

# ‘Wonderland’, ‘Salsa’, and ‘Pinky Swear’ Lance-leaved Caladiums for Containers and the Landscape

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Caladiums [*Caladium* × *hortulanum* Birdsey, Araceae Juss.] are ornamental aroids valued for their colorful, variable-shaped foliage. The vast majority of commercial caladium plants are produced by forcing tubers in containers. Florida growers produce all the caladium tubers used in the United States and the world (Bell et al. 1998; Deng et al. 2008). Most of caladium tubers are used to produce potted plants, with a smaller portion of caladium tubers directly planted in the landscape. Caladium tubers are often de-eyed (de-eyeing) before planting to improve the quality of containerized caladium plants. Like shoot tipping, this practice entails removing or destroying one or more of the main buds on the tubers (Evans et al. 1992). Sufficient plant vigor, development of multiple bright leaves, sunburn tolerance, and good leaf health are essential for caladium plants to perform well in the landscape, and

tuber yield and grade are important to Florida caladium growers because these factors determine the commercial value of a caladium cultivar in the field planting.

Commercial caladium cultivars can be broadly divided into eight groups based on leaf type (fancy and lance-leaved) and leaf color (white, red, pink, and multicolored) (Bell et al. 1998). Fancy-leaved caladiums have heart-shaped (triangular- or round-ovate) leaves with three main veins, a petiole attached to the back, and the two large basal lobes. Lance leaves have a broad sagittate to cordate-lanceolate base, obvious or barely obvious basal lobes, and a petiole attached to the base of the leaf. In general, plants of lance-leaved cultivars are shorter, have thicker and denser leaves that are more resilient to environmental stresses such as sunburns and wind damage, and produce more branched tubers. Consumer demand for lance-leaved cultivars has been increasing steadily. Grower surveys showed that they planted more acres for this group of cultivars in recent decades (Bell et al. 1998; Deng et al. 2008). To meet this need from consumers and growers, the University of Florida/Institute of Food and Agricultural Science (UF/IFAS) caladium breeding program at the Gulf Coast Research and Education Center (GCREC) has developed new lance-leaved cultivars that can produce attractive and robust plants with many bright, colorful leaves and have improved tuber yield potential. The breeding approach used by this program has been hybridizing commercial caladium cultivars and breeding lines followed by multiyear and rigorous selection and evaluation. This article reports the origin, botanical characteristics, tuber yield potential, and plant performance of three new lance-leaved caladium cultivars, ‘Wonderland’, ‘Salsa’, and ‘Pinky Swear’.

‘Wonderland’ caladium (Fig. 1) is the progeny of a cross between proprietary breeding line UF 317 and a nonpatent commercial cultivar ‘Gingerland’ (Fig. 2). The cross was made in Balm, FL, USA in Jul 2012. ‘Gingerland’ is a lance-leaved cultivar with long petioles and spotted leaves. UF 317 had white fancy leaves with numerous burgundy spots and was progeny of a cross that was made in Summer 2003 between two commercial cultivars ‘Florida Sweetheart’ (Wilfret 1991) and ‘Miss Muffet’. ‘Florida Sweetheart’ was a patented cultivar (PP8,526), but its patent had expired. This cultivar has been the most widely grown among all the lance-leaved caladiums. ‘Wonderland’ was initially selected in Sep 2015 and given the code 1227R-1, which was recoded as 15-23 in Apr 2016.

‘Salsa’ (Fig. 3) resulted from a cross made in Balm, FL, USA in Jul 2012 between ‘Florida Sweetheart’ and proprietary breeding line UF 67 (Fig. 4). UF 67 had red fancy leaves and was progeny of a cross involving the commercial cultivar ‘Red Flash’ that was made in Summer 2003. The initial selection of ‘Salsa’ was made in Sep 2015 and given the code 1240-4, which was recoded as 15-30 in Apr 2016.

‘Pinky Swear’ (Fig. 5) originated from a cross between ‘Sizzle’ and ‘Carolyn Whorton’ that was made in Balm, FL, USA in Summer 2012 (cross no. 1216R) (Fig. 6). ‘Carolyn Whorton’ was a nonpatented commercial cultivar. ‘Sizzle’ was a patented cultivar (PP26,591) and was progeny of the commercial cultivar ‘Candidum Junior’ and ‘Florida Sweetheart’ (Deng et al. 2015). ‘Pinky Swear’ was initially selected in Sep 2015 as breeding line 1216R-1, which was recoded as 15-671 in Apr 2016.

The ancestry of ‘Florida Sweetheart’ (Wilfret 1991) and ‘Sizzle’ (Deng et al. 2015) is shown in Figs. 2, 4, and 6. The ancestry of ‘Candidum Junior’, ‘Carolyn Whorton’, ‘Gingerland’, ‘Miss Muffet’, and ‘Red Flash’ was unknown. ‘Miss Muffet’ was developed by Frank M. Joyner (Bates T, personal communication) in Tampa, FL, USA in the 1940s or early 1950s (Camathan 2012).

The first asexual propagation of ‘Wonderland’, ‘Salsa’, and ‘Pinky Swear’ occurred in Balm, FL, USA in Spring 2015. Since then, they have been asexually propagated annually through tuber division. Plant, foliar, and growth characteristics of ‘Wonderland’, ‘Salsa’, and ‘Pinky Swear’ have been stable and consistent during asexual propagation.

## Description

Description of color for plant parts were 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 ~30% light exclusion. The containers were filled with the commercial potting mix Pro-Line 4B (Jolly Gardener,

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Fig. 1. A typical plant of 'Wonderland' caladium (45-day-old) forced from four No.1 (3.8- to 6.4-cm diameter) tubers in a 20.3-cm container. Tubers were planted on 14 May 2020, the plant was grown in a greenhouse with approx. 30% light exclusion, and the photo was taken on 28 Jun 2020 (photo credit: K. Druffel).

Poland Spring, ME) amended with the commercial controlled-release fertilizer Osmocote® (15N-3.9P-10K, 5-6 months; Scotts Co., Marysville, OH, USA) at the rate of 4.3 kg·m<sup>-3</sup> and MicroMax micronutrients (ICL Fertilizers, Dublin, OH, USA) at the rate of 0.48 kg·m<sup>-3</sup>. Temperatures in the greenhouse ranged from 25 °C (night) to 33 °C (day).

'Wonderland': Plants are ~28 cm tall and 62 cm wide and produce outwardly arching leaves (Fig. 1). Mature leaves have an average size of 20.9 cm (length) × 13.6 cm (width). Leaves have a cordate base, a slightly undulate margin, an acuminate apex, and a pinnate venation pattern. The upper surface has a green (RHS 137A) margin bordering the entire leaf except for the basal leaf valley formed by the two lobes where it is red-purple (RHS 58A to 61C). The midrib and primary veins are white (RHS 155A) and streaked with red-purple (RHS 61A/B). Numerous spots of red-purple (RHS 61A), in variable sizes and of irregular shapes, are distributed throughout the leaf surface against a white (RHS 155D) to green-white (RHS 157A) background. Further, irregular, small light red-purple (RHS 61C/D) mottling and or blotching is present along the leaf margin. The underside surface has greyed-green (RHS 190D) margins, up to 15 mm in width, a very thin edge of red purple (RHS 58A), a creamy white (RHS 157C/D) center, and greyed-green (RHS 192D) midrib and greyed-green (RHS 192A/B) primary veins. Petioles are brown (RHS 200B) or grey-brown (RHS 199D) near the leaf base, with short streaks of red-purple (RHS 61B). The tuber surface is brown (RHS 200A), and the cortical area is yellow (RHS 14B) with yellow edges (RHS 14C).



Fig. 2. Pedigree of 'Wonderland' caladium.



Fig. 3. A typical plant of 'Salsa' caladium (70-day-old) forced from four No.1 (3.8- to 6.4-cm diameter) tubers in a 20.3-cm container. Tubers were planted on 22 Apr 2022, the plant was grown in a greenhouse with ~30% light exclusion, and the photo was taken on 30 Jun 2022 (photo credit: J.M. Velte).

'Salsa': Plants are ~45 cm tall and 63 cm wide and produce outwardly arching leaves (Fig. 3). Mature leaves have an average size of 19.4 cm (length) × 10.1 cm (width). Leaves have a cordate base, a slightly undulate margin, an acuminate apex, and a pinnate venation pattern. The upper surface has a dark green (RHS 139B) margin, up to 15 mm wide, bordering the entire leaf except for the basal leaf valley where it is red-purple (RHS 58D) and a red-purple (RHS 67D) center. Multiple red-purple (RHS 67D) veins radiate from a central main vein of red-purple (RHS 64D/67D) and connect marginally with a thin red-purple vein (RHS 67D) that parallels with the leaf margin. The undersurface has a greyed-green (RHS 194B/CB) margin, up to 20 mm wide, a red-purple (RHS 59A/B) center, and red-purple (RHS 59A/B) veins. Petioles are 3 to 5 mm and brown (RHS 200D) to greyed-purple (RHS 183D) at the apex, and the colors diffuse into a light greyed-purple (RHS 183C) at the base that is around 8 mm in diameter. The low portion of the petiole has a dense distribution of brown (RHS 200B/C) speckles. Jumbo tubers are multisegmented, bearing about six dominant buds. Tuber surfaces are brown (RHS 200D) with the cortical area yellow-orange (RHS 15D).

'Pinky Swear': Plants are ~58.3 cm tall and 61 cm wide and have outwardly arching leaves (Fig. 5). Mature leaves have an average size of 19.5 cm (length) × 13.2 cm (width). Leaves are ovate in shape and have a cordate base, an acuminate apex, slightly undulate margins, and two obvious lobes. On the upper leaf surface, a green (RHS 134B/C) margin borders the entire leaf except for the basal leaf valley where it is red-purple (RHS 58D). Venation

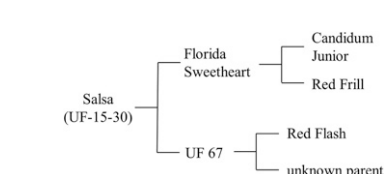


Fig. 4. Pedigree of 'Salsa' caladium.



Fig. 5. A typical plant of 'Pinky Swear' caladium (70-day-old) forced from four No. 1 (3.8- to 6.4-cm diameter) tubers in a 20.3-cm container. Tubers were planted on 22 Apr 2022, the plant was grown in a greenhouse with ~30% light exclusion, and the photo was taken on 30 Jun 2022 (photo credit: J.M. Velte).

pattern is pinnate, with up to 10 red-purple (RHS 64C/D) primary veins from a central main vein of red (RHS 59D) to red-purple (RHS 64D) and connecting marginally with a thin red-purple vein (RHS 73B) that parallels the leaf margin. Secondary and tertiary veins tend to be netted across the whole leaf. Numerous irregular blotches of red-purple (RHS 62C/D) are scattered across the leaf blade between main veins. Occasionally, a few small red-purple (RHS 62D) blotches appear in the leaf margins. The leaf undersurface surface has a greyed-green (RHS 190A/B) margin, a greyed-purple (RHS 185B/C) midrib vein, and 8 to 11 greyed-green (RHS 198C/D) to greyed-red (RHS 181C/D) primary veins. Numerous irregular blotches of greyed-purple (RHS 186C/D) and of assorted sizes are scattered on the underside. Petioles are greyed-purple (RHS 186C/D) near to the top and light to deep brown (RHS C/D). Dense streaks of various shades of brown (RHS 200A/B/C/D) to black (RHS 202A/B/C) are present along the petioles. The surface of dried tubers is brown (RHS 200B/C), and the interior is yellow (RHS 10B).

### Tuber Yield Potential

'Wonderland', 'Salsa', and 'Pinky Swear' were evaluated for tuber yield potential (tuber weight, grade, and count) in replicated experimental field plots in Balm, FL, USA in 2018, 2019, and/or 2020. The soil was Eau Gallie fine sand with ~1% organic matter

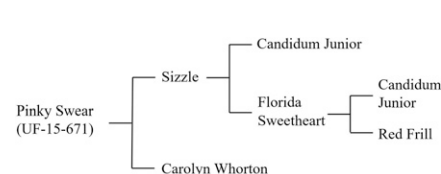


Fig. 6. Pedigree of 'Pinky Swear' caladium.

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 2018 season, ground beds (81 cm wide, 20 cm high) were fumigated on 13 Feb with Pic-Clor 60<sup>®</sup> (39.0% 1,3-dichloropropene, 59.6% chloropicrin) (TriCal, Inc., Hollister, CA, USA) at 448 kg·ha<sup>-1</sup> and Prowl<sup>®</sup> H20. Seed tubers were treated in hot water (50 °C) for 30 min (Rhodes 1964). Seed tuber pieces were dusted with RootShield<sup>®</sup> Plus WP (BioWorks, Victor, NY, USA) and planted manually on 27 Apr with ~15.2 cm between-row spacing and ~15.2 cm in-row spacing. Fifty-six kilograms of granular nitrogen (50 N) per hectare were 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 29 May, injecting a commercial liquid fertilizer (5N-0.87P-6.64K, Chemical Dynamics, Plant City, FL, USA) at the rate of 1.121 kg of nitrogen per hectare a day, and stopped on 31 Oct. New crop tubers were dug and washed on 17 Dec and air-dried for ~50 d inside a greenhouse. Dried tubers from each experimental field plot were weighed, graded, and counted on 10 Feb 2015, as described by Deng and Harbaugh (2006). Tuber grading was by the maximum diameter: Mammoth (8.9 to 11.4 cm), Jumbo (6.4 to 8.9 cm), No.1 (3.8 to 6.4 cm), No. 2 (2.5 to 3.8 cm), and unmarketable (<2.5 cm). The grade and count of marketable tubers (Mammoth to No. 2) were converted into a production index to show the relative economic value of the harvested tubers per field plot: Production index = 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.

For the 2019 evaluation, beds were fumigated on 24 Feb with Pic-Clor 60<sup>®</sup> at 448 kg·ha<sup>-1</sup>. Seed pieces were planted on 4 Apr. Fifty-six kg of granular nitrogen (50 N) per hectare were incorporated into the soil before bedding. Fertigation began on 1 Jun, by injecting a commercial liquid fertilizer (5N-0.87P-6.64K, Chemical Dynamics) at 1.121 kg of nitrogen a hectare a day. The fertilization rate was increased to 2.243 kg of nitrogen a hectare a day on 24 Jul and ended on 31 Oct. Tubers were dug and washed on 9 Dec, dried in the greenhouse for ~45 d, and weighed, graded, and counted on 21 Jan 2020, as described by Deng and Harbaugh (2006).

In the 2020 season, ground beds were fumigated on 12 Feb with Pic-Clor 60 at 448 kg·ha<sup>-1</sup>. Seed tubers were treated in hot water (50 °C) for 30 min. Seed tuber pieces were dusted with RootShield<sup>®</sup> Plus WP (BioWorks) and planted manually on 15 Apr with the same in-row and between-row spacing as in 2018. Two drip tapes were buried under the plastic mulch along the raised beds to provide the irrigation water and fertilization. Fertigation began on 28 May, injecting a commercial liquid fertilizer (5N-0.87P-6.64K, Chemical Dynamics) at the rate

of 1.121 kg of nitrogen per hectare per day, and ended on 30 Oct. Tubers were dug and washed on 1–2 Dec; dried in the greenhouse for ~63 d; and weighed, graded, and counted on 3 Feb 2021 as described earlier.

In each growing season, 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 propagules (tuber pieces). Commercial cultivars or recently released cultivars were included in the field trials as standards to assess the tuber yield potential and plant performance of candidate cultivars. ‘Gingerland’ was included as the standard for ‘Wonderland’ because both shared the same leaf coloration pattern. ‘Florida Sweetheart’ and ‘Florida Red Ruffles’ were included as the checks because the former was the most popular pink lance-leaved cultivar in commercial production and the latter was the most popular red lance-leaved cultivar. ‘Crimson Skye’, ‘Fairytale Princess’, ‘Pink Panther’, ‘Red Hot’, and/or ‘Sizzle’ were also included as the standards for ‘Salsa’ or ‘Pinky Swear’ as they represented recently released lance-leaved cultivars (Deng et al. 2021). Analysis of variance was conducted using the JMP Pro 16.1.0 program, followed by means comparisons using the Tukey–Kramer honestly significant difference test (The SAS Institute, Inc. 2020).

‘Wonderland’: The tuber weight, marketable tubers, and production index of ‘Wonderland’ were not significantly different from those of ‘Gingerland’ in 2019 (Table 1), but the tuber weight, marketable tubers, and production index of ‘Wonderland’ were 112%, 279%, or 150% greater than those of ‘Gingerland’ in 2020, respectively (Table 1). These results indicate that ‘Wonderland’ might have higher tuber yield potential than ‘Gingerland’. The primary grade of tubers produced by ‘Wonderland’ was No. 2 (48.7% in 2019 and 74.5% in 2020), followed by No. 1 (45.8% in 2019 and 22.9% in 2020). ‘Wonderland’ produced more No.1 tubers than ‘Gingerland’ in 2019 (Table 1).

‘Salsa’: In 2018, ‘Salsa’s tuber weight was 2.10 kg, its number of marketable tubers was 53.3 per plot, and its production index was 106 (Table 1), indicating that ‘Salsa’ produced significantly larger and more tubers than ‘Fairytale Princess’ or ‘Red Hot’. In 2020, ‘Salsa’ was comparable to ‘Florida Red Ruffles’, ‘Florida Sweetheart’, and ‘Sizzle’ in tuber weight, marketable tubers, and production index (Table 1). In terms of tuber grade distribution, most tubers produced by ‘Salsa’ were in categories No. 1 and 2.

‘Pinky Swear’: The tuber weight, number of marketable tubers, and production index of ‘Pinky Swear’ in 2019 were 2.11 kg, 47.7, and 96, respectively (Table 1). These values were not significantly different from those of ‘Crimson Skye’ or ‘Pink Panther’. ‘Pinky Swear’ and ‘Florida Sweetheart’ were not significantly different in the 2020 growing season (Table 1), with a tuber weight of 1.47 kg (vs. 1.86 kg), 56.0 marketable tubers (vs. 50.0), and a production index of 95 (vs. 82). The primary grade of tubers produced by ‘Pinky Swear’ was

No. 1 (46.7% in 2019) or No. 2 (72.1% in 2020) (Table 1).

## Container Trials

The suitability of ‘Wonderland’ for container plant production was evaluated in 2020 by forcing tubers in 12.7-cm containers (diameter) following the protocol of Harbaugh and Tjia (1985). No. 1 tubers (intact or de-eyed) were planted on 1 May 2020 in the commercial potting mix Pro-Line 4B (Jolly Gardener, Poland Spring, ME, USA) amended with Osmocote<sup>®</sup> fertilizer (15N–3.9P–10K, 5–6 months) at 4.3 kg·m<sup>-3</sup> and Micromax (ICL Fertilizers, Dublin, OH, USA) 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 six replicates. Fungicide Subdue Maxx (Syngenta Group Company, Switzerland) and insecticide Neemix (CertiS USA, Columbia, MD, USA) were applied as a drench to all potted plants. Plant height, plant width, number of leaves, and foliar characteristics were recorded ~8 weeks after planting. Quality of the potted caladium plants was rated on a scale of 1 to 5, with 1 = very poor, unattractive, 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. ‘Gingerland’ was included as a check for ‘Wonderland’. Analysis of variance and mean comparisons were performed in JMP Pro 16.1.0 (SAS Institute Inc., 2021).

The suitability of ‘Salsa’ and ‘Pinky Swear’ for container plant production was evaluated in 2022 following the protocol as described earlier. No. 1 tubers (intact and de-eyed) were planted 11 Mar 2022. The experiment was arranged in a randomized complete block design with eight replicates. Containerized plants were evaluated on 31 May and 1 Jun 2022, ~11 weeks after planting the tubers. ‘Florida Sweetheart’ was included as a commercial check for ‘Salsa’ and ‘Pinky Swear’. Overall, tubers were slower to sprout in 2022, presumably because the tubers were planted too early.

‘Wonderland’: Intact tubers sprouted about 32 d after planting, ~17 d later than ‘Gingerland’ (Table 2). Plants forced from intact tubers had an average height of 21.7 cm, an average width of 38.8 cm, an average of 13.2 leaves, and the leaves were averaged to be 19.8 cm long and 12.8 cm wide. Thus, plants of ‘Wonderland’ forced from intact tubers and grown for 8 weeks were 18 cm shorter and 6.5 cm narrower, and leaves were 7.3 cm shorter and 5.4 cm narrower than ‘Gingerland’. De-eyed tubers of ‘Wonderland’ sprouted about 33 d after planting, ~8 d later than ‘Gingerland’. On average, plants of ‘Wonderland’ forced from de-eyed tubers were 21.8 cm tall and 39.7 cm wide and had about 15 leaves per plant; leaves were 16.0 cm long and 10.0 cm wide. Compared with ‘Gingerland’ plants from

Table 1. Tuber weight, number of marketable tubers, production index, and grade distribution of ‘Wonderland’, ‘Salsa’, ‘Pinky Swear’, and commercial caladium cultivars (checks) in replicated experimental field plots in Wimauma, FL, USA in 2018, 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>i</sup>	Mammoth	Jumbo	No. 1	No. 2
2019							
Wonderland	1.20	29.0	48		5.5	45.8 a	48.7
Gingerland	0.73	23.7	33		1.2	19.6 b	79.2
<i>P</i> value	0.2465	0.3564	0.2985		0.2225	0.0326	0.0530
2020							
Wonderland	1.40 a <sup>ii</sup>	52.0 a	75 a		2.5	22.9	74.5
Gingerland	0.66 b	13.7 b	30 b		4.9	22.0	73.1
<i>P</i> value	0.0159	0.0296	0.0202		0.3266	0.8485	0.8154
2018							
Salsa	2.10 a	53.3 a	106 a	1.3	7.0 a	53.1 a	38.5 b
Fairytales Princess	0.12 b	8.3 b	10 b	0	0 b	0 b	100.0 a
Red Hot	0.16 b	6.7 b	12 b	0	0 b	21.5 b	78.5 a
<i>P</i> value	0.0014	0.0005	0.0010	0.1232	0.0347	0.0029	0.0031
2020							
Salsa	1.63	57.0	87 ab	0	4.3	21.7	74.0 a
Sizzle	2.14	67.3	107 a	0.5	3.5	28.7	67.3 a
Fl. Red Ruffles	1.57	45.0	78 b	0	9.7	31.0	59.3 b
Fl. Sweetheart	1.86	50.0	82 b	0	1.3	26.9	71.8 a
<i>P</i> value	0.0758	0.3229	0.0155	0.4547	0.2041	0.1506	0.0018
2019							
Pinky Swear	2.11	47.7	96		15.5	46.7	37.0
Crimson Skye	2.09	52.0	100		5.3	36.1	58.6
Pink Panther	1.96	46.7	86		4.2	52.8	43.0
<i>P</i> value	0.9140	0.2821	0.6969		0.0606	0.3177	0.1366
2020							
Pinky Swear	1.47	56.0	95		2.7	25.3	72.1
Fl. Sweetheart	1.86	50.0	82		1.2	26.9	71.8
<i>P</i> value	0.2055	0.7120	0.5607		0.1979	0.7497	0.9602

<sup>i</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 (Mammoths), 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), and Mammoth (8.9 to 11.4 cm). Tuber grade distribution data were transformed using the arcsine function in Excel {asin[sqrt(tuber grade distribution in percentage/100)]}.

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

de-eyed tubers, ‘Wonderland’ plants from de-eyed tubers were 4.9 cm shorter and had fewer leaves (15.2 vs. 28.8). Plants of ‘Wonderland’ from intact and de-eyed tubers received a quality rating of 3.1 or 3.2, indicating that these plants met the required quality for potted caladium plants. These results indicate that ‘Wonderland’ was slower to sprout than

‘Gingerland’. In addition to producing more compact plants in containers, ‘Wonderland’ also had fewer blooms (0 to 0.2 vs. 1.2 to 1.7 per plant) than ‘Gingerland’. ‘Wonderland’ produced quality pot plants without de-eyeing; thus, de-eyeing is not necessary for this cultivar.

‘Salsa’: When tubers were planted intact, ‘Salsa’ sprouted ~44 d after planting, similar

to the sprouting time of ‘Florida Sweetheart’ (Table 2). Tuber de-eyeing did not cause any obvious change in sprouting time in ‘Salsa’. Intact plants of ‘Salsa’ and ‘Florida Sweetheart’ were not significantly different in plant height (19.9 and 19.1 cm), plant width (36.6 and 34.1 cm), leaf length (17.2 and 17.5 cm), and leaf width (12.3 and 13.3 cm), except that ‘Salsa’ had significantly more leaves (24.9 vs. 15.6) (Table 2). When tubers were de-eyed, ‘Salsa’ and ‘Florida Sweetheart’ were also not significantly different in plant height (18.5 and 21.0 cm), plant width (34.4 and 39.6 cm), leaf length (14.7 and 16.4 cm), leaf width (10.0 and 11.2 cm), and number of leaves (32.1 and 24.3) (Table 2). ‘Salsa’ was not significantly different from ‘Florida Sweetheart’ in plant quality rating (2.5 and 2.0 with intact plants and 3.1 with de-eyed plants). De-eyeing may be optional for this cultivar (Fig. 7).

‘Pinky Swear’: Intact and de-eyed tubers sprouted about 43 and 48 d after potting, respectively, not significantly different from ‘Florida Sweetheart’ (Table 2). On average, intact plants of ‘Pinky Swear’ were 6.8 cm taller than ‘Florida Sweetheart’, but the two cultivars were not significantly different in plant width (35.7 and 34.1 cm), leaf number (16.1 and 15.6), leaf length (20.5 and 17.5 cm), leaf width (14.6 and 13.3 cm), and plant quality rating (Table 2). When the tubers were de-eyed, ‘Pinky Swear’ and ‘Florida Sweetheart’ were not significantly different in plant height (20.6 and 21.0 cm), plant width (34.6 and 39.6 cm), leaf number (19.0 and 24.3), leaf length (16.4 and 16.4 cm), leaf width (11.4 and 11.2 cm), and plant quality (3.3 and 3.1) (Table 2). De-eyeing may be optional for ‘Pinky Swear’ (Fig. 8).

### Plant Performance in Open Fields

‘Wonderland’, ‘Salsa’, and ‘Pinky Swear’ were evaluated for plant growth, leaf color display, sunburn tolerance, and leaf health in the same field plots where they were evaluated for tuber production potential. Growing conditions were described above. 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), 3

Table 2. Days to sprout, plant height and width, leaf number, length and width, number of blooms (inflorescences), and plant quality ratings of ‘Wonderland’, ‘Salsa’, ‘Pinky Swear’, and commercial caladium cultivars (checks) grown in small containers. No. 1 tubers were planted in 11.4-cm containers (one tuber per container) and grown in a shaded glasshouse in Wimauma, FL, USA in 2020 (‘Wonderland’ and ‘Gingerland’) or 2022 (‘Salsa’, ‘Pinky Swear’, and ‘Florida Sweetheart’). 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>i</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
Wonderland	32.3 a <sup>ii</sup>	32.7 a	21.7 b	21.8 b	38.8 b	39.7	13.2	15.2 b	19.8 b	16.0	12.8 b	10.0	0.2 b	0	3.1	3.2 b
Gingerland	15.2 b	24.2 b	39.7 a	26.7 a	45.3 a	41.8	10.8	28.8 a	27.1 a	16.5	18.2 a	9.8	1.7 a	1.2	2.7	4.4 a
<i>P</i> value	0.0002	0.0001	0.0101	0.0334	0.0345	0.4603	0.3088	0.0004	0.0006	0.4155	0.0003	0.8319	0.0446	0.0583	0.3522	0.0004
Salsa	44.4	40.3 b	19.9 b	18.5	36.6	34.4	24.9	32.1 a	17.2	14.7	12.3	10.0	0 b	0	2.5	3.1
Pinky Swear	43.1	48.1 a	25.9 a	20.6	35.7	34.6	16.1	19.0 b	20.5	16.4	14.6	11.4	0.6 a	0.1	2.6	3.3
Fl. Sweetheart	49.7	41.6 b	19.1 b	21.0	34.1	39.6	15.6	24.3 ab	17.5	16.4	13.3	11.2	0.1 ab	0	2.0	3.1
<i>P</i> value	0.3382	0.0122	0.0032	0.3681	0.2808	0.0767	0.0554	0.0175	0.1208	0.3811	0.0784	0.3382	0.0217	0.3966	0.1959	0.8329

<sup>i</sup> Quality of the potted caladium plants was rated on a scale of 1 to 5, with 1 = very poor, unattractive, 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>ii</sup> Mean comparisons within column by the Tukey–Kramer honestly significant difference test at  $P < 0.05$ .





Fig. 7. Plants of 'Salsa' caladium forced from one intact (left) or de-eyed (right) No. 1 tuber in 12.7-cm-diameter containers. Tubers were planted on 10 Mar 2022, plants were grown in a greenhouse with ~30% light exclusion, and the photo was taken on 30 May 2022 (photo credit: K. Druffel).

being acceptable, 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), 3 being acceptable, and 5 being excellent (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), 3 having some sunburn damages but acceptable, 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, 3 having some diseased spots but acceptable, and 5 being healthy and free of visible leaf spot disease. Evaluations of plant growth, leaf color, sunburn tolerance and leaf health were done on 13 Jul, 13 Aug, and 18 Sep 2019 and on 31 Jul, 21 Aug, and 25 Sep 2020.

'Wonderland': Plants received a score of 1.3 to 4.0 for their growth in seven evaluations

in 2019 and 2020 (Table 3). These scores were low but significantly higher than those of 'Gingerland' (1.2 to 2.5) in one of the three evaluations in 2019 and two of the four evaluations in 2020, indicating better plant growth than 'Gingerland'. Leaf color scores were between 2.8 and 4.2, significantly higher than the leaf color scores of 'Gingerland' in two out of the seven evaluations (Table 3). 'Wonderland' showed good to excellent sunburn tolerance in both growing seasons, with sunburn tolerance ratings between 3.7 and 4.8 (Table 4). Its sunburn tolerance ratings were not significantly different from those of 'Gingerland' (3.8 to 4.8) in all seven evaluations. The leaf health score of 'Wonderland' ranged from 2.3 to 4.8 in 2019 and from 3.5 to 4.5 in 2020, which were not significantly different from those of 'Gingerland', except that 'Wonderland' received a higher leaf health score in one evaluation.

'Salsa': In 2019, 'Salsa' was compared with two commercial checks, 'Fairytale Princess'

and 'Florida Sweetheart'. The three cultivars were comparable in plant growth, with a score of 2.3 to 2.8 in July and 2.8 to 3.5 in August (Table 3). Plants died back in September, resulting in a lower score of 1.5 to 2.0. In these three evaluations, 'Salsa' was not significantly different from 'Fairytale Princess' or 'Florida Sweetheart'. In 2020, 'Salsa' was compared with 'Florida Red Ruffles', 'Florida Sweetheart', and 'Sizzle'. 'Salsa' received higher plant growth scores (3.0 to 4.0) in 2020 than in 2019. Nevertheless, 'Salsa' was not significantly different from any of three commercial cultivars (Table 3). The leaf color score of 'Salsa' ranged from 2.5 to 4.5 in 2019 and from 3.5 to 4.0 in 2020, which were not significantly different from those of 'Fairytale Princess' in 2019 or from those of 'Florida Red Ruffles' or 'Sizzle' in 2020. In both years, 'Salsa' received higher leaf color scores than 'Florida Sweetheart' in five out of seven evaluations. 'Salsa' showed excellent sunburn tolerance in both 2019 and 2020, with a score of 3.3 to 4.5 (Table 4). These scores were not significantly different from those of 'Fairytale Princess', 'Florida Red Ruffles', or 'Sizzle' but were higher than the scores 'Florida Sweetheart' received (2.0 to 4.2). 'Salsa' showed good to excellent leaf health in both 2019 and 2020 and received a leaf health score of 3.7 to 4.5 (Table 4), like the scores given to Fairytale Princess', 'Florida Red Ruffles', 'Florida Sweetheart', or 'Sizzle'.

'Pinky Swear': Plants received a growth score of 2.5 to 4.0 in 2019 and 2020 growing seasons (Table 3), which were not significantly different from the scores for 'Crimson Skye' or 'Pink Panther' in 2019 nor significantly different from the scores for 'Florida Sweetheart' in 2020, except that 'Pinky Swear' scored higher than 'Florida Sweetheart' in one evaluation (Jul 2020). Leaf color rating ranged from 2.7 to 4.7, significantly higher than 'Pink Panther' scores in two of three evaluations and higher than 'Florida Sweetheart' scores in one of three evaluations (Table 3). For sunburn tolerance, 'Pinky Swear' received a score of 2.7 to 4.5 in 2019 and 2020 (Table 4), not significantly different from the scores 'Crimson Skye', 'Pink Panther', and 'Florida Sweetheart' received in most of the evaluations. The leaf health score of 'Pinky Swear' in the 2019 and 2020 growing seasons ranged from 2.8 to 4.5 (Table 4), indicating good tolerance to foliar diseases in 'Pinky Swear'. In one evaluation, 'Pinky Swear' scored significantly higher than 'Pink Panther'. No significant differences were observed between 'Pinky Swear' and 'Florida Sweetheart' in leaf health in the 2020 growing season.

#### Evaluation of Plant Performance under Shade

One garden trial was conducted to evaluate the plant performance of 'Wonderland', 'Salsa', and 'Pinky Swear' under 30% shade. Garden beds were covered with black landscape fabric. Two drip tapes were laid below the fabric to provide irrigation water. For each cultivar, five No. 1 intact tubers (6.4 to



Fig. 8. Plants of 'Pinky Swear' caladium forced from one intact (left) or de-eyed (right) No.1 tuber in 12.7-cm-diameter containers. Tubers were planted on 10 Mar 2022, plants were grown in a greenhouse with ~30% light exclusion, and the photo was taken on 30 May 2022 (photo credit: K. Druffel).

Table 3. Plant growth and leaf color rating of ‘Wonderland’, ‘Salsa’, ‘Pinky Swear’ and commercial caladium cultivars (checks) grown from 2.5-cm tuber propagules in ground beds in full sun in Wimauma, FL, USA in 2019 and 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>i</sup>								Leaf color rating <sup>ii</sup>							
	2019				2020				2019				2020			
	Jul	Aug	Sep	Oct	Jul	Aug	Sep	Oct	Jul	Aug	Sep	Oct	Jul	Aug	Sep	Oct
Wonderland	2.7	2.8 a <sup>iii</sup>	1.3	2.3 a	2.2	4.0 a	2.5	4.2	4.2	2.8	3.8 a	3.8 a	3.2	3.7	3.0	3.0
Gingerland	2.5	1.5 b	1.2	1.3 b	1.3	2.0 b	1.5	3.2	3.2	2.7	2.7 b	3.0 b	3.0	3.0	3.0	3.0
<i>P</i> value	0.4226	0.0012	0.7418	0.0377	0.0742	0.0427	0.0742	0.0742	0.0742	0.4226	0.0198	0.0377	0.4226	0.0572	0.0572	0.0572
Salsa	2.8	3.5	1.5	3.0	3.2 ab	4.0	3.1	4.3 a	4.5 a	2.5 a	3.8	3.8 a	4.0 a	3.5	3.5	3.5
Fairytale Princess	2.3	2.8	2.0	—	—	—	—	4.0 a	4.0 ab	3.0 a	—	—	—	—	—	—
Fl. Red Ruffles	—	—	—	2.2	2.3 b	4.3	3.3	—	—	—	3.7	3.5 ab	4.0 a	3.8	3.8	3.8
Fl. Sweetheart	2.8	3.0	1.7	2.3	2.3 b	3.7	2.4	3.0 b	3.5 b	1.8 b	3.3	3.2 b	2.0 b	2.8	2.8	2.8
Sizzle	—	—	—	3.2	3.7 a	4.8	3.1	—	—	—	3.7	4.0 a	3.3 ab	3.8	3.8	3.8
<i>P</i> value	0.5289	0.4768	0.5487	0.1188	0.0038	0.2579	0.1097	0.0178	0.0331	0.0316	0.4547	0.0063	0.0161	0.0541	0.0541	0.0541
Pinky Swear	2.5	4.0	3.0	3.8 a	3.8	3.5	2.7	4.5 a	4.7 a	3.2	4.3	4.0 a	2.7	3.5	3.5	3.5
Crimson Skye	3.2	4.0	2.5	—	—	—	—	4.3 ab	4.5 a	3.0	—	—	—	—	—	—
Pink Panther	3.7	3.5	3.0	—	—	—	—	4.0 b	4.0 b	2.7	—	—	—	—	—	—
Fl. Sweetheart	—	—	—	2.3 b	2.3	3.7	2.4	—	—	—	3.3	3.2 b	2.0	2.8	2.8	2.8
<i>P</i> value	0.0525	0.5289	0.6944	0.0351	0.1217	0.7418	0.7060	0.0494	0.0178	0.5017	0.1835	0.0377	0.1835	0.0572	0.0572	0.0572

<sup>i</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>ii</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. Plant growth and leaf color were evaluated on 13 Jul, 13 Aug, and 18 Sep 2019 and on 31 Jul, 21 Aug, and 25 Sep 2020.

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

8.9 cm in diameter) were planted into the beds (one tuber per replicate) on 22 Apr 2022, with a spacing of ~1 m. Fifteen grams of the controlled release fertilizer Osmocote® (15N-3.9P-10K, 5–6 months) were applied to each plant. Approximately 12 weeks after planting, plants were evaluated on a scale of 1 to 5 for plant growth, leaf color display, sunburn tolerance, and leaf health, as described earlier.

‘Wonderland’: This caladium performed well under shade, receiving a plant growth score of 4.5, a leaf color score of 4.4, sunburn tolerance score of 4.1, and leaf health score of 4.3 (Table 5). ‘Wonderland’ was comparable to ‘Gingerland’ in these four parameters (Table 5). These results indicate ‘Wonderland’ performed well under shade.

‘Salsa’: The scores for this caladium in plant growth, leaf color, sunburn tolerance, and leaf health were 4.7, 4.7, 4.4, and 4.4, respectively (Table 5), indicating excellent plant growth, leaf color display, sunburn tolerance, and leaf health under shade. ‘Salsa’ was comparable to ‘Florida Sweetheart’ and ‘Sizzle’ in these four parameters (Table 5).

‘Pinky Swear’: This caladium performed well in the garden trial under shade, receiving a plant rating of 4.7, leaf color rating of 4.5, sunburn tolerance rating of 4.5, and leaf health rating of 4.5 (Table 5). ‘Pinky Swear’ was comparable to ‘Florida Sweetheart’ in plant growth, leaf color, sunburn tolerance, and leaf health (Table 5).

### Grower Trials

‘Wonderland’ was evaluated in growers’ open fields in full sun in 2019, 2020, 2021, and 2022. It performed well in the field, with a plant growth rating of 4 from Jul to Oct 2019, 2020, and 2021 (Table 6, Fig. 9). This caladium showed excellent leaf color display (an average score of 5) and sunburn tolerance (an average score of 5) in those 3 years. In 2022, caladium growers experienced a severe drought and extreme heat stress. Even under these stresses, ‘Wonderland’ received a plant growth score of 3, leaf color score of 4, and sunburn tolerance score of 5. Growers indicated that ‘Wonderland’ was shorter than ‘Gingerland’, but plants were fuller than ‘Gingerland.’ Tuber increase rates were estimated at

Table 4. Sunburn tolerance and leaf health rating of ‘Wonderland’, ‘Salsa’, ‘Pinky Swear’, and commercial caladium cultivars (checks) grown from 2.5-cm tuber propagules in ground beds in full sun in Wimauma, FL, USA in 2019 and 2020. Values presented are means of three plots based on whole plot evaluation in each evaluation.

Cultivars	Sunburn tolerance rating <sup>i</sup>								Leaf health rating <sup>ii</sup>							
	2019				2020				2019				2020			
	Jul	Aug	Sep	Oct	Jul	Aug	Sep	Oct	Jul	Aug	Sep	Oct	Jul	Aug	Sep	Oct
Wonderland	4.8	4.3	3.8	4.5	4.5	3.7	3.8	4.8	4.3 a	2.3	4.5	4.0	3.5	3.8	3.8	3.8
Gingerland	4.8	4.0	3.8	4.2	4.2	4.0	3.8	4.3	1.7 b	2.8	3.8	3.2	2.3	3.7	3.7	3.7
<i>P</i> value	0.1835	0.1835	0.4226	0.1835	0.1835	0.4226	0.1835	0.2254	0.0263	0.4226	0.0572	0.1994	0.1181	0.1181	0.1181	0.1181
Salsa	4.0	4.5 a <sup>iii</sup>	3.3 a	4.5	4.3 a	3.5 ab	3.3 ab	—	4.3	4.2	4.5	4.2	3.7	3.7	3.7	3.7
Fairytale Princess	3.7	4.2 a	3.3 a	—	—	—	—	—	4.3	4.0	—	—	—	—	—	—
Fl. Red Ruffles	—	—	—	4.5	4.5 a	4.0 a	4.2 a	—	—	—	4.5	4.5	3.8	4.2	4.2	4.2
Fl. Sweetheart	4.2	3.8 b	2.0 b	3.5	3.8 b	3.0 b	2.5 b	—	4.2	3.7	4.5	4.0	4.0	3.8	3.8	3.8
Sizzle	—	—	—	4.3	4.5 a	4.0 a	4.2 a	—	—	—	4.5	4.3	3.7	4.3	4.3	4.3
<i>P</i> value	0.4444	0.0400	0.0123	0.1170	0.0079	0.0075	0.0325	0.7901	0.2844	0.3942	0.7091	0.2010	0.2010	0.2010	0.2010	0.2010
Pinky Swear	4.5	4.5	3.5 a	4.3	4.0	2.7	2.8	—	4.5 a	4.0	4.5	4.0	3.0	2.8	2.8	2.8
Crimson Skye	5.0	4.5	3.7 a	—	—	—	—	—	4.7 a	3.5	—	—	—	—	—	—
Pink Panther	4.8	4.0	3.0 b	—	—	—	—	—	3.8 b	3.7	—	—	—	—	—	—
Fl. Sweetheart	—	—	—	3.5	3.8	3.0	2.5	—	—	—	4.0	4.0	4.0	3.8	3.8	3.8
<i>P</i> value	0.1738	0.0567	0.0178	0.2999	0.8075	0.4226	0.5286	0.0494	0.5017	0.2254	0.4523	0.4523	0.4523	0.4523	0.4523	0.4523

<sup>i</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>ii</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 Jul, 13 Aug, and 18 Sep 2019 and on 31 Jul, 21 Aug, and 25 Sep 2020.

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

Table 5. Plant rating, color display rating, sunburn tolerance, and leaf health rating of ‘Wonderland’, ‘Salsa’, ‘Pinky Swear’, and commercial caladiums in a garden trial in Wimauma, FL, USA in 2022. Data were taken 13 weeks after No.1-sized tubers were planted in the ground beds under ~30% shade on 22 Apr 2022. Plants were evaluated on 22 Jul 2022. Values presented are mean values of five replicates (single plant per replicate).

Cultivars	Plant rating <sup>i</sup>	Foliage color <sup>ii</sup>	Sunburn tolerance <sup>iii</sup>	Leaf health rating <sup>iv</sup>
Wonderland	4.5	4.4	4.1	4.3
Gingerland	4.5	4.6	4.4	4.3
<i>P</i> value	0.8712	0.1778	0.3627	0.6213
Salsa	4.7	4.7	4.4	4.4
Pinky Swear	4.7	4.5	4.5	4.5
Fl. Sweetheart	4.6	4.3	4.3	4.3
Sizzle	4.6	4.2	4.1	4.4
<i>P</i> value	0.8383	0.1186	0.3017	0.2761

<sup>i</sup> Plants 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 and fullness.

<sup>ii</sup> Leaves were rated on a scale of 1 to 5, with 1 being very poor, 3 fair and acceptable, and 5 being excellent in leaf color display.

<sup>iii</sup> Leaf 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>iv</sup> Leaf health was rated on a scale of 1 to 5, with 1 being numerous disease spots and completely unsightly and 5 being healthy without any disease spots.

~3 or 4, which indicated a lower tuber yield potential.

‘Salsa’ was evaluated in open caladium fields in full sun in 2019, 2020, 2021, and 2022. It grew well in 2019 and very well in 2020 and 2021, with an average plant growth score of 4 in 2019 and 5 in 2020 and 2021 (Table 6, Fig. 10). This caladium had good to excellent leaf color display (an average score of 4 in 2019 and 5 in 2020 and 2021) (Fig. 8) and good to excellent sunburn tolerance (an average score of 4 in 2019 and 5 in 2020 and 2021) (Table 6). Even under the severe drought and extreme heat stress in Summer 2022, ‘Salsa’ received an average plant growth score of 4, an average leaf color score of 4, and an average sunburn tolerance score of 5. In grower trials, ‘Salsa’ was shorter than ‘Florida Red Ruffles’ but taller than ‘Cherry Tart’,

grew better than ‘Florida Red Ruffles’ and ‘Cherry Tart’. The tuber increase rates for ‘Salsa’ were estimated at about 4.5 to 6.0.

‘Pinky Swear’: Grower field trial data indicated that ‘Pinky Swear’ scored 3 to 5, on a scale of 1 to 5, in plant growth (average 3.9), 4 to 5 in leaf color (average 4.5), and 4 to 5 in sunburn tolerance (average 4.5) in Jul through Oct 2020 and 2021 (Table 6). The observed increase rate was ~6.7 in 2020 and 5 in 2021 (Table 6). In the 2022 growing season, this caladium suffered from a severe drought and extreme heat and received lower scores in plant growth, leaf color display, and sunburn tolerance. Growers indicated that ‘Pinky Swear’ grew and produced better than ‘Florida Red Ruffles’ and comparably to ‘Florida Sweetheart’.

Table 6. Grower assessment of ‘Wonderland’, ‘Salsa’, ‘Pinky Swear’ in open fields in full sun in Lake Placid, FL, USA in 2019, 2020, 2021, and 2022. Tuber increase or multiplication rates were estimated based on growers’ yield data.

Yr	Plant growth rating <sup>i</sup>				Leaf color rating <sup>i</sup>				Sunburn tolerance rating <sup>i</sup>				Tuber increase rate <sup>ii</sup>
	Jul	Aug	Sep	Oct	Jul	Aug	Sep	Oct	Jul	Aug	Sept	Oct	
Wonderland													
2019	4	4	4	4	5	5	5	5	5	5	5	5	~4
2020	4	4	4	4	5	5	5	5	5	5	5	5	~3
2021	4	4	4	4	5	5	5	5	5	5	5	5	~3
2022	3	3	3	3	4	4	4	4	5	5	5	5	—
													Avg ~3.3
Salsa													
2019	4	4	4	4	4	4	4	4	4	4	4	4	~4.5
2020	5	5	5	5	5	5	5	5	5	5	5	5	~6
2021	5	5	5	5	5	5	5	5	5	5	5	5	~4.7
2022	4	4	4	4	4	4	4	4	5	5	5	5	—
													Avg ~5.1
Pinky Swear													
2020	4	4	5	5	4	4	5	5	5	5	4	4	~6.7
2021	3	3	3	4	4	4	5	5	4	4	5	5	~5
2022	2	2	3	—	3	3	3	—	3	3	4	—	—
													Avg ~5.9

<sup>i</sup> Plant growth, leaf color and sunburn tolerance of caladiums were assessed by growers in mid-July, mid-August, mid-September and mid-October each year on a scale of 1 to 5, with 1 = very poor, 2 = poor, 3 = acceptable, 4 = good, and 5 = excellent. Field plots varied from 100 sq ft up to 5000 sq ft.

<sup>ii</sup> Calculated by dividing the amount (pounds or trays) of new tubers harvested at the end of the growing season with the amount (pounds or trays) of seed tubers planted at the beginning of the season.

## Susceptibility to *Pythium* Root Rot, *Fusarium* Tuber Rot, and Root-knot Nematodes

*Pythium* root rot and *Fusarium* tuber rot are major pre- and post-harvest diseases in commercial production of caladium tubers. They are caused by *Pythium myriotylum* and *Fusarium solani*, respectively (Knauss 1975; Ridings and Hartman 1976). Most caladium cultivars in commercial production are susceptible or highly susceptible to these diseases (Deng et al. 2005; Goktepe et al. 2007). In addition, root-knot nematodes (*Meloidogyne arenaria*, *M. javanica*, and *M. incognita*, among other species) can cause severe damages to caladium roots in the fields, especially in sandy soils (Kokalis-Burelle et al. 2017).

‘Wonderland’ and ‘Pinky Swear’ were assessed for susceptibility to *Pythium* root rot, *Fusarium* tuber rot, and/or *M. javanica*. In 2019 and 2020, cured, stored tubers of ‘Wonderland’, ‘Pinky Swear’, and multiple commercial cultivars were inoculated with three isolates of *F. solani*, known to be pathogenic to caladium, to determine the relative susceptibility to *Fusarium* tuber rot, following the procedure of Goktepe et al. (2007). To determine the relative susceptibility to *Pythium* root rot, the root balls of ‘Pinky Swear’ young plants were inoculated with *P. myriotylum* (a mixture of three isolates) in 2019 using the procedure of Deng et al. (2005). ‘Wonderland’ showed a moderate level of resistance to *Fusarium* tuber rot, like commercial cultivars ‘Candidum Senior’ and ‘Florida Sweetheart’, which were both classified as moderately resistant or resistant previously (Goktepe et al. 2007; Seijo et al. unpublished data). ‘Pinky Swear’ was found to be susceptible to *Fusarium* tuber rot, similar to ‘Carolyn Whorton’ and ‘Postman Joyner’, but ‘Pinky Swear’ showed a moderate level of resistance to *Pythium* root rot, similar to ‘Florida Moonlight’ and ‘Florida Sweetheart’ (Seijo et al. unpublished data).

To determine the susceptibility of ‘Pinky Swear’ to *M. javanica*, young caladium plants were grown in sand in containers and inoculated with *M. javanica* eggs in 2019. Three months later, the inoculated roots were harvested and ground to extract nematode eggs and juveniles. The effects of root-knot nematodes on plant vigor, quality, dry weight, and dry root weight were also documented. Data on nematode egg number, dry root weight, and plant growth indicated that ‘Pinky Swear’ had tolerance to root-knot nematode damages (Desaeger et al. unpublished data).

## Summary

‘Wonderland’ is characterized by a compact plant stature and multiple white/creamy white leaves with a short petiole and numerous brightly colored red to burgundy spots. It shares a similar leaf coloration pattern with the commercial cultivar ‘Gingerland’, but this new caladium is shorter, and its leaves are shorter and narrower. In addition, this new



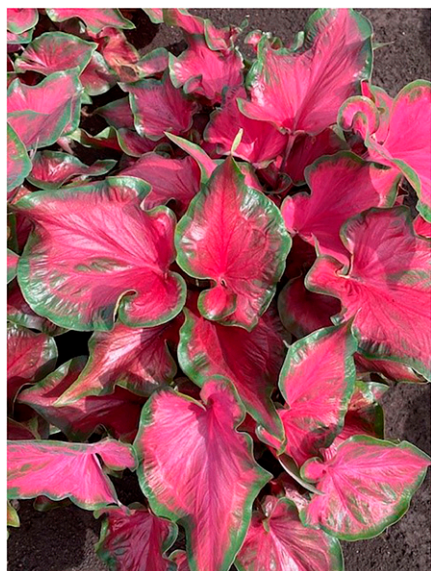


Fig. 9. Plants of 'Salsa' caladium grown in a grower's field in full sun in central Florida. Photo was taken in Sep 2022 (photo credit: T. Bates).

caladium does not require de-eyeing for forcing pot plants in small containers and produces few blooms, whereas 'Gingerland' tends to have multiple blooms when forced in containers. Thus, this new caladium is better suited for pot plant production, especially in small containers (5 inches or smaller in diameter). 'Wonderland' showed good leaf color display, good sunburn tolerance, and good leaf health in open fields as well as garden trials under shade. This caladium is expected to perform well in both sunny and shade landscapes. 'Wonderland' has been observed to have a lower tuber yield potential compared with other lance-leaved caladiums. Nevertheless, growers' data indicated profitable tuber pro-



Fig. 10. Typical leaves of 'Pinky Swear' caladium grown in a grower's field in full sun in central Florida. Photo was taken in Sep 2022 (photo credit: J. Holmes).

duction with this caladium. It is important to provide adequate irrigation and fertilization and keep this caladium growing well in the caladium field.

'Salsa' is a new red lance-leaved caladium, and its leaves have a large red center and lightly undulated green margins. 'Salsa' is shorter than 'Florida Red Ruffles' and taller than 'Cherry Tart'. In growers' fields, plants of 'Salsa' grew better and yielded better than 'Florida Red Ruffles'. 'Salsa' showed good to excellent leaf color display and performed well in containers and landscapes with good sunburn tolerance and leaf health. 'Salsa' is suitable for a range of container sizes for pot plant production and can perform well in a range of landscape situations from sunny to shady locations. De-eyeing is needed for forcing in small containers.

'Pinky Swear' is a distinct pink lance-leaved caladium, whose leaves are characterized by multiple prominent bright-pink-colored veins and irregular light pink or green blotches. This caladium is well suited for producing pot plants in containers with small to large diameters. Tuber de-eyeing will be needed for forcing in small containers. 'Pinky Swear' has shown good leaf color display, good sunburn tolerance, and good leaf health in full sun or shady locations; it should be suitable for use in a range of landscape conditions, from full sun to shady locations. Tuber yield potential is comparable to other major commercial lance-leaved cultivars.

All evaluations described in this article 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 preplant hot-water treatment of tubers is encouraged to prolong their life.

#### Availability

'Wonderland', 'Salsa', and 'Pinky Swear' were released under UF-15-23, UF-15-30, and UF-15-671, respectively. Plant patent and/or trademark may be applied for these caladiums. 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/>).

#### References Cited

- Bell ML, Wilfret GJ, DeVoll DA. 1998. Survey of caladium tuber producers for acreage of cultivars grown. *Proc Florida State Hort Soc*. 111:32–34. <https://journals.flvc.org/fshs/article/view/91393/87591>.
- Carnathan P. 2012. The Postman Joyner caladium, a very popular caladium, grows decades later in a Tampa garden—to the surprise of its homeowners. *Tampa Bay Times*, p. 248. <https://www.tampabay.com/features/homeandgarden/the-postman-joyner-caladium-a-very-popular-caladium-grows-decades-later-in/1252347/>. [accessed 19 Aug 2023].
- Deng Z, Harbaugh BK. 2006. 'Garden White'—A large white fancy-leaved caladium for sunny landscapes and large containers. *HortScience*. 41:840–842. <https://doi.org/10.21273/HORTSCI.41.3.840>.
- Deng Z, Harbaugh BK, Kelly KO, Seijo T, McGovern RJ. 2005. *Pythium* root rot resistance in commercial caladium cultivars. *HortScience*. 40(3):549–552. <https://doi.org/10.21273/HORTSCI.40.3.549>.
- Deng Z, Harbaugh BK, Schoellhorn RK, Andrew RC. 2008. 2003 Survey of the Florida caladium tuber production industry. Univ Florida IFAS Ext Fact Sheet, ENH 1007. <https://edis.ifas.ufl.edu/publication/EP258>. [accessed 19 Aug 2023].
- Deng Z, Harbaugh BK, Peres NA. 2015. 'UF 432' and 'UF 4015'—Two lance-leaved caladium cultivars. *HortScience*. 50(7):1099–1103. <https://doi.org/10.21273/HORTSCI.50.7.1099>.
- Deng Z, Peres NA, Desaege J. 2021. Two lance-leaved caladium cultivars, 'Pink Panther' and 'Crimson Skye'. *HortScience*. 56(7):853–859. <https://doi.org/10.21273/HORTSCI.56.7.853>.
- Evans MR, Wilfret GJ, Harbaugh BK. 1992. Caladiums as potted and landscape plants. Univ Florida IFAS Agric Ext Serv Circ 1060. <http://palm.digital.flvc.org/islandora/object/uf%3A117962#page/UNNUMBERED/mode/lup>. [accessed 19 Aug 2023].
- Goktepe F, Seijo T, Deng Z, Harbaugh BK, Peres NA. 2007. Toward breeding for resistance to *Fusarium* tuber rot in caladium: Inoculation technique and sources of resistance. *HortScience*. 42(5):1135–1139. <https://doi.org/10.21273/HORTSCI.42.5.1135>.
- Harbaugh BK, Tjia BO. 1985. Commercial forcing of caladiums. Univ Florida IFAS Agric Ext Serv Circ 621. <https://original-ufdc.uflib.ufl.edu/UF00027975/00001?search=harbaugh>. [accessed 19 Aug 2023].
- Knauss JF. 1975. Description and control of *Fusarium* tuber rot of caladium. *Plant Dis Rep*. 59:975–979. <https://babel.hathitrust.org/cgi/pt?id=chi.23661194&seq=483>.
- Kokalis-Burelle N, Brito JA, Hartman RD. 2017. Susceptibility of seven caladium (*Caladium × hortulanum*) cultivars to *Meloidogyne arenaria*, *M. enterolobii*, *M. floridensis*, *M. incognita*, and *M. javanica*. *J Nematol*. 49(4):457–461. <https://journals.flvc.org/jon/issue/view/4788>.
- Rhodes HL. 1964. Effect of hot water treatment of seed tubers and soil fumigation for control of root knot on yield of caladiums. *Plant Dis Rep*. 8:568–571. <https://babel.hathitrust.org/cgi/pt?id=chi.098078550&view=lup&seq=7>.
- Ridings WH, Hartman RD. 1976. Pathogenicity of *Pythium myriotylum* and other species of *Pythium* to caladium derived from shoot-tip culture. *Phytopathology*. 66:704–709. [https://www.apsnet.org/publications/phytopathology/backissues/Documents/1976Articles/Phyto66n06\\_704.PDF](https://www.apsnet.org/publications/phytopathology/backissues/Documents/1976Articles/Phyto66n06_704.PDF).
- Royal Horticultural Society. 1986. RHS Colour Chart. Royal Horticultural Society, London.
- SAS Institute. 2021. JMP® Pro 16.1.0. SAS Institute, Cary, NC, USA.
- Wilfret GJ. 1991. Caladium cultivar 'Florida Sweetheart'. US Patent. <https://image-ppubs.uspto.gov/dirsearch-public/print/downloadPdf/PP08526>. [accessed 19 Aug 2023].