using the arcsine function in Excel {asin[sqrt(tuber grade distribution in percentage/100)]}.

<sup>y</sup>Mean values with the same letters within columns by year are not significantly different by the Tukey-Kramer honestly significant difference test at *P* < 0.05.

'Icicle' and 'White Butterfly' (Table 1). In the 2020 growing season, 'UF-15-441' also showed excellent tuber yield potential, with 66.7% to 108.3% greater tuber weight, 36.3% to 91.2% more marketable tubers, and 65.2% to 98.7% higher production index than the two white lance-leaved commercial cultivars White Butterfly and White Wing (Table 1). The primary grades of tubers were No. 1 or No. 2. This tuber size distribution was not significantly different from that of 'White Butterfly' or 'White Wing'. Thus, compared with other white-colored lance-leaved cultivars, 'UF-UF-441' seems to have better tuber potential.

'UF-16-597'. Its tuber weight (4.1 kg), marketable tubers (53.0), and production index (129.7) in 2019 were significantly different from those parameters of 'Gingerland' (Table 1). Similarly, 'UF-16-597' produced more and heavier tubers and had higher production index than 'Gingerland' and 'Tricolor Butterfly' in the 2020 growing season (Table 1). The primary grade of tubers produced by 'UF-6-597' in 2019 and 2020 was No. 1 (48.3% and 37.9% in 2019 and 2020, respectively), followed by Jumbo (23.5% in 2019 and 20.3% in 2020) and No. 2 tubers (23.3% in 2019 and 37.8% in 2020). These data indicate that 'UF-16-597' produces larger tubers and has better yield potential than 'Gingerland' or 'Tricolor Butterfly'.

### Container Trials

The suitability of 'UF-R1410', 'UF-15-21', 'UF-15-441', and 'UF-16-597' for container plant production was evaluated by forcing tubers in small containers and following the protocol of Harbaugh and Tjia (1985). In the 2019 replicated container trials, intact or de-eyed No. 1 tubers of 'UF-R1410' and commercial cultivar Gingerland were planted on 31 May in 11.4-cm containers (diameter) filled with the commercial potting mix Pro-Line 4B (Jolly Gardener, Poland Spring, ME) amended with Osmocote fertilizer (15N-3.9 P-10K, 5-6 months) at 4.3 kg·m<sup>-3</sup> and Micromax (ICL Fertilizers, Summerville, SC) at 0.48 kg·m<sup>-3</sup>. Potted tubers and plants were grown in a greenhouse with ≈30% light exclusion. Temperatures in the greenhouse ranged from 25°C (night) to 33°C (day). Potted tubers and plants were arranged on metal benches, with a pot-to-pot spacing of 0.4 m, in the greenhouse in a randomized complete block design with seven replicates. Data on plant height, width, leaf size, plant quality, etc., were taken on 23 to 24 July, ≈8 weeks after planting. Quality of the potted caladium plants was rated on a scale of 1 to 5, with 1 = very poor, unattractive, totally unacceptable as potted plants with few leaves, and 5 = very attractive, full plants with a symmetrical shape, an appropriate height, and many bright, colorful leaves. The suitability of 'UF-15-21' for container plant production was evaluated in 2020 by forcing tubers in 12.7-cm containers (diameter) following the previously described protocol. No. 1 tubers (intact or de-eyed) were planted on 1 May. 'White Wing' was included as a check. Fungicide Subdue

Maxx (Syngenta Group Company, Basel, Switzerland) was applied as a drench to all potted plants on 4 June. Plant height, plant width, number of leaves, and foliar characteristics were recorded as described previously on 23 to 24 June, ≈8 weeks after planting. The suitability of 'UF-15-441' and 'UF-16-597' for container plant production was evaluated in 2021 by forcing tubers in 12.7-cm containers (diameter), as described previously. No. 1 tubers (intact or de-eyed) were planted on 2 July. Growing conditions and experimental design were the same as in 2020. Two lance-leaved cultivars, Icicle and White Wing, were included as checks for 'UF-15-441', whereas 'Tricolor Butterfly' was included as a check for 'UF-16-597'. Fungicide Subdue Maxx and insecticide Neemix (Certis USA, Columbia, MD) were applied as a drench to all potted plants on 20 July. Plant height, plant width, number of leaves, and foliar characteristics were recorded on 1 Sept., ≈9 weeks after planting. Analysis of variance and mean comparisons were performed in JMP Pro 15.0.0, as described previously.

'UF-R1410'. Intact tubers of 'UF-5412' sprouted ≈33 d after planting, ≈22 d later than 'Gingerland' (Table 2). Plants forced from intact tubers had an average height of 25.2 cm, an average width of 31.9 cm, an average of 5.1 leaves, and the leaves were averaged to be 17.6 cm long and 11.5 cm wide. Thus, plants of 'UF-R1410' forced from intact tubers and grown for ≈8 weeks were 5.0 cm narrower, and leaves were 5.7 cm shorter and 5.0 cm narrower than 'Gingerland'. De-eyed tubers of 'UF-R1410' sprouted 36 d after planting, ≈15 d later than 'Gingerland'. On average, plants of 'UF-R1410' forced from de-eyed tubers were 20.4 cm tall and 29.4 cm wide and had about seven leaves per plant, and leaves were 14.6 cm long and 8.7 cm wide. Compared with 'Gingerland' plants from de-eyed tubers, 'UF-R1410' plants from de-eyed tubers were 11.9 cm narrower and had many fewer leaves (about one-third). Plants of 'UF-R1410' from intact and de-eyed tubers received a quality rating of 2.6 or 2.7, indicating that these plants barely met the required quality for potted caladium plants. When the container trial was extended for 2 more weeks, 'UF-R1410' plants developed more leaves and received a quality rating of 3 or above. These results indicate that 'UF-R1410' is among the slowest sprouting caladium and will need additional time for production of prefinished or finished container plants.

'UF-15-21'. Intact tubers of 'UF-15-21' sprouted ≈20 d after planting, significantly later (6 d) than 'White Wing' (≈14 d) (Table 2). De-eyed tubers of 'UF-15-21' sprouted 26 d after planting, not significantly different from de-eyed tubers of 'White Wing' (about 24 d). Plants of 'UF-15-21' forced from intact tubers had an average height of 30.9 cm, an average width of 45.6 cm, and an average of 10.9 leaves per plant, and its leaves had an average size of 15.7 cm (length) × 17.0 cm (width) (Table 2, Fig. 6). They were not significantly different from the corresponding parameters of 'White Wing', except that 'UF-15-21' had significantly longer leaves. Plants of 'UF-15-21' forced from de-eyed tubers were significantly different

from 'White Wing': The former were 8.8 cm taller and 3.1 cm wider and had about seven fewer leaves, and the leaves were 2.9 cm longer and 4.5 cm wider. Overall, plants of 'UF-15-21' from intact tubers appeared to be taller (3.8 cm) and had larger (4.4 cm longer, 2.2 cm wider) but 4.2 fewer leaves. Because of this, these plants received a significantly lower quality rating (2.2) (Table 2). This rating indicates that intact tubers produced low-quality plants in small containers. De-eyed tubers produced acceptable plants in small containers, receiving an average quality rating of 3.4. Thus, tuber de-eyeing may be required for 'UF-15-12' to produce desirable plants in containers 12.7 cm or smaller in diameter. Plants of 'UF-15-21' forced from de-eyed tubers were significantly different from plants of 'White Wing' in height, width, number of leaves, leaf length, and leaf width.

'UF-15-441'. Intact tubers of 'UF-15-441' sprouted ≈23 d after planting, not significantly different from 'Icicle' but significantly later (6 d) than 'White Wing' (≈6 d) (Table 2). De-eyed tubers of 'UF-15-441' sprouted 28 d after planting, not significantly different from de-eyed tubers of 'Icicle' or 'White Wing' (27 or 28 d). Plants of 'UF-15-441' forced from intact tubers had an average height of 23.2 cm, an average width of 38.1 cm, and an average of 19.8 leaves per plant, and its leaves had an average size of 17.8 cm (length) × 11.8 cm (width) (Table 2). They were not significantly different from the corresponding parameters of 'Icicle', except that 'UF-15-441' had significantly more leaves than 'Icicle' (19.8 vs. 14.2). Compared with 'White Wing', plants of 'UF-15-441' from intact tubers were narrower (38.1 cm vs. 43.9 cm) and had more leaves (19.8 vs. 13.4). Plants of 'UF-15-441' forced from de-eyed tubers had an average height of 20.6 cm, an average width of 33.6 cm, and an average of 24.6 leaves per plant, and its leaves had an average size of 14.9 cm (length) × 9.9 cm (width) (Table 2). On average, plants of 'UF-15-441' were 7 cm taller than 'Icicle', but were 4.4 cm shorter and 9.6 cm narrower than 'White Wing'; the leaves of 'UF-15-441' were ≈3 cm shorter than 'White Wing' leaves. Both intact and de-eyed tubers of 'UF-15-441' produced acceptable plants in small containers, receiving an average quality rating of 3.6 to 3.7 (Fig. 7). Thus, tuber de-eyeing may not be required for 'UF-15-441' to produce plants in containers 12.7 cm or smaller in diameter.

'UF-16-597'. Intact tubers of 'UF-16-597' sprouted ≈25 d after planting, not significantly different from 'Tricolor Butterfly' (Table 2). Plants forced from intact tubers had an average height of 21.0 cm, an average width of 35.3 cm, an average of 9.6 leaves, and the leaves were averaged to be 17.2 cm long and 11.9 cm wide. Thus, plants of 'UF-16-597' forced from intact tubers and grown for 8 weeks were ≈6 cm taller and 11 cm wider than 'Tricolor Butterfly'. De-eyed tubers of 'UF-16-597' sprouted ≈36 d after planting, not significantly different from 'Tricolor Butterfly'. On average, plants of

Table 2. Days to sprout, plant height and width, leaf number, length and width, number of blooms (inflorescences), and plant quality ratings of 'UF-R1410', 'UF-15-21', 'UF-15-441', 'UF-16-597', and commercial caladium cultivars (checks) grown in small containers. No. 1 tubers were planted in 11.4-cm or 12.7-cm containers (one tuber per container) and grown in a shaded glasshouse in Wimauma, FL, in 2019 ('UF-R1410'), 2020 ('UF-15-21'), or 2021 ('UF-15-441' and 'UF-16-597'). Values represent the means of six or seven plants (replicates) produced from intact or de-eyed No. 1 (3.8 to 6.4 cm in diameter) tubers planted individually per container.

Cultivar	Days to sprout		Plant ht (cm)		Plant width (cm)		Leaves (no.)		Leaf length (cm)		Leaf width (cm)		Blooms (no.)		Quality rating <sup>z</sup>	
	Intact	De-eye	Intact	De-eye	Intact	De-eye	Intact	De-eye	Intact	De-eye	Intact	De-eye	Intact	De-eye	Intact	De-eye
UF-R1410	33.4 a <sup>y</sup>	36.0 a	25.2	20.4	31.9 b	29.4 b	5.1	7.1 b	17.6 b	14.6	11.5 b	8.7	0.3	0.6	2.6	2.7 b
Gingerland	11.1 b	20.7 b	28.9	20.8	46.9 a	41.3 a	5.9	22.1 a	23.3 a	14.6	16.5 a	9.4	0.6	1.3	3.0	4.4 a
<i>P</i> value	0.0004	0.0003	0.2673	0.8137	0.0003	0.0005	0.6982	0.0003	0.0164	0.9556	0.0028	0.0962	0.9078	0.2832	0.2438	0.0022
UF-15-21	20.3 a	26.0	30.9	29.9 a	45.6	41.6 a	10.9	18.7 b	25.7 a	18.6 a	17.0	11.9 a	1.0	0	2.2 b	3.4
White Wing	14.4 b	24.3	27.1	21.1 b	44.9	38.5 b	15.1	25.5 a	21.3 b	15.7 b	14.8	7.4 b	1.0	0	3.0 a	3.5
<i>P</i> value	0.0038	0.4287	0.0716	<0.000001	0.7349	0.0142	0.3404	0.0342	0.0401	0.0202	0.1007	<0.0001	0.0341	0.1778	0.0300	0.06493
UF-15-441	23.4 a	28.0	23.2 a	20.6 b	38.1 b	33.6 b	19.8 a	24.6	17.8 ab	14.9 b	11.8	9.9	1.8	0.2	3.6 a	3.7 ab
Icicle	22.4 a	27.0	19.8 b	13.6 c	36.2 b	33.2 b	14.2 b	18.6	17.1 b	13.1 b	11.5	8.5	1.2	0.2	2.7 b	2.8 b
White Wing	17.0 b	27.6	25.0 a	25.0 a	43.9 a	43.2 a	13.4 b	25.0	20.1 a	17.8 a	13.3	10.1	1.2	0	3.5 ab	3.9 a
<i>P</i> value	<0.0001	0.0915	0.0028	<0.0001	<0.0001	<0.0001	0.0190	0.3069	0.0327	0.0011	0.1807	0.1658	0.7872	0.6561	0.0393	0.0218
UF-16-597	25.4	35.6	21.0 a	15.6	35.3 a	34.4 a	9.6 b	11.0	17.2	15.9	11.9	9.4	1.0 a	0.4	2.9	2.7
Tricolor Butterfly	26.2	33.2	15.2 b	12.0	24.7 b	23.8 b	17.0 a	8.4	14.2	12.9	9.3	8.7	0 b	0	2.6	2.2
<i>P</i> value	0.5769	0.4852	0.0141	0.0533	0.0020	0.0094	0.0239	0.3675	0.2187	0.1387	0.0769	0.3897	0.0341	0.1778	0.0993	0.2560

<sup>z</sup>Quality of the potted caladium plants was rated on a scale of 1 to 5, with 1 = very poor, unattractive, totally unacceptable as potted plants with few leaves, and 5 = very attractive, full plants with a symmetrical shape, an appropriate height, and many bright, colorful leaves.

<sup>y</sup>Mean comparisons within column by the Tukey-Kramer honestly significant difference test at  $P < 0.05$ .



Fig. 6. Plants of 'UF-15-21' caladium forced from one intact (left) or de-eyed (right) No. 1 tuber in 12.7-cm-diameter containers (photo by K. Druffel).

'UF-16-597' forced from de-eyed tubers were 15.6 cm tall and 34.4 cm wide and had  $\approx 11$  leaves per plant, and leaves were 15.9 cm long and 9.4 cm wide. Compared with 'Tricolor Butterfly', 'UF-16-597' plants from de-eyed tubers were  $\approx 11$  cm wider. Plants of 'UF-16-597' from intact and de-eyed tubers received a quality rating of 2.7 or 2.8, indicating that these plants barely met the required quality for potted caladium plants. 'UF-16-597' plants, either from intact or de-eyed tubers, produced some blooms, which were rarely observed in 'Tricolor Butterfly'. When the container trial was extended for 2 more weeks, 'UF-16-597' plants developed more leaves and received a quality rating of 3 or above. These results indicate that 'UF-16-597' is slow to sprout and produce leaves to fill the pot, thus this caladium will need additional time for production of prefinished or finished plants in containers.

#### Plant Performance in Ground Beds

'UF-R1410', 'UF-15-21', 'UF-15-441', and 'UF-16-597' were evaluated for plant growth, leaf color display, sunburn tolerance, and leaf health in the same field plots that were used for evaluating tuber production. Growing conditions were described previously. Rating scales were the same as previously described (Deng and Harbaugh, 2006). Briefly, a scale of 1 to 5 was used for rating plant growth, with 1 being very poor (few leaves and lack of vigor) and 5 being excellent (full plants, numerous leaves). A scale of 1 to 5 was used for rating leaf color display, with 1 being very poor (dull or bleached, lack of color display) and 5 being excellent



Fig. 7. Plants of 'UF-15-441' caladium forced from one intact (left) or de-eyed (right) No. 1 tuber in a small container (12.7 cm diameter) (photo by K. Druffel).

Table 3. Plant growth and leaf color rating of 'UF-R1410', 'UF-15-21', 'UF-15-441', 'UF-16-597', and commercial caladium cultivars (checks) grown from 2.5-cm tuber propagules in ground beds in full sun in Wimauma, FL, in 2014, 2015, 2019, and/or 2020. Plant growth and leaf color rating values are means of three plots based on whole plot evaluation in each evaluation.

Cultivars	Plant growth rating <sup>z</sup>						Leaf color rating <sup>y</sup>					
	Aug. 2014	Sept. 2014	Oct. 2014	July 2015	Aug. 2015	Sept. 2015	Oct. 2015	Aug. 2015	Sept. 2015	Oct. 2015		
UF-R1410	3.6	4.1 a <sup>x</sup>	4.7 a	2.5	3.8	3.8	3.8 a	4.7 a	4.0	3.5		
Gingerland	3.2	2.9 b	2.6 b	2.8	2.5	2.5	2.9 b	2.4 b	4.7	3.8		
<i>P</i> value	0.3701	0.0198	0.0247	0.4778	0.1296	0.0699	0.0082	0.0276	0.0572	0.4226		
Cultivars	Plant growth rating <sup>z</sup>						Leaf color rating <sup>y</sup>					
	July 2019	Aug. 2019	Sept. 2019	July 2020	Aug. 2020	Sept. 2020	July 2019	Aug. 2019	Sept. 2019	July 2020	Aug. 2020	Sept. 2020
UF-15-21	3.3 a	3.7	3.3 a	2.0 b	2.3 b	3.2 ab	3.7	3.7 ab	3.2 b	2.5 b	2.8 bc	2.8
UF-15-441	3.2 a	3.5	2.3 ab	4.3 a	4.3 a	4.1 a	3.0	3.0 b	2.5 c	3.2 a	3.2 ab	2.8
Icicle	2.3 b	2.7	1.7 b	–	–	–	3.0	3.3 ab	3.2 b	–	–	–
White Butterfly	2.2 b	2.5	3.0 ab	2.7 b	2.7 b	3.5 ab	3.7	3.8 a	4.0 a	3.5 a	3.8 a	2.9
White Wing	–	–	–	3.0 b	2.7 b	2.7 b	–	–	–	2.2 b	2.2 c	2.5
<i>P</i> value	0.0014	0.1878	0.0238	0.0021	0.0012	0.0299	0.1788	0.0391	0.0010	0.0011	0.0049	0.0997
UF-16-597	3.2	3.3	2.3	3.5 a	3.5 a	3.1	2.5	2.0 b	2.0	2.2	2.0	2.6 b
Gingerland	2.5	1.5	1.2	1.3 b	1.3 b	1.8	3.2	3.2 a	2.7	2.7	3.0	3.0 a
Tricolor Butterfly	–	–	–	2.0 b	1.8 b	2.5	–	–	–	2.3	2.0	2.5 b
<i>P</i> value	0.2697	0.0927	0.1917	0.0002	0.0002	0.0869	0.0534	0.0123	0.0572	0.2844	1.000	0.0037

<sup>z</sup>Plant growth was rated on a scale of 1 to 5, with 1 being very poor and 5 being excellent in plant vigor and fullness.

<sup>y</sup>Leaf color was rated on a scale of 1 to 5, with 1 being very poor and 5 being excellent in leaf color display.

<sup>x</sup>Mean separation within columns by the Tukey-Kramer honestly significant difference test at  $P < 0.05$ .

Plant growth and leaf color were evaluated on 13 Aug., 10 Sept., and 1 Oct. 2014; 16 July, 17 Aug., 16 Sept. and 15 Oct. 2015; 13 July, 13 Aug., and 18 Sept. 2019; and 31 July, 21 Aug., and 25 Sept. 2020.

(bright, very attractive). Sunburn tolerance was evaluated on a scale of 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). Leaf health was evaluated on a scale of 1 to 5, with 1 being numerous diseased spots and completely unsightly and 5 being healthy and free of visible leaf spot diseases. Evaluations of plant

growth, leaf color, sunburn tolerance, and leaf health were done on 13 Aug., 10 Sept., and 1 Oct. 2014; 16 July, 17 Aug., 16 Sept., and 15 Oct. 2015; 13 July, 13 Aug., and 18 Sept. 2019; and/or 31 July, 21 Aug., and 25 Sept. 2020.

'UF-R1410'. Plants of 'UF-R1410' grew well in both 2014 and 2015 seasons, with a growth score between 2.5 and 4.7 (average 3.2) (Table 3). Its growth scores were significantly

higher than those of 'Gingerland' (1.7 to 2.8) in two of three evaluations in 2014. Leaf color scores were between 3.5 and 4.7, higher than the leaf color scores of 'Gingerland' in two of four evaluations (Table 3). Plants of 'UF-R1410' showed good to excellent sunburn tolerance in both 2014 and 2015 growing seasons, with sunburn tolerance ratings between 4.5 and 4.5 (Table 4). Its sunburn tolerance ratings were not significantly different from those of

Table 4. Sunburn tolerance and leaf health rating of 'UF-R1410', 'UF-15-21', 'UF-15-441', 'UF-16-597', and commercial caladium cultivars (checks) grown from 2.5-cm tuber propagules in ground beds in full sun in Wimauma, FL, in 2014, 2015, 2019, and/or 2020. Values presented are means of three plots based on whole plot evaluation in each evaluation.

Cultivars	Sunburn tolerance rating <sup>z</sup>							Leaf health rating <sup>x</sup>				
	Aug. 2014	Sept. 2014	Oct. 2014	July 2015	Aug. 2015	Sept. 2015	Oct. 2015	Aug. 2019	Sept. 2019	July 2020	Aug. 2020	Sept. 2020
UF-R1410	4.1	4.5	4.5	4.0	4.4 a <sup>y</sup>	3.8 b	3.7	2.7 b	3.8	3.8 b	4.3 a	2.1 b
Gingerland	4.4	3.5	4.0	3.6	2.5 b	4.5 a	4.2	3.0 ab	2.7	4.7 a	4.5 a	3.2 a
<i>P</i> value	0.2697	0.0533	0.2254	0.4975	0.0341	0.0153	0.4380	0.0442	0.1351	0.0026	0.0018	0.0414
Cultivars	Sunburn tolerance rating <sup>z</sup>						Leaf health rating <sup>x</sup>					
	July 2019	Aug. 2019	Sept. 2019	July 2020	Aug. 2020	Sept. 2020	Aug. 2019	Sept. 2019	July 2020	Aug. 2020	Sept. 2020	
UF-15-21	3.0 b	1.5 b	2.3 b	3.0 b	3.2 b	2.8	2.7 b	3.8	3.8 b	4.3 a	2.1 b	
UF-15-441	5.0 a	4.3 a	3.5 ab	4.7 a	4.7 a	4.0	3.0 ab	2.7	4.7 a	4.5 a	3.2 a	
Icicle	2.7 b	3.5 ab	3.3 ab	–	–	–	3.0 ab	3.3	–	–	–	
White Butterfly	3.5 ab	4.3 a	4.0 a	4.0 ab	4.2 ab	3.3	4.2 a	4.2	3.7 b	4.0 a	2.4 ab	
White Wing	–	–	–	4.2 a	3.5 ab	3.4	–	–	4.0 b	3.2 b	2.7 ab	
<i>P</i> value	0.0122	0.0218	0.0142	0.0112	0.0204	0.1071	0.0442	0.1351	0.0026	0.0018	0.0414	
UF-16-597	4.8	4.8	4.2	4.8	4.3	3.9	4.5 a	4.0 a	4.5	4.0	3.1	
Gingerland	4.8	4.0	3.8	4.2	4.2	3.9	1.7 b	2.8 b	3.8	3.2	2.5	
Tricolor Butterfly	–	–	–	4.5	4.5	4.2	–	–	4.3	4.0	3.4	
<i>P</i> value	1.0000	0.0955	0.1835	0.1049	0.2500	0.3906	0.0034	0.0198	0.1451	0.1638	0.0873	

<sup>z</sup>Sunburn tolerance was rated on a scale of 1 to 5, with 1 being very poor and 5 being excellent without showing any signs of leaf burns and/or color bleaching.

<sup>y</sup>Mean separation within columns by the Tukey-Kramer honestly significant difference test at  $P < 0.05$ .

<sup>x</sup>Leaf health was rated on a scale of 1 to 5, with 1 being numerous diseased necrotic spots and completely unsightly and 5 being resistant without any obvious necrotic spots.

Sunburn tolerance and leaf health were evaluated on 13 Aug., 10 Sept., and 1 Oct. 2014; 16 July, 17 Aug., 16 Sept., and 15 Oct. 2015; 13 July, 13 Aug., and 18 Sept. 2019; and 31 July, 21 Aug., and 25 Sept. 2020.

'Gingerland' (2.5 to 4.5) in five of seven evaluations, except for two evaluations in which 'UF-R1410' received a higher score in Aug. 2015 and then a lower score in Sept. 2015.

'UF-15-21'. Plants had good growth in 2019, receiving a score of 3.3 to 3.7 (Table 3). Its plant growth scores in 2019 were higher than the scores of 'Icicle' in two of three evaluations, higher than 'White Butterfly' in one of three evaluations. In 2020, plant scores were low, 2.0 or 2.3, and they were not significantly different from the scores of 'White Butterfly' or 'White Wing'. Nematodes were found in the beds where these caladiums were grown. So the low growth scores of 'UF-15-21' and the two checks ('White Butterfly' and 'White Wing') might be due to nematode damage. Leaf color ratings ranged from 3.2 to 3.7 in 2019 and 2.5 and 2.8 in 2020 (Table 3). Thus, leaf color scores of 'UF-15-21' were comparable to the leaf color scores of 'Icicle', but were lower than the leaf color score of 'White Butterfly' in one evaluation. In 2020, the leaf color scores of 'UF-15-21' were comparable to the scores of 'White Wing', but lower than the scores of 'White Butterfly'. Overall, leaf color display of 'UF-15-21' in full sun was acceptable and comparable to 'Icicle' and 'White Wing', but was not as good as the leaf color of 'White Butterfly', which was more "clean" and "pure" through the growing season. Sunburn tolerance scores of 'UF-15-21' in 2019 and 2020 ranged from 1.5 to 3.2, which were lower than the scores of 'Icicle' and 'White Butterfly' in one or two of three evaluations (Table 4). Leaf health scores of 'UF-15-21' in 2019 and 2020 were from 2.7 to 4.3, comparable to the scores of the checks in three evaluations but lower than the scores of the checks in one evaluation (Table 4).

'UF-15-441'. Plants showed good growth in 2019, receiving a score of 2.3 to 3.5 (Table 3). Its plant growth scores in 2019 were higher than the scores of 'Icicle' in two of three evaluations, higher than 'White Butterfly' in one of three evaluations. In 2020, plant scores were good, 4.1 to 4.3, which were significantly better than the scores of 'White Butterfly' in one of the three evaluations and better than 'White Wing' in two of the evaluations. Leaf color ratings ranged from 2.5 to 3.0 in 2019 and 2.8 to 3.2 in 2020 (Table 3). Thus, the leaf color scores of 'UF-15-441' were lower than the leaf color scores of 'Icicle' in one evaluation, lower than the leaf color score of 'White Butterfly' in two evaluations. Compared with 'White Wing', 'UF-15-441' received higher leaf color scores in two of three evaluations in 2020. Overall, in terms of leaf color display in full sun, 'UF-15-441' was acceptable, better than 'White Wing', but not as good as 'Icicle', especially 'White Butterfly'. Sunburn tolerance scores of 'UF-15-441' in 2019 and 2020 ranged from 3.5 to 5.0, which were higher than the scores of 'Icicle' in one of three evaluations. These ratings indicate that 'UF-15-441' showed excellent sunburn tolerance, comparable to 'White Butterfly' or 'White Wing' (Table 4). Leaf health scores of 'UF-15-441' in 2019

and 2020 were from 2.7 to 4.7, higher than the scores of 'White Butterfly' in one evaluation and higher than the scores of 'White Wing' in two evaluations (Table 4).

'UF-16-597'. Plants of 'UF-16-597' grew fairly well in both 2019 and 2020 seasons, with a plant growth score between 2.3 and 3.5 (average 3.2) (Table 3). Nevertheless, these growth scores were significantly higher than those of 'Gingerland' (1.7 to 2.8) and 'Tricolor Butterfly' (1.8 to 2.5) in two evaluations in 2020. Leaf color scores were between 2.0 and 2.6, which were comparable to the leaf color scores of 'Tricolor Butterfly' (2.0 to 2.5) but lower than the leaf color scores of 'Gingerland' in two of six evaluations (Table 3). The low leaf color scores of 'UF-16-597' were mainly due to the dark green background color. Plants of 'UF-16-597' showed good to excellent sunburn tolerance in both 2019 and 2020 growing seasons, with sunburn tolerance ratings between 3.9 and 4.8 (Table 4), which are comparable to the sunburn tolerance of 'Gingerland' and 'Tricolor Butterfly', both of which are known for their strong tolerance to sunburn. 'UF-16-597' also showed excellent leaf health; its leaf health scores ranged from 3.1 to 4.5 in 2019 and 2020, comparable to 'Tricolor Butterfly' and better than 'Gingerland' in one of six evaluations (Table 4).

### Recommendation

'UF-R1410' is characterized by a novel coloration pattern (white main veins and multiple light pink spots), excellent tolerance to sunburn, and resistance to leaf spot diseases. It is well suited for use in the landscape, especially sunny locations. In full sun, color contrast becomes intensified and leaves become more attractive. Tubers of this caladium are slower to sprout and thus will need an additional 2 to 3 weeks to produce prefinished or finished pot plants. Tuber yield potential is intermediate to high.

Plants of 'UF-15-21' are characterized by wide white lance leaves and light pink streaks on mature leaves. Apical buds on tubers have strong dominance, and tuber de-eyeing is necessary when tubers are used to produce plants in small containers. This caladium performs best in shady locations in the landscape. Leaves may be susceptible to leaf spot diseases, and fungicide applications may be needed to control the diseases.

Plants of 'UF-15-441' are characterized by wide white lance leaves, good leaf health, good sunburn tolerance, and good tuber yield potential. Tubers have multiple branches, and de-eyeing may be unnecessary when tubers are used to produce plants in small containers. This caladium can perform well in both shady and sunny locations in the landscape.

UF-16-597 is a novel lance-leaved cultivar characterized by thick green main veins, multiple burgundy spots, excellent tolerance to sunburn, and strong resistance to leaf spot diseases, and excellent tuber yield potential. It is well suited for use in the landscape.

Tubers of this caladium are slower to sprout and thus will need an additional 2 to 3 weeks to produce prefinished or finished pot plants. Plants are slower to produce new leaves and fill the space in the landscape; thus, they may need to be planted more closely to cover the ground in the landscape. For tuber production, it may be beneficial to plant 'UF-16-597' early and harvest it late so that there is a longer growing season for this cultivar.

All evaluations described previously were performed on small acreages or limited numbers of plants. Tuber producers are encouraged to plant only limited quantities of these cultivars until having gained experience in producing them. Standard postharvest treatment of tubers is recommended (Harbaugh and Tjia, 1985) and pre-plant hot water treatment of tubers is encouraged to prolong their life.

### Availability

'UF-R1410', 'UF-15-21', 'UF-15-441', and 'UF-16-597' have been named 'Dots Delight', 'White Lightning', 'Firefly', and 'Spicy Lizard', respectively. Plant patent and/or trademark will be applied for these cultivars. Commercial production of these cultivars is required to have a licensing agreement with the Florida Foundation Seed Producers, Inc., P.O. Box 309, Greenwood, FL 32443. Information on tuber availability and licensing agreements can be obtained from the Florida Foundation Seed Producers, Inc. (<http://www.ffsp.net/>).

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