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‘UF 432’ and ‘UF 4015’—Two Lance-leaved Caladium Cultivars

Zhanao Deng[2] and Brent K. Harbaugh[1]
Environmental Horticulture Department, University of Florida/Institute of Food and Agricultural Sciences (IFAS), Gulf Coast Research and Education Center, 14625 County Road 672, Wimauma, FL 33598

Natalia A. Peres
Plant Pathology Department, University of Florida/IFAS, Gulf Coast Research and Education Center, 14625 County Road 672, Wimauma, FL 33598

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Caladiums (*Caladium* ×*hortulanum* Birdsey, Araceae Juss.) are valued for their colorful and variably shaped leaves (Harbaugh and Tjia, 1985; Wilfret, 1993). Commercial caladium cultivars generally are grouped into the fancy- or lance-leaved type (Wilfret, 1986). Fancy-leaved caladiums produce large round-ovate to triangular leaves with three main veins, two large basal lobes partially to fully joined, and a petiole attached to the back of the leaf blade. Lance-leaved caladiums produce leaves that are sagittate to cordate-lanceolate and have basal lobes obvious to barely obvious and petioles attached to the base of the leaves (Deng and Harbaugh, 2006a). The majority of commercial caladium cultivars are fancy leaved (Bell et al., 1998; Deng et al., 2011), but there has been an increase in demand for lance-leaved cultivars. Florida caladium growers reported that >50% more acres of lance-leaved caladiums were planted in 2008 than in 1998 (Bell et al., 1998; Deng et al., 2011). Plants of lance-leaved caladium cultivars generally are more compact, with smaller leaves and shorter petioles than fancy-leaved caladiums. Tubers produced by lance-leaved caladiums generally are more branched than tubers from fancy-leaved cultivars and do not need to be de-eyed for pot plant production, which saves production costs (Deng and Harbaugh, 2008). Lance-leaved caladium plants tend to be more adaptable to different container sizes and are less expensive and easier to ship from production sites to markets. Lance-leaved caladiums appeared to be more resilient to wind damages, droughts, sun, and shading than fancy-leaved caladiums, and they may perform better than fancy-leaved caladiums in the landscape when such stresses occur (Deng and Harbaugh, 2008).

Tuber yield is one of the most important factors determining the economic value of caladium cultivars for commercial tuber production. Many lance-leaved caladiums often produce small tubers (Wilfret, 1983), making it difficult for growers to produce caladium crops profitably. Developing new lance-leaved caladium cultivars with adequate tuber yield potential has been a priority breeding objective for the University of Florida (UF) caladium breeding program.

Currently, ‘Florida Sweetheart’ is the most widely grown lance-leaved commercial cultivar of any color, and ‘Florida Red Ruffles’ is the most widely grown red lance-leaved commercial cultivar (Bell et al., 1998; Deng et al., 2011). Both cultivars were introduced by the UF caladium breeding program. Plants of ‘Florida Sweetheart’ are compact and produce wide lance leaves with a rosy color and relatively large tubers (Wilfret, 1991a). ‘Florida Red Ruffles’ has a compact, upright growth habit and excellent sun tolerance (Wilfret, 1991b).

‘UF 432’ (Figs. 1 and 2) is a new and distinct lance-leaved caladium, and its leaves are characterized by thick, dark red to purple veins and a dark red to purple overtone. This cultivar was as productive as or more productive than ‘Florida Sweetheart’, produced high quality pot plants similar to ‘Florida Sweetheart’, and performed very well in the landscape with excellent sun tolerance. ‘UF 432’ produced fuller pot plants with more leaves than ‘Florida Sweetheart’.

‘UF 4015’ (Figs. 3 and 4) showed an overall plant growth habit similar to that of ‘Florida Red Ruffles’, but it is distinct from ‘Florida Red Ruffles’ with bright pink leaves and higher tuber yield potential. The availability of ‘UF 4015’ as a new cultivar can expand the color palette for caladium plants with this growth habit desired by greenhouse growers, nurseries, and gardeners.

Origin

‘UF 432’ was derived from a cross between ‘Candidum Junior’ and ‘Florida Sweetheart’ (Fig. 5) that was developed in Bradenton, FL, in Spring 2003. ‘UF 4015’ was progeny of a cross between ‘Aaron’ and ‘Florida Red Ruffles’ that was developed in Bradenton in Spring 2004 (Fig. 5). ‘UF 432’ was selected initially in 2004, and ‘UF 4015’ was selected initially in Aug. 2005. Since then, they have been propagated asexually through tuber division over 9–10 generations. The growth characteristics of these cultivars have been stable and consistent during asexual propagations and field trials.

‘Florida Sweetheart’ (U.S.PP8,526) was selected as the paternal parent of ‘UF 432’ because of its compact growth habit, bright rosy leaves, excellent sun tolerance, and good tuber yield potential. ‘Florida Sweetheart’ was derived from a 1977 cross between ‘Candidum Junior’ and ‘Red Frill’. ‘Florida Red Ruffles’ (U.S. PP13,136), progeny of (‘Red Frill’ × ‘Candidum Junior’) × ‘Red Frill’, was used as the paternal parent of ‘UF 4015’ for its compact growth habit, adaptability to pot plant production, dark red leaves, superb sun tolerance, and adequate tuber yield. ‘Candidum Junior’, a white fancy-leaved commercial cultivar, was selected for its excellent pot plant growth habit. ‘Aaron’ has white leaves and is known for its tuber yield and sun tolerance. The ancestries of ‘Aaron’, ‘Candidum Junior’, and ‘Red Frill’ are unknown.

Description

Descriptions of color [e.g., Royal Horticultural Society (RHS) 200B] for plant parts are based on comparison with the RHS Color Chart (Royal Horticultural Society, 1986). Plants used for describing color were grown from de-eyed, jumbo-sized (or equivalent) tubers (two per container) in 20.3-cm containers in a 35% shaded greenhouse. The potting mix used in the containers was Fafard 3B (Conrad Fafard Inc., Agawam, MA) amended with the controlled-release fertilizer Osmocote® (15N–2.6P–10K, 5–6 months; Scotts Co., Marysville, OH) at 4.8 kg·m^{-3}.

‘UF 432’. Plants of ‘UF 432’ (≈1.5 months old) had an average height of 36.7 cm. Leaves had an average size of 20 cm × 16 cm (length × width), are ovate, and have a cordate base, an acuminate to acute apex, an entire and slightly undulate margin, and two basal lobes. On the upper leaf surface, a green (RHS 139A) margin, up to 10 mm wide, borders the entire leaf. The leaf center is red (RHS 51B). Venation pattern is pinnate, with as many as 16 grayed-purple (RHS 183A) veins radiating from a central main vein of red (RHS 53C). Secondary and tertiary veins tend to be netted across the entire leaf. Small blotches of green (RHS 139A) and numerous specks of white, or both (RHS 155A) may appear along the margin and

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[1]Emeritus Professor.
[2]To whom reprint requests should be addressed; e-mail zdeng@ufl.edu.

Fig. 1. A typical container-grown plant of 'UF 432' cultivar (6 weeks old) forced from four No.1-sized (3.8–6.4 cm diameter) tubers in a 20.3-cm container.

Fig. 2. Typical mature leaves of 'UF 432' cultivar from 6-weeks-old container-grown plants.

between primary veins. The leaf undersurface has a grayed-green (RHS 191A) margin up to 20 mm wide, a red (RHS 51B) center, a grayed-red (RHS 182C) midrib vein, and several green (RHS 137B to 137D) primary veins. Irregular yellow-white (RHS 158C) mottling appear from the margin into the center area. Petioles are mostly erect, curving outward with development. They are mostly light brown (RHS 200D), with long streaks of darker brown (RHS 200A) or speckling of brown (RHS 200C) from the apex to the base of the petioles. Jumbo tubers are multisegmented, bearing six to nine dominant buds. Tuber surfaces are brown (RHS 200B) with the cortical area yellow (RHS 7B).

'UF 4015'. Plants of 'UF 4015' (≈1.5 months old) have an average height of 33 cm. Leaves had an average of 23.8 cm × 15.7 cm (length × width). Leaves are ovate and have a sagittate base, an acuminate to acute apex, and an entire and wavy margin. On the upper leaf surface, a narrow green (RHS 139A) margin, up to 5 mm wide, borders the entire leaf. The leaf center is red (RHS 54B). Venation pattern is pinnate, with as many as 10 red (RHS 53C) veins radiating from a central main vein of red (RHS 53C). Secondary and tertiary veins tended to netted across the entire leaf. Numerous specks of white (RHS 155B) appear along margins and between primary veins. The leaf undersurface has a grayed-green (RHS 191A) margin up to 10 mm wide, a grayed-purple (RHS

Fig. 3. A typical container-grown plant of 'UF 4015' cultivar (6 weeks old) forced from four No.1-sized (3.8–6.4 cm diameter) tubers in a 20.3-cm container.

Fig. 4. Typical mature leaves of 'UF 4015' from 6-weeks-old container-grown plants.

185D) center, and grayed-purple (RHS 184D) midrib veins and several grayed-purple (RHS 185D) primary veins. Irregular grayed-yellow (RHS 162D) and grayed-green (RHS 191A) mottling, up to 15 mm wide, parallels the margin. Petioles are mostly erect, curving outward with development, and are mainly grayed-red (RHS 179D) with specks of grayed-green (RHS 189A) running from apex to base. Colors of yellow-green (RHS 148A and yellow-green (RHS 146B) can show on the petioles. Jumbo tubers are multisegmented, bearing six to nine dominant buds. Tuber surfaces are brown (RHS 200B), and the cortical area is yellow (RHS 7A).

Tuber Yield Potential

Field experiments. 'UF 432' and 'UF 4015' were evaluated for tuber production at the Gulf Coast Research and Education Center in Wimauma, FL, in 2007, 2008, and 2009. The soil was Eau Gallie fine sand with ≈1% organic matter and pH between 6.2 and 7.4. Caladium plants were grown in the field using a plastic-mulched raised-bed system. For the 2007 growing season, ground beds (81 cm wide, 20 cm high) were fumigated on 3 Apr. with a mixture of 67% methyl bromide and 33% chloropicrin (by volume) at 196 kg·ha^{-1}. Caladium seed pieces (tuber pieces, ≈2.5 × 2.5 × 2.5 cm) were planted manually on 26 Apr. with ≈25.4 cm between-row spacing and ≈15.2 cm in-row spacing. Drip tapes were buried under the plastic mulch and delivered ≈6 mm of water to the bed per day. Fertigation began when young caladium plants emerged from the soil, supplying soluble fertilizer (6N–0.8P–3.9K) at ≈1.9 kg of nitrogen per ha per day and a total of 290 kg of nitrogen per ha per growing season. Tubers (new crop) were dug, washed, and dried in early Jan. 2008. Dried tubers from each experimental field plot were weighed, graded, and counted in late Jan. 2008, as described by Deng and Harbaugh (2006b). Tubers were graded by their maximum diameter: Super Mammoth (greater than 11.4 cm), Mammoth (8.9–11.4 cm), Jumbo (6.4–8.9 cm), No. 1 (3.8–6.4 cm), and No. 2 (2.5–3.8 cm). Tuber grades and counts were converted into a production index (PI) to show the relative economic value of the harvested tubers per field plot: PI = 8n (Supper Mammoth) + 6n (Mammoth) + 4n (Jumbo) + 2n (No.1) + n (No.2), where n = number of tubers in the grade.

For the 2008 growing season, beds were fumigated with a mixture of 80% methyl bromide and 20% chloropicrin (by volume) at 448 kg·ha^{-1}. Caladium seed pieces were planted 18 Apr. at ≈15-cm spacing between and within rows. The irrigation and fertigation system were the same as the one used in 2007. Tubers were dug on 2 Dec. to 8 Dec. 2009, followed by washing, drying, weighing, grading, and counting as was done in 2007.

For the 2009 growing season, beds were fumigated on 27 Feb. with a mixture of 50% methyl bromide and 50% chloropicrin (by volume) at 196 kg·ha^{-1}. Caladium seed pieces were planted 9 Apr. at ≈15-cm spacing between rows and in rows. The irrigation and fertigation system were the same as the one used in 2007, but one teaspoon (≈7 g) of the controlled-release fertilizer Osmocote (15N–2.6P–10K, 5–6 months) was applied to each plant on 21 July. Tubers were dug on 30 Nov. to 2 Dec. 2009, followed by washing, drying, weighing, grading, and counting as was done in 2007.

Experimental design and data analysis. Field plots were arranged in each growing season in a randomized complete block design with three blocks, 1.2 m^2 plots planted with 30 caladium seed pieces. Two commercial cultivars Florida Red Ruffles and Florida Sweetheart were included as controls in each block. Analyses of variance were conducted using the PROC GLM procedure in SAS (SAS Institute, 2011) to compare the tuber yields of 'UF 432' and 'UF 4015' to that of 'Florida Red Ruffles' and 'Florida Sweetheart'.

'UF 432'. There were no significant differences between 'UF 432' and 'Florida Sweetheart' in tuber weight, numbers of marketable tubers, and PI in the 2007 growing season (Table 1). Again, the differences between 'UF 432' and 'Florida Sweetheart' in tuber weight, number of marketable tubers, and PI in the 2009 growing season were not significant. 'UF 432' had an 84.2% greater tuber weight and a 54.5% higher PI than 'Florida Sweetheart' in the 2008 season.

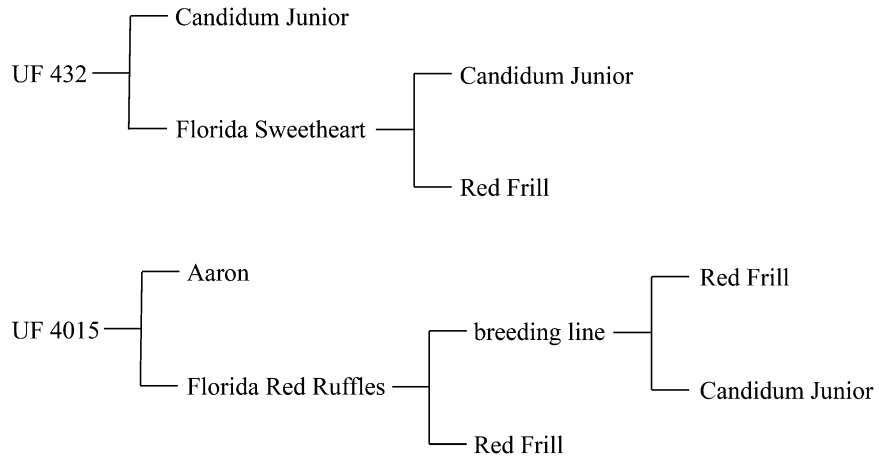

Fig. 5. Pedigree of 'UF 432' and 'UF 4015' caladiums.

Tuber weights of 'UF 432' were 33.3% (2007), 133.3% (2008), or 177.8% (2009) greater than those of 'Florida Red Ruffles'; the PIs of 'UF 432' were 59.1% (2007), 67.7% (2008), or 118.4% (2009) higher than the PIs of 'Florida Red Ruffles'.

Overall 'UF 432' and 'Florida Sweetheart' shared similar tuber grade distributions, except that 'UF 432' produced more No. 1-sized tubers in 2007 (Table 1). 'UF 432' shared the same tuber grade distribution with 'Florida Red Ruffles' in 2007 but produced larger tubers in 2008 and 2009. 'UF 432' produced a higher percentage of Jumbo-sized tubers with a lower percentage of No. 2-sized tubers in 2008, and a higher percentage of Mammoth-sized tubers, a higher percentage of Jumbo-sized tubers, with a lower percentage of No. 2-sized tubers in 2009.

'UF 4015'. There were no significant differences between 'UF 4015' and 'Florida Sweetheart' in tuber weights, numbers of marketable tubers, and PI in 2007 (Table 1). 'UF 4015' had a greater tuber weight and a higher PI than 'Florida Sweetheart' in 2008. In 2009, 'UF 4015' and 'Florida Sweetheart' were not significantly different in tuber weight and PI, but 'UF 4015' produced fewer marketable tubers than 'Florida Sweetheart'.

'UF 4015' had similar numbers of marketable tubers with 'Florida Red Ruffles', but its tuber weights were 59.3% (2007), 193.3% (2008), and 222.2% (2009) greater than the tuber weights of 'Florida Red Ruffles' in corresponding years.

'UF 4015' seemed to produce more tubers in larger-size categories (Mammoth or Jumbo) and fewer tubers in the small-size category (No. 2) than both 'Florida Sweetheart'

Table 1. Tuber weight, number of marketable tubers, production index (PI), and tuber grade distribution of 'UF 432', 'UF 4015', and two commercial cultivars grown in Wimauma, FL, in 2007, 2008, and 2009. Values presented for each year are means of three plots in three randomized complete blocks, and each plot was 1.2 m^2 with 30 tuber propagules planted.

	Tuber			Tuber grade distribution (%)				
Cultivars	Wt (kg)	Marketable (no.)	PI[z]	Super Mammoth	Mammoth	Jumbo	No. 1	No. 2
			Year 2007					
UF 432	3.6 ab[y]	53.7	134.3 ab	—	7.0	22.3	41.4 a	29.4
UF 4015	4.3 a	58.9	136.0 a	—	7.6	18.3	43.3 a	30.8
Florida Red Ruffles	2.7 b	42.2	84.4 b	—	1.0	20.0	41.0 a	37.9
Florida Sweetheart	3.3 ab	45.6	104.9 ab	—	2.6	28.6	31.3 b	37.5
LSD ($\alpha = 0.05$)	1.4	NS	50.9	—	NS	NS	8.1	NS
			Year 2008					
UF 432	3.5 a	60.0	136.0 a	—	0.0 b	26.1 ab	50.6	23.3 b
UF 4015	4.4 a	66.1	184.5 a	—	4.3 a	41.4 a	36.9	17.4 b
Florida Red Ruffles	1.5 b	50.1	81.1 b	—	0.0 b	3.9 c	51.5	44.6 a
Florida Sweetheart	1.9 b	53.3	88.0 b	—	0.0 b	17.4 bc	64.9	17.8 b
LSD ($\alpha = 0.05$)	1.1	NS	49.5	—	3.2	15.9	NS	21.5
			Year 2009					
UF 432	2.5 a	32.3 ab	83.3 a	0.0	5.3 ab	27.8 a	50.4	16.5 bc
UF 4015	2.9 a	29.3 b	81.0 a	1.1	6.9 a	27.2 a	52.1	12.7 c
Florida Red Ruffles	0.9 b	24.7 b	38.0 b	0.0	0.0 c	4.4 b	32.4	63.2 a
Florida Sweetheart	2.7 a	47.0 a	94.7 a	0.0	1.3 bc	19.5 ab	38.9	40.3 ab
LSD ($\alpha = 0.05$)	0.6	16.2	24.5	NS	5.0	17.2	NS	26.1

[z]The production index is an indicator of economic value of the crop harvested, and is calculated as: 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 (2.5–3.8 cm), No. 1 (3.8–6.4 cm), Jumbo (6.4–8.9 cm), Mammoth (8.9–11.4 cm), and Super Mammoth (>11.4 cm).
[y]Mean values with the same letters within column are not significantly different at $P \leq 0.05$.
NS = not significantly different at $P \leq 0.05$.
LSD = least significant difference.

Table 2. Plant characteristics and performance of caladium cultivars grown from No. 1 tubers in 11.4-cm containers in a 45% shaded glasshouse in Wimauma, FL, in 2008. Values represent the means of eight plants produced from intact No. 1 (>3.8 and <6.4 cm in diameter) tubers planted individually per container and data taken ≈8 weeks after planting.

Cultivars	Days to sprout[z] (no.)	Plant ht (cm)	Plant width (cm)	Leaves (no.)	Leaf length (cm)	Leaf width (cm)	Quality rating
UF 432	36.9 a[y]	19.3 b	38.5 b	30.8 a	15.9 c	9.9 c	4.1
UF 4015	33.5 b	22.9 a	45.1 a	20.4 b	22.1 a	12.1 bc	3.8
Florida Red Ruffles	35.3 ab	18.3 b	35.8 b	19.1 b	17.9 bc	12.3 b	3.7
Florida Sweetheart	35.3 ab	16.0 b	33.5 b	19.0 b	19.2 b	14.6 a	3.9
LSD ($\alpha = 0.05$)	2.5	3.5	5.2	7.3	2.3	2.2	NS

[z]Number of days from planting to the appearance of the first unfurled leaves.
[y]Mean values with the same letters within column are not significantly different at $P \leq 0.05$.
NS = not significantly different at $P \leq 0.05$.
LSD = least significant difference.

and 'Florida Red Ruffles' (Table 1). Specifically, 'UF 4015' produced more No. 1-sized tubers than 'Florida Sweetheart' in 2007, and more Mammoth- and Jumbo-sized tubers than 'Florida Sweetheart' in 2008. 'UF 4015' produced more Mammoth- and fewer No. 2-sized tubers than 'Florida Sweetheart' in 2009.

'UF 4015' produced more Mammoth- and Jumbo-sized tubers but fewer No. 2-sized tubers than 'Florida Red Ruffles' in 2008. 'UF 4015' also produced more Mammoth- and Jumbo-sized tubers but fewer No. 2-sized tubers in 2009.

Container Trials

The suitability of 'UF 432' and 'UF 4015' for pot plant production was evaluated by forcing tubers in 11.4-cm containers in Spring 2008. No. 1 tubers were planted in a peat/vermiculite mix (VerGro Container Mix A; Verlite, Tampa, FL) on 17 Apr. The study was conducted in a greenhouse with 45% light exclusion. Average daily temperatures in the greenhouse ranged from a low of 16 °C at night to 29 °C during the day. Potted plants were arranged on metal benches in the greenhouse in a randomized complete block design with eight replications. Plant height, plant width, number of leaves, and foliar characteristics were recorded on 12 June 2008, 8 weeks after planting. Quality of the potted caladium plants was rated on a scale of 1 to 5, with 1 = very poor, few leaves, totally unacceptable as potted plants, and 5 = very attractive with many bright, colorful leaves, a full plant, a symmetrical shape, and an appropriate height.

'UF 432'. Tubers of 'UF 432' sprouted ≈37 d after planting, and so did the tubers of 'Florida Red Ruffles' and 'Florida Sweetheart' (≈35 d) (Table 2). Container-grown plants of 'UF 432' had a similar height and width with container-grown plants of 'Florida Red Ruffles' and 'Florida Sweetheart'. Container-grown plants of 'UF 432' produced ≈61% more leaves that were 2.0–3.3 cm shorter and 2.4–4.7 cm narrower than those of 'Florida Red Ruffles' and 'Florida Sweetheart', respectively. Container-grown plants of 'UF 432', 'Florida Red Ruffles', and 'Florida Sweetheart' received similar quality ratings (3.7–4.1) (Table 2).

'UF 4015'. Tubers of 'UF 4015' sprouted ≈34 d after planting, similar to the tubers of 'Florida Red Ruffles' and 'Florida Sweetheart' (Table 2). Container-grown plants of 'UF 4015' had an average height of 22.9 cm and width of 45.1 cm; 4.6–6.9 cm taller and 9.3–11.6 cm wider than those of 'Florida Red Ruffles' and 'Florida Sweetheart', respectively. Plants of 'UF 4015' produced similar numbers of leaves as plants of 'Florida Red Ruffles' and 'Florida Sweetheart', but leaves of 'UF 4015' were 22.1 cm long and 12.1 cm wide, 2.9–4.2 cm longer than the leaves of 'Florida Red Ruffles' and 'Florida Sweetheart'. The leaves of 'UF 432' were 2.5 cm narrower than those of 'Florida Sweetheart' but had a similar width with those of 'Florida Red Ruffles'. Intact tubers of 'UF 4015' produced quality pot plants in 8 weeks, with an average plant quality rating of 3.8, similar to that of 'Florida Red Ruffles' and 'Florida Sweetheart'.

Landscape Performance

Landscape performance of 'UF 432' and 'UF 4015' was evaluated on the same plots used for evaluating tuber production. A scale of 1 to 5 was used with 1 being very poor (few leaves and lack of vigor), and 5 being excellent (full plants, numerous leaves, and bright color display). Leaf sun tolerance was evaluated on a scale of 1 to 5, with 1 being very susceptible to sun (leaves having numerous sun-damaged areas or holes) and 5 being resistant to sun (no visible sun-damaged areas). Three evaluations were conducted in each growing season for plant performance and sun tolerance, and they were done in July, Aug., and Sept. 2007; Aug., Sept., and Oct. in 2008; and Aug., Sept., and Oct. 2009. Plant height, number of leaves, and leaf size were

Table 3. Plant characteristics of 'UF 432', 'UF 4015', and two commercial cultivars ≈4 mo. from planting tuber propagules (≈2.54 × 2.54 × 2.54 cm^3) in full sun and ground beds (sandy soil) in Wimauma, FL, in 2007 and 2009. Values presented are means of 3 years' data from three replications and three plants measured per plot per year.

Cultivar	Plant ht (cm)	Leaves (no.)	leaf length[z] (cm)	Leaf width[y] (cm)
UF 432	28.0 b[x]	28.4 bc	20.4 ab	12.4 ab
UF 4015	26.3 bc	35.4 b	21.7 a	11.1 bc
Florida Red Ruffles	17.9 d	27.7 c	16.9 c	10.0 c
Florida Sweetheart	22.8 c	28.7 bc	19.4 b	13.4 a
LSD ($\alpha = 0.05$)	4.6	7.4	2.2	1.4

[z]Leaf length was measured on the largest leaves along the longest line from the leaf lobe to the leaf tip.
[y]Leaf width was measured on the largest leaves across the widest middle part.
[x]Mean values with the same letters within column are not significantly different at $P \leq 0.05$.
LSD = least significant difference.

Table 4. Plant performance of 'UF 432', 'UF 4015', and two commercial cultivars planted in full sun and ground beds in Wimauma, FL, in 2007, 2008, and 2009. Values presented are means of three replications in each year.

	2007			2008			2009		
Cultivars	July	August	September	August	September	October	August	September	October
UF 432	4.5 a[z]	3.8	3.1	4.3 b	4.3 a	4.7 a	3.2 b	4.5	4.5 a
UF 4015	3.9 ab	3.9	2.9	4.8 a	4.9 a	4.4 a	4.0 a	4.5	4.3 a
Florida Red Ruffles	3.8 b	3.1	2.9	3.1 c	2.7 b	2.5 c	3.2 b	3.7	3.5 b
Florida Sweetheart	3.3 b	3.1	2.8	3.3 c	3.3 b	3.5 b	4.7 a	4.5	3.3 b
LSD ($\alpha = 0.05$)	0.7	NS	NS	0.4	0.9	0.6	0.8	NS	0.7

[z]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, fullness, and color display, on 27 July, 28 Aug., and 15 Sept. 2007; 16 Aug., 1 Sept., and 1 Oct. 2008; and 12 Aug., 15 Sept., and 8 Oct. 2009. Mean values with the same letters within column are not significantly different at $P \leq 0.05$.
NS = not significantly different at $P \leq 0.05$.
LSD = least significant difference.

Table 5. Sun tolerance ratings of 'UF 432', 'UF 4015', and two commercial cultivars planted in full sun and ground beds in Wimauma, FL, in 2007, 2008, and 2009. Values presented are means of three replications in each year.

	2007			2008			2009		
Cultivars	July	August	September	August	September	October	August	September	October
UF 432	3.7[z]	3.6 ab[y]	3.5	4.6 ab	4.2 a	4.6 a	4.2 b	5.0	4.3 a
UF 4015	3.6	2.9 b	3.0	4.8 a	4.7 a	1.8 c	5.0 a	4.8	4.7 a
Florida Red Ruffles	3.6	4.3 a	4.0	3.9 bc	2.3 b	3.0 bc	5.0 a	5.0	4.7 a
Florida Sweetheart	3.5	4.3 a	3.8	3.3 c	3.2 ab	3.5 ab	4.7 ab	4.5	3.3 b
LSD ($\alpha = 0.05$)	NS	1.1	NS	0.8	1.7	1.3	0.5	NS	0.4

[z]Plant sun tolerance was rated on a scale of 1 to 5, with 1 being very poor, 3 fair and acceptable, and 5 being excellent without showing any signs of leaf burns or holes caused by sun on leaf surfaces, on 27 July, 28 Aug., and 15 Sept. 2007; 16 Aug., 1 Sept., and 1 Oct. 2008; and 12 Aug., 15 Sept., and 8 Oct. 2009.
[y]Mean values with the same letters within column are not significantly different at $P \leq 0.05$.
NS = not significantly different at $P \leq 0.05$.
LSD = least significant difference.

measured on three plants randomly chosen from each plot, ≈4 months after planting.

'UF 432'. This cultivar showed good to excellent plant performance when grown in ground beds in full sun. After 4 months, plants had an average height of 28.0 cm, which was ≈5–10 cm taller than 'Florida Red Ruffles' or 'Florida Sweetheart' plants, respectively (Table 3). Leaves of 'UF 432' had an average size of 20.4 cm × 12.4 cm (length × width), 3.5 cm longer and 2.4 cm wider than the leaves of 'Florida Red Ruffles', but similar to the average size of the leaves of 'Florida Sweetheart'. Plants of 'UF 432' developed an average of 28.4 leaves that were dark red/purple and showed thick veins. These plants received acceptable to excellent plant performance ratings (3.1–4.7) in all evaluations in three growing seasons (Table 4). The plant performance ratings of 'UF 432' were significantly higher than those of 'Florida Red Ruffles' or 'Florida Sweetheart' in five out of nine evaluations, and were similar to the ratings of 'Florida Red Ruffles' and 'Florida Sweetheart' in three to four evaluations. 'UF 432' did not perform as well as 'Florida Sweetheart' in only one evaluation.

'Florida Red Ruffles' and 'Florida Sweetheart' are considered sun-tolerant cultivars. The sun tolerance rating of 'Florida Red Ruffles' and 'Florida Sweetheart' in 2007, 2008, and 2009 ranged from 2.3 to 5.0 and from 3.2 to 4.7, respectively (Table 5). The sun tolerance ratings of 'UF 432' were between 3.5 and 5.0 (Table 5), similar to or better than the sun tolerance ratings of 'Florida Sweetheart' or 'Florida Red Ruffles' in eight out of the nine evaluations. These ratings suggest excellent sun tolerance in 'UF 432'.

'UF 4015'. Plants of 'UF 4015' had an average height of 26.3 cm with 28.4 leaves. The average leaf size was 21.7 cm × 11.1 cm (length × width) (Table 3). Thus, plants of 'UF 4015' were ≈5–8 cm taller than plants of 'Florida Red Ruffles' or 'Florida Sweetheart'; leaves were 2–5 cm longer than leaves of these commercial cultivars. Plant performance ratings of 'UF 4015' ranged from 2.9 to 4.9 in nine evaluations over three growing seasons from 2007 to 2009; its performance ratings were significantly higher than the ratings of 'Florida Red Ruffles' or 'Florida Sweetheart' in four or five out of the nine evaluations (2008 and 2009) (Table 4). The sun tolerance ratings of 'UF 4015' were between 2.9 and 5.0, except for one evaluation in which its sun tolerance rating was 1.8. 'UF 4015' showed lower sun tolerance than the commercial cultivars in two evaluations (Table 5). Sunlight bleached out the pink color, causing lower sun tolerance ratings.

Availability

Plant patents will be applied for 'UF 432' and 'UF 4015' by the Florida Agricultural Experiment Station. Commercial production of these cultivars is to be with a licensing agreement with the Florida Foundation Seed Producers, Inc., P.O. Box 309, Greenwood, FL 32443. Information on tuber availability and propagation agreements can be obtained from the Florida Foundation Seed Producers, Inc. (http://www.ffsp.net/). 'UF 432' and 'UF 4015' will be marketed under Sizzle™ and Passionista™, respectively.

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