

Cultivar and Germplasm Releases

**‘UF-18-49’ – A Fancy-leaved Red Caladium for Large Containers and Sunny Landscapes**

Zhanao Deng and Brent K. Harbaugh

University of Florida, IFAS, Department of Environmental Horticulture, Gulf Coast Research and Education Center, 14625 C.R. 672, Wimauma, FL 33598

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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. Red fancy-leaved cultivars represented 23% of the tuber producing industry in a 1998 survey (Bell et al., 1998) compared to 29% and 28% for fancy white or pink cultivars, respectively. ‘Frieda Hemple’ (33%) and ‘Postman Joyner’ (13%) accounted for nearly half of the red cultivars 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 bred primarily for use in containers because it produces many leaves without the need to de-eye tubers. ‘UF-18-49’ is a new red fancy-leaved cultivar that has been selected for its vigor, tall stature, very large leaf size, and sun tolerance. It has shown outstanding performance in container forcing and landscape planting. Growers have trialed ‘UF-18-49’ on their farms in central Florida with standard commercial field practices since 2006, and now they have requested its release as a new cultivar for potential tuber sales in spring 2011.

## **Origin**

‘UF-18-49’ was selected in 2001 out of a population of progeny from a cross made in 2000 between UF-702 and ‘Red Flash’ (Fig. 3). 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, excellent sun tolerance, high tuber yields, and large tuber sizes (ell et al., 1998; Deng et al., 2008). ‘Fire Chief’ and ‘Buck’ are commercially produced on a much smaller scale, but they carry some unique characteristics: the former produces red translucent leaves and the latter deep dark red leaves. The ancestry of ‘Aaron’, ‘Fire Chief’, ‘Red Flash’ and ‘Buck’ are unknown.

## **Description**

Descriptions of color (e.g. RHS 200B) for plant parts are based on comparison with the Royal Horticultural Society Colour Chart (Royal Horticultural Society, 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) tubers.

Leaves of 'UF-18-49' are peltate, sagitate-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 greyed-purple (RHS 187B). Interveinal areas and the primary veins in the center of the leaf blade are greyed-purple (RHS 187B). The undersurface is primarily a greyed-green (RHS 191A) with red purple (RHS 60A and 60B) primary veins. Petioles are 4 to 7 mm in diameter and are greyed-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**

'UF-18-49' was evaluated for tuber production and plant performance at the Gulf Coast Research and Education Center in Wimauma, Fla. in 2005 and 2006. The soil was an EauGallie fine sand with about 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). In 2005, ground beds were fumigated on February 25 (6 weeks before planting), with a mixture of 67% methyl bromide and 33% chloropicrin (by volume) at the rate of 392 kg· ha<sup>-1</sup>, and in 2006, the beds were fumigated on March 10, 10 days before planting, with the same

fumigant mixture but at the half rate,  $196 \text{ kg} \cdot \text{ha}^{-1}$ . The beds were 91 cm wide and 20 cm high with caladium seed pieces (cut tuber propagules, about 2.5 cm) planted 15 cm apart in three rows. Osmocote 18N-2.6P-10K 8-9 month controlled release fertilizer (Scotts Co., Marysville, Ohio) was applied to the bed surface when shoot tips were emerging from the soil with N at  $336 \text{ kg} \cdot \text{ha}^{-1}$ .

Field plots were organized in three randomized complete blocks, and each plot was  $1.25 \text{ m}^2$  with 30 plants. In 2005, seed tuber pieces were planted in April and tubers were harvested in Nov. and in 2006, seed pieces were planted in April and tubers were harvested in Dec. Dried tubers were weighed and counted per plot. They were then graded by maximum diameter; No. 2 (2.5 to 3.8 cm), No. 1 (3.8 to 6.4 cm), Jumbo (6.4 to 8.9 cm), Mammoth (8.9 to 11.4 cm), and Super Mammoth (>11.4 cm). The production index, an indicator of economic value of the harvested tubers, was calculated as:  $N (\text{No. 2}) + 2N (\text{No. 1}) + 4N (\text{Jumbo}) + 6N (\text{Mammoth}) + 8N (\text{Super Mammoth})$ ; where N = number of tubers in each grade. An analysis of variance was conducted using the GLM procedure in the SAS program (SAS Institute, 2003) to compare the performance of 'UF-18-49' to that of 'Florida Cardinal', 'Frieda Hemple', and 'Postman Joyner', red fancy-leaved commercial cultivars.

'UF-18-49' was significantly more productive than all the commercial cultivars in 2005: Its 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 tested red cultivars (Table 1). In 2006, 'UF-18-49' was comparable to 'Florida Cardinal', 'Frieda 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 'Frieda Hemple'. The size distribution of tubers produced by 'UF-18-49' was similar in 2005 and 2006 growing seasons: ~60% tubers in No.1

and Jumbo and ~20% in Mammoth. This distribution was desirable for a cultivar to be marketed for large container and landscape use.

Landscape performance of cultivars grown under full-sun conditions was evaluated in 2005 and 2006 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 sun burn tolerance was also evaluated in each growing season on a scale of 1 to 5, with 1 being very susceptible to sun burns and showing numerous sun-damaged areas or holes on leaves and 5 being resistant to sun burns and not showing any sun-damaged areas. At approximately 4 months after planting, plant height, number of leaves, and foliar characteristics were measured.

‘UF-18-49’ plants were 8 to 27 cm taller, leaves 5 to 27 cm longer and 3 to 7 cm wider than those of ‘Florida Cardinal’, ‘Frieda Hemple’ and ‘Postman Joyner’ (Table 2). Thus, ‘UF-18-49’ produced the tallest plants with the largest leaves for this red fancy-leaved cultivar group. Sun tolerance ratings of ‘UF-18-49’ plants were between 3.9 and 4.6, significantly higher than the rating scores of ‘Florida Cardinal’ in all five evaluations (1.8 to 2.8), and higher than those of ‘Postman Joyner’ in four of five evaluations (2.5 to 3.9), and even higher than the scores of ‘Frieda Hemple’ (currently the most popular red cultivar being sold) in three out of five evaluations (2.7 to 4.0). With this sun tolerance and outstanding vigor, plants of ‘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). ‘UF-18-49’s ratings were also significantly higher than ‘Frieda Hemple’s in two of five evaluations.

The suitability for container forcing was evaluated by forcing tubers in 11.4-cm containers. No. 1 tubers were planted either intact or de-eyed in a peat/vermiculite mix (VerGro Container Mix A, Verlite, Tampa, Fla.) on 26 March 2007. The study was conducted in a greenhouse with 45% light exclusion during the summer in Wimauma, Fla. Average daily temperatures ranged from a low of 16°C night to 29°C 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.

‘UF-18-49’ sprouted ~30 days after planting either intact or de-eyed tubers, and was similar to ‘Florida Cardinal’ in sprouting time in container forcing, but ~5 days later than ‘Frieda Hemple’ and ~2 to 4 days later than ‘Postman Joyner’ (Table 3). When tubers were planted intact, forced ‘UF-18-49’ plants were the tallest with a height of 40.5 cm, 7 to 10 cm taller than plants of the checks. When tubers were de-eyed before planting, no significant differences in height were observed between ‘UF-18-49’, ‘Frieda Hemple’ and ‘Postman Joyner’. Leaves of ‘UF-18-49’ were again longer (3 to 5 cm) and wider (3 to 5 cm) than the leaves of the other cultivars, regardless of tuber treatment (intact or de-eyed). ‘UF-18-49’ was similar to ‘Postman Joyner’ in leaf development, producing 8 to 10 leaves within 8 weeks after planting. Both of these cultivars produced fewer leaves than ‘Florida Cardinal’ and ‘Frieda Hemple’. Pot plant quality rating of ‘UF-18-49’ was above 4.0, higher than that of ‘Florida Cardinal’ and ‘Postman Joyner’ and similar to that of ‘Frieda Hemple’.

## **Recommendation**

Plants of 'UF-18-49' are vigorous and develop very large leaves. Colors of these leaves are very bright and attractive, not affected when grown in full sun. These characteristics make this cultivar ideal 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 '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 is encouraged to prolong their life.

### **Availability**

A patent will be applied for 'UF-18-49' 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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1 Table 1. Tuber weight, production index, number, and grade distribution of four caladium cultivars (2005 and 2006). Values  
 2 presented are means of three replications with 30 propagules planted in a plot.

Cultivar	Tuber			Tuber distribution <sup>z</sup> (%)				
	Weight	Production	Marketable	Super				
	(kg)	index <sup>y</sup>	(no.)	mammoth	Mammoth	Jumbo	No. 1	No. 2
----- Year 2005 -----								
UF-18-49	3.9 a <sup>x</sup>	160 a	44.4 a	6.0 a	18.0 <sup>NS</sup>	32.7 <sup>NS</sup>	30.7 <sup>NS</sup>	12.7 <sup>NS</sup>
Florida Cardinal	2.8 c	113 c	34.3 b	3.3 a	12.7	40.0	30.0	14.7
Frieda 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
----- Year 2006 -----								
UF-18-49	4.4 <sup>NS</sup>	134 ab	39.7 b	3.3 <sup>NS</sup>	17.7 b	31.0 a	32.0 <sup>NS</sup>	15.7 <sup>NS</sup>
Florida Cardinal	4.1	137 ab	35.2 b	6.3	26.7 a	28.7 a	26.7	11.0
Frieda Hemple	5.2	159 a	48.8 a	6.0	17.3 b	22.0 ab	35.3	18.7

18	Postman Joyner	3.8	115 b	36.6 b	2.7	27.0 ab	13.0	42.7	18.7
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20 <sup>z</sup> Tubers graded by maximum diameter; No. 2 (2.5 to 3.8 cm), No. 1 (3.8 to 6.4 cm), Jumbo (6.4 to 8.9 cm), Mammoth (8.9 to 11.4  
 21 cm), and Super Mammoth (>11.4 cm). Tuber distribution data (%) were transformed using the formula arcsine [square root  
 22 (percentage /100)] before analysis of variance and mean separation.

23 <sup>y</sup> The production index is an indicator of economic value of the crop harvested and is calculated as: N (No. 2) + 2N (No. 1) + 4N  
 24 (Jumbo) + 6N (Mammoth) + 8N (Super Mammoth), where N = number of tubers in each grade.

25 <sup>x</sup> Mean separation within column by Fisher's least-significant-difference test at  $P \leq 0.05$ . <sup>NS</sup> Not significantly different by F test at  $P =$   
 26 0.05.

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Table 2. Plant characteristics, performance and sun tolerance from planting 2.54-cm caladium 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, while performance and sun burn tolerance ratings are means of three replications based on whole plot evaluation.

Cultivar	Plant height <sup>z</sup> (cm)	Leaf number <sup>z</sup> (no.)	Leaf length <sup>z</sup> (cm)	Leaf width <sup>z</sup> (cm)	Performance rating <sup>y</sup>					Sun tolerance rating <sup>x</sup>				
					-----2005-----		----2006----			-----2005-----		----2006----		
					June	July	Aug.	Aug.	Sept.	June	July	Aug.	Aug.	Sept.
UF-18-49	51.3 a <sup>w</sup>	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
Frieda 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

<sup>z</sup>Data were taken over two growing seasons (2005 and 2006), approximately 4 months (August 2005 and 2006) after tubers were planted in April each year.

<sup>y</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, fullness, and color display, in July, August and September 2005 and August and September 2006, respectively.

<sup>x</sup>Plants' 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 July, August and September 2005 and August and September 2006, respectively.

<sup>w</sup>Mean separation within columns by Fisher's least-significant-difference test at  $P \leq 0.05$ .

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

Cultivar	Days to sprout <sup>z</sup>		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
UF-18-49	30.3 a <sup>x</sup>	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
Frieda 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

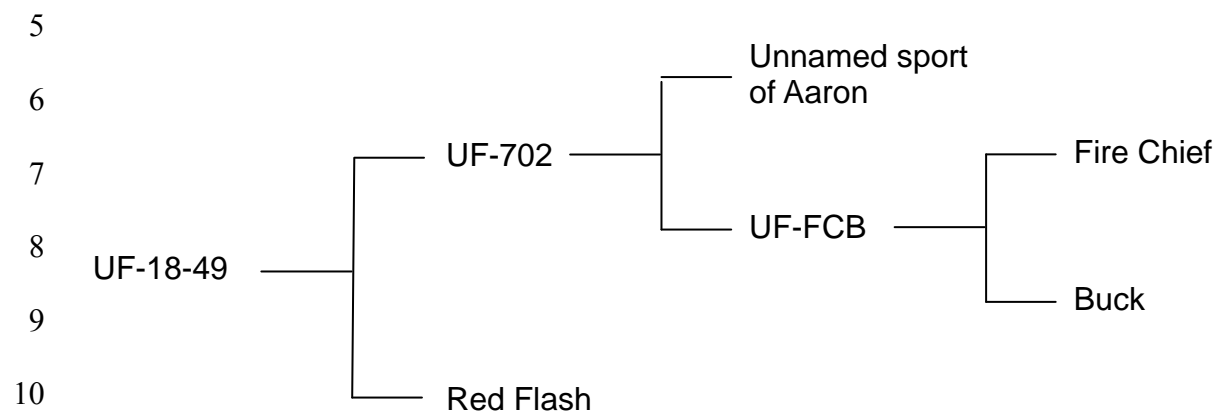
<sup>z</sup> Number of days from planting to the first unfurled leaf.

<sup>x</sup> Mean separation within column by Fisher's least-significant-difference test at  $P \leq 0.05$ .



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Fig. 1. 'UF-18-49' plants grown in full sun.



13 Fig. 2. Pedigree of caladium cultivars 'UF-18-49'.