

Royal Flush™ ‘UF-18-49’—a Red Fancy-leaved Caladium for Large Containers and Sunny Landscapes

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Caladiums (*Caladium × hortulanum* Birdsey, Araceae Juss.) are often used to provide color and a tropical ambiance to container gardening or the landscape (Evans et al., 1992). Approximately 95% of the caladium tubers used in the United States and worldwide are produced in Florida. Red fancy-leaved cultivars accounted for 23% of the acreage planted by Florida caladium growers (Bell et al., 1998). ‘Freida Hemple’ (33%) and ‘Postman Joyner’ (13%) accounted for nearly half of the red fancy-leaved cultivars commercially grown. ‘Florida Cardinal’, released from the University of Florida caladium breeding program in 1988 (Wilfret, 1988), comprised 7% of the red fancy-leaved cultivars grown. It was selected primarily for use in containers because it produces many leaves without the need to de-eye tubers. Recently, ‘Freida Hemple’ was found highly susceptible to fusarium tuber rot, the most important disease that affects caladium tuber quality (Goktepe et al., 2007). ‘Postman Joyner’ and ‘Florida Cardinal’ were also susceptible to fusarium tuber rot (Goktepe et al., 2007). Therefore, there was a strong need for new red fancy-leaved caladium cultivars. Royal Flush™ ‘UF-18-49’ is a new red fancy-leaved cultivar that has been selected for its vigor, tall stature, large leaf size, and sun tolerance. It has shown outstanding performance in container forcing and landscape planting trials in Florida, and it was selected as “Best of the Best” in the 2013 Ohio State University cultivar trials (Dolce, 2013; Pangborn and Pasian, 2013).

Origin

Royal Flush™ ‘UF-18-49’ (Fig. 1) was selected in 2001 out of progeny from a cross between UF-702 and ‘Red Flash’ (Fig. 2). UF-702 was a breeding line derived from

a cross between an unnamed sport of ‘Aaron’ and UF-FCB, a breeding line resulting from the cross ‘Fire Chief’ × ‘Buck’. ‘Red Flash’ and ‘Aaron’ are major commercial cultivars known for their attractive leaf colors, strong plant vigor, good sun tolerance, high tuber yields, and large tuber sizes (Bell et al., 1998; Deng et al., 2011). ‘Fire Chief’ and ‘Buck’ are commercially produced on a much smaller scale, but they carry unique characteristics: the former produces red translucent leaves and the latter deep dark red leaves. The ancestries of ‘Aaron’, ‘Fire Chief’, ‘Red Flash’, and ‘Buck’ are unknown.

Description

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

Leaves of Royal Flush™ ‘UF-18-49’ are peltate, sagittate-cordate, with palmate-pinnate venation. Primary and secondary veins are red (RHS 53B to 53D). The upper surface has a green (RHS 137A) margin, up to 15 mm wide, bordering the entire leaf except for the basal leaf sinus where it is grayed purple (RHS 187B). Interveneal areas and the primary veins in the center of the leaf blade are grayed purple (RHS 187B). The under-surface is primarily a grayed green (RHS 191A) with red–purple (RHS 60A and 60B) primary veins. Petioles are 4 to 7 mm in diameter and are grayed purple (RHS 187A) to black (RHS 202A). Tuber surfaces are brown (RHS 200C–D) with the cortical area yellow (RHS 10B). Jumbo tubers are multi-segmented, usually bearing three to five dominant buds.

Performance

Royal Flush™ ‘UF-18-49’ was evaluated for tuber production and plant performance at the Gulf Coast Research and Education

Center in Wimauma, FL, in 2005 and 2006. The soil was an Eau Gallie fine sand with 1% organic matter and a pH of 6.2. Plants were grown in a plastic-mulched raised-bed system maintaining a constant water table with seep irrigation (Geraldson et al., 1965). For the 2005 evaluation, ground beds were fumigated on 25 Feb. 2005 (6 weeks before planting) with a mixture of 67% methyl bromide and 33% chloropicrin (by volume) at the rate of 392 kg·ha⁻¹. For the 2006 evaluation, ground beds were fumigated on 10 Mar. 2006, 10 d before planting, with the same fumigant mixture but at the half rate, 196 kg·ha⁻¹. The ground beds were 91 cm wide and 20 cm high, and caladium seed pieces (cut tuber propagules, ≈2.5 cm) were planted 15 cm apart in three rows. Controlled-release fertilizer Osmocote 18N–2.6P–10K (8–9 months; Scotts Co., Marysville, OH) was applied to the bed surface when caladium shoot tips emerged from the soil with nitrogen at 336 kg·ha⁻¹.

Field plots were organized in three randomized complete blocks, and each plot was 1.25 m² with 30 plants. In 2005, seed tuber pieces were planted in April and new tubers were harvested in November; in 2006, seed pieces were planted in April and new tubers were harvested in December. Newly harvested tubers were washed and dried before they were weighed, graded, and counted per plot. Tubers were graded into five categories by their 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). The production index, an indicator of economic value of the harvested tubers, was calculated as: N (No. 2) + 2N (No. 1) + 4N (Jumbo) + 6N (Mammoth) + 8N (Super Mammoth), where N = number of tubers in each grade. An analysis of variance was conducted using the GLM procedure in the SAS program (SAS Institute, 2009) to compare the performance of Royal Flush™ ‘UF-18-49’ with that of ‘Florida Cardinal’, ‘Freida Hemple’, and ‘Postman Joyner’. The latter cultivars are important commercial red fancy-leaved caladium cultivars.

Royal Flush™ ‘UF-18-49’ was significantly more productive by several measures of performance than all the commercial cultivars in 2005. The tuber weight was 18% to 56% greater, number of marketable tubers 27% to 40% more, and production index 25% to 77.8% higher than the other red cultivars (Table 1). In 2006, Royal Flush™ ‘UF-18-49’ was comparable to ‘Florida Cardinal’, ‘Freida Hemple’, and ‘Postman Joyner’ in tuber weight, number of marketable tubers, and production index, except that its number of marketable tubers was smaller than that of ‘Freida Hemple’. The size distribution of tubers produced by Royal Flush™ ‘UF-18-49’ was similar in 2005 and 2006 growing seasons: ≈60% of the tubers were graded as No. 1 and Jumbo, and ≈20% were in the Mammoth size.

Landscape performance under full-sun conditions was evaluated in 2005 and 2006

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Fig. 1. Royal Flush™ 'UF-18-49' plants (4 months old) grown in full sun in Wimauma, FL.

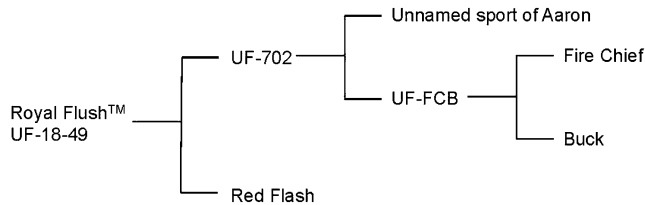


Fig. 2. Pedigree of Royal Flush™ 'UF-18-49' caladium.

on the same plots used for evaluating tuber production. The overall plant performance was rated in two growing seasons 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). Leaf sunburn tolerance was also evaluated 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.

Royal Flush™ 'UF-18-49' plants were 8 to 27 cm taller and leaves 5 to 11 cm longer and 3 to 7 cm wider than those of 'Florida Cardinal', 'Freida Hemple', and 'Postman Joyner' (Table 2). Thus, Royal Flush™ 'UF-18-49' produced the tallest plants with the largest leaves among the red fancy-leaved cultivars evaluated. Sun tolerance ratings of Royal Flush™ 'UF-18-49' were between 3.9 and 4.6, significantly higher than the ratings of 'Florida Cardinal' in all five evaluations (1.8 to 2.8), higher than those of 'Postman Joyner' in four of five evaluations (2.5 to 3.9), and even higher than the ratings of 'Freida Hemple' (currently the most popular red cultivar being sold) in three of five evaluations (2.7 to 4.0). With good sun tolerance and vigor, plants of Royal Flush™ 'UF-18-49' received the highest landscape performance ratings (4.0 to 4.8), which were much higher than that of 'Florida Cardinal' and 'Postman Joyner' (1.7 to 2.9). The ratings of Royal Flush™ 'UF-18-49' were also significantly higher than those of 'Freida Hemple' in two of five evaluations.

The suitability of Royal Flush™ 'UF-18-49' for container forcing was evaluated by forcing tubers in 11.4-cm containers and

Table 1. Tuber weight, production index, number, and grade distribution of four caladium cultivars grown in Wimauma, FL (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>								
Royal Flush™ UF-18-49	3.9 a ^w	160 a	44.4 a	6.0 a	18.0 NS	32.7 NS	30.7 NS	12.7 NS
Florida Cardinal	2.8 c	113 c	34.3 b	3.3 a	12.7	40.0	30.0	14.7
Freida Hemple	3.3 b	128 b	35.0 b	6.7 a	17.3	38.0	28.0	9.3
Postman Joyner	2.5 c	90 d	31.7 b	0 b	10.0	27.0	54.3	9.3
<i>Year 2006</i>								
Royal Flush™ UF-18-49	4.4 NS	134 ab	39.7 b	3.3 NS	17.7 b	31.0 a	32.0 NS	15.7 NS
Florida Cardinal	4.1	137 ab	35.2 b	6.3	26.7 a	28.7 a	26.7	11.0
Freida Hemple	5.2	159 a	48.8 a	6.0	17.3 b	22.0 ab	35.3	18.7
Postman Joyner	3.8	115 b	36.6 b	2.7	27.0 ab	13.0 b	42.7	18.7

^zValues presented are means of three replicates with 30 propagules planted in a plot.

^yTubers graded into five categories by maximum tuber 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 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 tubers harvested and is calculated as follows: 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 $P \leq 0.05$. Mean values with the same letter within column are not statistically different.

NS Nonsignificantly different by F test at $P = 0.05$.

Table 2. Plant characteristics, performance and sun tolerance from planting 2.54-cm caladium tuber propagules in ground beds in full sun in Wimauma, FL (2005 and 2006).^z

Cultivar	Plant ht ^y (cm)	Leaf			Performance rating ^x				Sun tolerance rating ^w					
		Number ^y	Length ^y (cm)	Width ^y (cm)	2005			2006		2005		2006		
					June	July	Aug.	Aug.	Sept.	June	July	Aug.	Sept.	
Royal Flush™ UF-18-49	51.3 a ^v	19.9 ab	32.3 a	21.2 a	4.0 a	4.8 a	4.8 a	4.3 a	4.5 a	2.6 bc	3.9 a	4.6 a	4.0 a	4.3 a
Florida Cardinal	24.6 d	19.3 ab	21.6 c	14.4 c	1.7 c	2.3 b	2.9 c	1.5 b	2.4 b	1.8 c	2.1 b	2.7 c	2.0 b	2.8 d
Freida Hemple	43.5 b	23.4 a	26.3 b	17.7 b	3.3 b	4.5 a	4.2 b	4.2 a	4.4 a	2.7 b	4.0 a	3.6 b	3.8 a	3.9 b
Postman Joyner	35.7 c	13.4 b	26.8 b	16.4 bc	1.6 c	2.0 b	2.8 c	2.2 b	2.6 b	3.9 a	2.5 b	3.8 b	2.3 b	3.5 c

^zValues presented for plant height, leaf number, length, and width are means of three replicates with three plants measured per plot per year, whereas performance and sunburn tolerance ratings are means of three replicates based on whole plot evaluation.

^yData were taken over two growing seasons (2005 and 2006), ≈ 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 July, Aug., and Sept. 2005 and Aug. and Sept. 2006, respectively.

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

^vMean separation within column by Fisher's least significant difference test at $P \leq 0.05$. Mean values with the same letter within column are not statistically different.

Table 3. Plant performance for caladium cultivars grown from No. 1 tubers in 11.4-cm containers in a 45% shaded glasshouse in Wimauma, FL, in 2006.²

Cultivar	Days to sprout ¹		Plant ht (cm)		Leaves (no.)		Leaf length (cm)		Leaf width (cm)		Quality rating	
	Intact	De-eye	Intact	De-eye	Intact	De-eye	Intact	De-eye	Intact	De-eye	Intact	De-eye
Royal Flush™ UF-18-49	30.3 a*	29.8 ab	40.5 a	37.9 a	9.0 b	9.9 c	28.0 a	22.6 a	20.4 a	16.4 a	3.9 a	4.2 a
Florida Cardinal	28.3 ab	32.9 a	33.0 b	28.4 b	13.1 a	17.0 b	23.6 b	17.8 b	16.8 b	11.8 b	2.5 b	3.3 b
Freida Hemple	24.6 b	25.1 c	29.8 b	34.9 a	16.3 a	21.0 a	23.3 b	17.8 b	17.1 b	12.1 b	3.8 a	4.1 a
Postman Joyner	25.9 b	27.6 bc	33.1 b	36.1 a	8.1 b	9.4 c	24.5 b	19.0 b	17.1 b	13.1 b	2.5 b	3.5 b

²Values represent the means of 10 plants produced from intact or de-eyed No. 1 (3.8 to 6.4 cm in diameter) tubers planted individually per container. Data were taken 8 weeks after planting.

¹Number of days from planting to the first unfurled leaf.

*Mean separation within column by Fisher's least significant difference test at $P \leq 0.05$. Mean values with the same letter within column are not statistically different.

comparing growth parameters with the same three cultivars used in field tests. No. 1 tubers were planted either intact or de-eyed in a peat/vermiculite mix (VerGro Container Mix A; Verlite, Tampa, FL) on 3 Apr. 2006. The study was conducted in a greenhouse with 45% light exclusion during the summer in Wimauma, FL. Daily temperatures ranged from a low of 16 °C at night to 29 °C during the day during the experiment. Potted plants were arranged on metal benches in the greenhouse in a randomized complete block design with 10 replications. Plant height, number of leaves, and foliar characteristics were recorded 8 to 10 weeks after planting.

Royal Flush™ 'UF-18-49' sprouted ≈ 30 d after planting either intact or de-eyed tubers and was similar to 'Florida Cardinal' in sprouting time in container forcing but ≈ 5 d later than 'Freida Hemple' and ≈ 2 to 4 d later than 'Postman Joyner' (Table 3). When tubers were planted intact, Royal Flush™ 'UF-18-49' plants were the tallest with a height of 40.5 cm, 7 to 10 cm taller than the other red cultivars. When tubers were de-eyed before planting, no significant differences in height were observed among Royal Flush™ 'UF-18-49', 'Freida Hemple', and 'Postman Joyner'. Leaves of Royal Flush™ 'UF-18-49' were again longer (3 to 5 cm) and wider (3 to 5 cm) than the leaves of the checks, regardless of tuber treatment (intact or de-eyed). Royal Flush™ 'UF-18-49' was similar to 'Postman Joyner' in leaf development, producing eight to 10 leaves within 8 weeks after planting. Royal Flush™ 'UF-18-49' and 'Postman Joyner' produced fewer leaves than 'Florida Cardinal' and 'Freida Hemple'. Pot plant quality ratings of Royal Flush™ 'UF-18-49' were

above 4.0, higher than that of 'Florida Cardinal' and 'Postman Joyner' and similar to that of 'Freida Hemple'.

Recommendation

Plants of Royal Flush™ 'UF-18-49' are vigorous with large leaves that are bright and attractive even when grown in full sun. These characteristics make Royal Flush™ 'UF-18-49' suitable for use in the landscape (sunny or shady locations) or large containers. To force this cultivar in small containers, tubers should be de-eyed before planting. Although extensive research and evaluations of this cultivar have been performed on small acreages, tuber producers are encouraged to plant only limited quantities of Royal Flush™ 'UF-18-49' 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 their life.

Availability

A plant patent has been granted for 'UF-18-49' caladium under the Plant Patent Number PP24,431. 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. (<<http://www.ffsp.net/>>).

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