'UF 85-5': A Spotted Caladium Cultivar for Use in Containers and Sunny Landscapes

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Caladiums (*Caladium ×hortulanum* Birdsey, Araceae Juss.) are tropical ornamental aroids. They are often forced as potted plants and grown in the landscape to provide color (Evans et al., 1992). A great majority of caladium plants in the floriculture trade are propagated from tubers. More than 95% of the caladium tubers used in the world comes from central Florida (Bell et al., 1998; Deng et al., 2008). Many existing commercial caladium cultivars show attractive coloration patterns but have poor pot or landscape performance and/or poor tuber yield. 'Marie Moir' is an example of this type of cultivar (Wilfret and Hurner, 1982). Its leaves are very attractive in coloration (white face with dark green veins and numerous red spots) but are few in number, resulting in poor pot or landscape plants unsatisfactory for commercial or homeowner acceptance. Additionally, its field production of tubers has been unstable over the years (Terri Bates, personal communication), thus tuber growers cannot profitably grow the tuber.

'UF 85-5' is a fancy-leaved cultivar with a primarily white leaf face and attractive red spots (Figs. 1 and 2). It is similar to 'Marie Moir' in leaf color and coloration pattern but different from 'Marie Moir' in petiole color (green versus brown on 'Marie Moir'). 'UF 85-5' is distinct from 'Cranberry Star', a cultivar released by this breeding program in 2007 and developing burgundy/purple spots on leaves (Deng et al., 2008). 'UF 85-5' sprouted earlier, produced higher quality pot plants, and showed better performance in the landscape than 'Marie Moir' and is improved over 'Marie Moir' in tuber yield. 'UF 85-5' is much improved over 'Cranberry Star' in sunburn tolerance and landscape performance. These improvements make 'UF 85-5' an ideal replacement for 'Marie Moir' and an additional sun-tolerant cultivar for the landscape palette.

Origin

'UF 85-5' was derived from a cross made in 2000 between 'Summer Rose' and 'Florida Fantasy' (Fig. 3) and selected out of a population of progeny in 2001. 'Summer Rose' was released in 2005 (Deng and Harbaugh, 2006). It was progeny of 'Aaron' and a breeding line UF-FCT that resulted from a cross between 'Fire Chief' and 'Torchy'. 'Florida Fantasy' was selected from progeny of a cross between 'Candidum Junior' and 'Red Frill' and released in 1990 (Wilfret, 1991). It has been in commercial production in Florida since then. The ancestry of 'Aaron', 'Candidum Junior', 'Fire Chief', 'Red Frill', and 'Torchy' is unknown.

Description

Descriptions of color (e.g., RHS 200B) for plant parts are based on comparison with the Royal Horticultural Society Color Chart (Royal Horticultural Society, 1986). Plants used for describing color were grown in 20.3-cm containers in a ≈30% shaded greenhouse from No. 1 (3.8 to 6.4 cm) intact tubers.

Leaves are peltate, sagittate–cordate, and have palmate–pinnate venation. The upper leaf surface has a green (RHS 137C) margin bordering the entire leaf, several green (RHS 137A) main veins, and numerous secondary green (RHS 137A) veins, which are netted over the whole leaf blade. Interveneal areas are mostly green–white (RHS 157D). Red (RHS 46A) spots occur between main veins in the range of 10 to 30 per fully developed leaf. The undersurface has a yellow–green (RHS 145D) undertone with heavily netted veins of grayed green (RHS 191A). Primary veins are grayed green (RHS 193D) at the basal notch and darkened to grayed green (RHS 193A) near the tip of the leaf. Spots are grayed purple (RHS 184C) and vary in size. Petioles are 3 to 5 mm near the apex and 5 to 10 mm near the base (in diameter). The prominent petiole color is yellow–green (RHS 144C to 145D) with streaks of grayed brown to brown (RHS 199C to 200B). Jumbo-sized (6.4 to 8.9 cm in diameter) tubers have multiple segments and bear four to six dominant buds. The tuber surface is brown (RHS 200B to 200D) and the cortical area is yellow (RHS 13B).

'UF 85-5' was evaluated for tuber production and plant performance under field conditions at the Gulf Coast Research and Education Center in Wimauma, FL, in 2005 and 2006. The soil was an Eau Gallie fine sand with ≈1% organic matter and pH between 6.2 and 7.4. Plants were grown in a plastic-mulched raised-bed system with a constant water table maintained through seepage irrigation (Geraldson et al., 1965). In 2005, ground beds were fumigated on 25 Feb. with a mixture of 67% methyl bromide and 33% chloropicrin (by volume) at the rate of 392 kg·ha⁻¹. In 2006, the beds were fumigated on 10 Mar. with the same fumigant mixture but at the rate of 196 kg·ha⁻¹. The raised beds were 91 cm wide and 20 cm high. Caladium seed pieces (cut tuber propagules, ≈2.5 cm) were planted in early to mid-April with 15-cm in-row and between-row spacing. Osmocote 18N–2.6P–10K 8–9 month controlled release fertilizer (Scotts Co., Marysville, OH) was manually applied to the bed surface when caladium shoot tips were emerging from the soil with N at 336 kg·ha⁻¹. At the end of the growing season, tubers (new crop) were harvested in late November (2005 season) or mid-December (2006 season). Harvested tubers were washed and dried before they were weighed, counted, and graded. Tuber grading was by maximum diameter: No. 2 (2.5 to 3.8 cm), No. 1 (3.8 to 6.4 cm), Jumbo (6.4 to 8.9 cm), Mammoth (8.9 to 11.4 cm), and Super Mammoth (greater than 11.4 cm). Based on the number of tubers in each of the five grades, a production index was calculated [N (No. 2) + 2N (No. 1) + 4N (Jumbo) + 6N (Mammoth) + 8N (Super Mammoth), where N = number of tubers in each grade] to determine the relative economic value of the harvested tubers.

In both 2005 and 2006, field plots were organized in three randomized complete blocks, and each plot was 1.2 m² with 30 plants. Three commercial cultivars, Candidum, Marie Moir, and Miss Muffet, were included in the experiment for performance comparison. 'Candidum' was the No. 1 or No. 2 best-selling caladium cultivar (Bell et al., 1998; Deng et al., 2008) and shares a similar coloration pattern to 'UF 85-5' except for not having colored spots on leaf blades. As mentioned, 'Marie Moir' is the closest to 'UF 85-5' in leaf coloration among commercial cultivars. 'Miss Muffet' was included because it was a popular spotted cultivar. An analysis of variance was conducted using the GLM procedure in the SAS program (SAS Institute, 2009) to compare the performance of 'UF 85-5' with that of these commercial cultivars.

'UF 85-5' was significantly more productive than 'Candidum' and 'Miss Muffet' in both 2005 and 2006 growing seasons. Its average tuber weight was 115% (2005) and 83% (2006) greater than that of 'Candidum' and 75% (2005) and 103% (2006) greater than that of 'Miss Muffet'; its production index was 66% (2005) and 53% (2006) higher than that of 'Candidum' and 49% (2005) and 65% (2006) higher than that of 'Miss Muffet';

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Fig. 1. Leaves of 'UF 85-5' grown in the ground bed in full sun. Tuber pieces were planted in Apr. 2009 and photograph was taken in Sept. 2009.

Fig. 2. Plant of 'UF 85-5' forced in a small square container (11.4 cm wide at mouth) from one de-eyed No. 1 tuber (2.54 cm in diameter). The plant was grown in the greenhouse with 35% light exclusion. Photograph was taken 9 weeks after the tuber was planted.

Fig. 3. Pedigree of 'UF 85-5'.

and its number of marketable tubers was 50% (2005) and 44% (2006) larger than that of 'Candidum' and 36% (2005) and 28% (2006) larger than that of 'Miss Muffet' (Table 1). 'UF 85-5' showed good consistency in tuber weight, number of marketable tubers, and production index between growing seasons, whereas 'Marie Moir' had poor consistency between growing seasons in tuber production. 'Marie Moir' yielded similarly well with 'UF 85-5' in 2005 but yielded poorly compared with 'UF 85-5' in 2006— $\approx 33\%$ less than 'UF 85-5's tuber weight and production index and only $\approx 50\%$ of 'UF 85-5's number of marketable tubers. These results are similar to growers' reports of 'Marie Moir' over years; that is, "Marie Moir" is not a dependable cultivar from year to year and many growers no longer produce it because it is unprofitable when it yields poorly.

Landscape performance of 'UF 85-5' grown under full-sun conditions was evaluated in 2005 and 2006 in the same plots used for evaluating tuber production. 'Cranberry Star' was also included with 'Candidum', 'Marie Moir', and 'Miss Muffet' for comparison with 'UF 85-5' in these tests. The overall plant performance was rated multiple times (June, July, and August) in each growing season, on a scale of 1 to 5, with 1 being very poor (few leaves and lack of vigor) and 5 being excellent (full plants, numerous leaves, and bright color display). Similarly, leaf sunburn tolerance was also evaluated multiple times in each growing season on a scale of 1 to 5 with 1 being very susceptible to sunburns and showing numerous sun-damaged areas or holes on leaves and 5 being resistant to sunburns and not showing any sun-damaged areas. At ≈ 4 months after planting, plant height, number of leaves, and foliar characteristics were measured.

Plants of 'UF 85-5' and 'Cranberry Star' were 9 to 13 cm taller and developed significantly more ($\approx 100\%$) leaves than 'Candidum' and 'Marie Moir' (Table 2). Leaf sizes were similar among all cultivars tested, except for 'Miss Muffet', a known dwarf cultivar, which was approximately half the size of other cultivars. Plants of 'UF 85-5' performed well in the landscape with performance ratings between 3.6 and 4.8, similar to 'Cranberry Star', but significantly higher than those of 'Candidum' (1.7 to 3.1), 'Marie Moir' (1.4 to 3.3), and 'Miss Muffet' (1.5 to 2.4). 'UF 85-5' received the highest sunburn tolerance ratings in all the evaluations in each growing season, indicating better or significantly better sun tolerance in this cultivar in comparison with the commercial cultivars and potential for use in sunny locations in the landscape (Fig. 1). Although 'UF 85-5' showed a high level of similarity to 'Cranberry Star', a recent release, in plant height, leaf number, and leaf size, 'Cranberry Star' was very susceptible to leaf damage in full sun and thus limited to use in shady locations (Table 2).

The suitability of 'UF 85-5' for container forcing was evaluated by forcing tubers in 11.4-cm containers. No. 1 tubers of 'UF 85-5', 'Cranberry Star', 'Marie Moir', and

'Miss Muffet' were planted either intact or de-eyed in a peat/vermiculite mix (VerGro Container Mix A; Verlite, Tampa, FL) on 26 Mar. 2007. The study was conducted in a greenhouse with 45% light exclusion. Temperatures in the greenhouse ranged from 16 to 32 °C during the experiment. Potted plants were arranged on metal benches in the greenhouse in 10 randomized complete blocks. Plant height, number of leaves, and foliar characteristics were recorded 8 weeks after planting.

Tubers of 'UF 85-5' sprouted in 30 d (intact) or 32 d (de-eyed) after planting, similar to plants of 'Miss Muffet' and 'Cranberry Star' but 4 to 9 d earlier than plants of 'Marie

Moir' (Table 3). Container-grown plants of 'UF 85-5' were 19 to 22 cm tall, regardless of tuber treatment (intact or de-eyed), similar to plants of 'Marie Moir' and 'Cranberry Star' but significantly taller (5 to 8 cm) than plants of 'Miss Muffet'. 'UF 85-5' produced an average of 12 leaves per intact plant 8 weeks after planting and 21 per de-eyed plant, similar to 'Miss Muffet' but significantly more than 'Marie Moir' or 'Cranberry Star'. Leaves of 'UF 85-5' were significantly smaller than those of 'Marie Moir', especially when tubers were planted intact: $\approx$ 8 cm shorter and $\approx$ 6 cm narrower. When tubers were de-eyed, leaf size differences became

smaller but might still be significant. With numerous medium-sized leaves, pot plants of 'UF 85-5' were significantly higher quality (3.4 to 4.4) than those of 'Marie Moir' (1.9 to 2.4). Pot plant quality ratings of 'UF 85-5' were similar to those of 'Cranberry Star' and 'Miss Muffet', which are known for their great pot habits. Tuber de-eyeing resulted in higher plant quality ratings for 'UF 85-5' (Fig. 2; Table 3).

Recommendation

'UF 85-5' sprouted 4 to 9 d earlier, produced higher quality pot plants, and performed

Table 1. Tuber weight, production index, marketable number, and grade distribution of 'UF 85-5' and three commercial caladium cultivars (2005 and 2006).^z

Cultivar	Tuber			Tuber distribution (%) ^y				
	Wt (kg)	Production index ^x	Marketable (no.)	Super mammoth	Mammoth	Jumbo	No. 1	No. 2
<i>Year 2005</i>								
UF 85-5	5.6 a ^w	171 a	50.6 a	6.3 a	13.3 NS	30.0 NS	39.3 NS	11.3 NS
Candidum	2.6 b	103 b	33.7 c	0 b	4.0	47.7	42.3	6.0
Marie Moir	5.0 a	159 a	46.2 ab	2.3 b	16.7	37.3	35.0	8.7
Miss Muffet	3.2 b	115 b	37.3 bc	0 b	10.3	40.0	40.0	10.3
<i>Year 2006</i>								
UF 85-5	5.5 a	175 a	49.8 a	7.3 a	16.0 a	30.7 a	29.7 NS	16.3 ab
Candidum	3.0 b	114 bc	34.6 c	2.3 ab	11.7 a	38.7 a	37.7	9.3 b
Marie Moir	1.5 c	58 d	29.9 c	2.3 ab	0 b	11.3 b	43.7	43.0 a
Miss Muffet	2.7 bc	106 cd	38.7 bc	0 c	10.0 a	28.3 a	42.7	19.0 ab

^zValues presented are means of three replications with 30 propagules planted per plot (1.2 m²).

^yTubers graded by their maximum diameter: No. 2 (2.5 to 3.8 cm), No. 1 (3.8 to 6.4 cm), Jumbo (6.4 to 8.9 cm), Mammoth (8.9 to 11.4 cm), and Super Mammoth (greater than 11.4 cm). Tuber grade distribution data (%) were transformed using the formula arcsine [square root (percentage/100)] before analysis of variance and mean separation.

^xThe production index is an indicator of economic value of the crop harvested and is calculated as: N (No. 2) + 2N (No. 1) + 4N (Jumbo) + 6N (Mammoth) + 8N (Super Mammoth), where N = number of tubers in each grade.

^wMean separation within column by Fisher's least-significant difference test at $P \leq 0.05$.

NS = Non-significantly different by F test at $P = 0.05$.

Table 2. Plant characteristics, performance, and sun tolerance of 'UF 85-5' and four commercial caladium cultivars.^z

Cultivar	Plant ht ^y (cm)	Leaves ^y (no.)	Leaf length ^y (cm)	Leaf width ^y (cm)	Performance rating ^x			Sun tolerance rating ^w		
					June	July	August	June	July	August
UF 85-5	41.9 a ^v	27.3 a	24.9 a	15.0 a	3.6 a	4.3 a	4.8 a	3.5 a	4.5 a	4.8 a
Candidum	31.5 bc	14.6 b	23.8 a	15.4 a	1.7 c	1.5 b	3.1 b	2.7 a	2.6 c	3.6 c
Cranberry Star	37.0 ab	24.9 a	24.8 a	15.8 a	2.6 b	4.0 a	4.6 a	1.8 b	3.6 b	3.0 d
Marie Moir	28.1 c	13.9 b	24.5 a	15.4 a	1.4 c	1.6 b	3.3 b	1.9 b	4.2 b	4.1 b
Miss Muffet	18.1 d	16.3 b	16.8 b	10.9 b	1.5 c	1.3 b	2.4 c	3.3 a	4.4 b	4.2 b

^zPlants were grown from 2.5-cm tuber propagules in ground beds in full sun (2005 and 2006). Values presented for plant height, leaf number, length, and width are means of three replications with three plants measured per plot per year, whereas performance and sunburn tolerance ratings are means of three replications based on whole plot evaluation.

^yData were taken over two growing seasons (2005 and 2006), $\approx$ 4 months (Aug. 2005 and 2006) after tubers were planted in April each year.

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

^wPlant sun burn 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 resulted holes on leaf surfaces, taken in June, July and Aug. in 2005 and 2006, respectively.

^vMean separation within column by Fisher's least significant difference test at $P \leq 0.05$.

Table 3. Plant performance of 'UF 85-5' and three commercial cultivars grown from No. 1 tubers (3.8 to 6.4 cm in diameter) in 11.4-cm containers in a 45% shaded glasshouse, Wimauma, FL.^z

Cultivar	Days to sprout ^y		Plant ht (cm)		Leaves (no.)		Leaf length (cm)		Leaf width (cm)		Quality rating ^x	
	Intact	De-eye	Intact	De-eye	Intact	De-eye	Intact	De-eye	Intact	De-eye	Intact	De-eye
UF 85-5	29.9 ab ^w	32.4 b	22.4 a	19.1 a	12.4 a	21.2 a	20.6 b	16.6 bc	13.9 b	10.2 b	3.4 a	4.4 ab
Cranberry Star	31.9 a	34.3 b	22.5 a	25.5 a	7.0 bc	12.1 b	23.2 b	21.8 a	14.9 b	13.4 a	3.8 a	4.7 a
Marie Moir	34.1 a	41.2 a	23.4 a	19.6 a	4.9 c	6.8 c	29.1 a	18.6 b	20.4 a	12.1 a	1.9 b	2.4 c
Miss Muffet	25.6 b	30.4 b	14.8 b	14.6 b	10.4 ab	17.7 a	19.1 b	14.7 c	12.1 b	8.2 c	3.3 a	4.1 b

^zTubers were planted individually per container. Data were taken 8 weeks after planting. Values represent the mean of 10 replicates.

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

^xPlant quality rated on a scale of 1 to 5 with 1 being very poor (few leaves, leggy, unattractive color display), 3 fair and acceptable, and 5 excellent (full plant, appropriate size, attractive color display).

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

better in the landscape than ‘Marie Moir’ and showed better sunburn tolerance than ‘Cranberry Star’. Additionally, ‘UF 85-5’ has shown improved tuber yield potential. In tuber forcing, ‘UF 85-5’ behaved like ‘Miss Muffet’ with a similar number of days to sprout, a similar number of leaves, more or less similar sizes of leaves, and similar plant quality, except that ‘UF 85-5’ is taller. Tuber de-eyeing seemed to be optional for pot plant production, but this practice improved the quality of pot plants. ‘UF 85-5’ showed excellent sun tolerance and produced a large number of leaves in sunny locations; thus, it is suitable for a wide range of locations in the landscape.

Although extensive research and evaluations of this cultivar have been performed on small acreages, tuber producers are encouraged to plant only limited quantities of ‘UF 85-5’ until having gained experience in producing this cultivar. Standard postharvest treatment of tubers is recommended (Harbaugh and Tjia, 1985) and pre-plant hot-water treatment of tubers (Rhodes, 1964) is encouraged to prolong the life of this cultivar.

Availability

A plant patent will be applied for ‘UF 85-5’ by the Florida Agricultural Experiment Station and production of this cultivar 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.

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