Fall and Spring Landscape Performance of African Marigold Varieties

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The LSU Agricultural Center has been actively pursuing landscape plant performance trials for the last several years. This has primarily concentrated on annual bedding plants. While interest in marigolds among gardening consumers and commercial landscapers has decreased, there is still the potential to determine performance of many of the African marigold varieties for adaptability in the landscape.

African marigold varieties growing in jumbo cell packs were transplanted on September 20, 2000, and April 15, 2001, into raised landscape beds at the Burden Center in Baton Rouge, La. Bed material was aged pine bark amended with 10% sand (by volume). Plants were planted on 12-to 16-inch centers and arranged in a randomized complete block by varieties with 24 plants per variety. Plants were located in full sun and were irrigated as needed to prevent stress throughout the evaluation period. Fertilizer (StaGreen Nursery Special 12-6-6) was applied by broadcasting 1.0 lbs N/1000 square feet immediately after both planting dates. Series of marigold varieties evaluated included Discovery, Atlantis, Galore, Inca, Jubilee, Medallion, Perfection, Crush and Antigua.

Visual quality ratings were determined October 15 and November 1 for the fall 2000 planted marigolds and May 1, May 15 and June 1 for the spring 2001 planted marigolds. The ratings were based on a scale from 1 to 5 with 1=worst, 5=best. Included in this evaluation were growth habit, foliage color/appeal and flower quality. Ratings in the fall 2000 planting were terminated because of a killing frost. Ratings in the spring 2001 planting were terminated because of plant decline caused by heavy rainfall in early June. Plants also were observed for petal spot, lodging (stem breakage) and spider mite infestation.

Visual quality ratings did not reveal significant differences among varieties. General trends indicated that the Antigua, Atlantis, Perfection, Inca and Discovery series were slightly superior. The Crush and Galore series were comparable in performance. The Medallion series performed unsatisfactorily.

Table 1. Visual quality ratings of African marigold varieties

Variety	Fall 2000		Spring 2001		
	Oct 15	Nov 1	May 1	May 15	June 1
Crush Papaya	4.0	3.5	3.0	3.5	3.5
Crush Pineapple	4.0	3.5	3.5	3.5	3.5
Crush Pumpkin	4.0	3.5	3.0	3.0	3.0
Discovery Orange	4.0	4.0	3.5	4.0	3.0
Discovery Yellow	4.0	4.0	3.0	3.5	3.0
Antigua Gold	3.5	3.5	3.5	4.0	4.0
Antigua Primrose	3.5	3.5	3.5	4.0	4.0
Antigua Orange	3.5	3.5	3.0	4.0	4.0
Antigua Yellow	3.5	3.5	3.0	3.5	4.0
Antigua Mix	3.5	3.5	3.5	3.5	4.0
Atlantis Orange	3.5	3.5	3.0	4.0	4.0
Atlantis Primrose	3.5	4.0	4.0	4.0	4.0
Atlantis Yellow	4.0	4.0	4.0	4.0	4.0
Inca Gold	3.0	3.5	4.0	4.0	3.5
Inca Orange	3.0	3.0	4.0	4.0	3.5
Inca Yellow	3.0	3.0	4.0	4.0	3.5
Inca Mix	3.0	3.5	4.0	3.5	3.5
Galore Gold	3.0	3.0	3.5	4.0	3.5
Galore Orange	3.0	3.0	3.5	4.0	3.5
Galore Yellow	3.5	3.5	3.5	4.0	3.5
Perfection Gold	3.5	3.5	4.0	4.5	3.5
Perfection Orange	3.5	3.5	4.0	4.5	3.5
Perfection Yellow	4.0	4.0	4.0	4.5	3.5
Perfection Mix	3.5	3.5	3.0	4.0	3.5
Medallion Orange	3.0	2.5	2.5	2.0	2.0
Medallion Yellow	2.5	2.5	2.5	2.0	2.0
Medallion Mix	3.0	2.5	2.5	2.0	2.0
Jubilee Diamond	3.0	3.0	3.0	3.5	2.5
Jubilee Orange	3.0	3.0	2.5	3.5	3.0
Jubilee Mix	3.0	3.0	2.5	3.0	2.5
Guys and Dolls	3.5	3.5	2.0	2.5	2.0
Gold Coins Mix	3.0	3.0	3.0	3.0	3.0
Crackerjack	3.0	3.0	3.0	3.0	2.5
Doubloon Yellow	3.0	3.0	3.0	3.0	3.0
Double Eagle	3.0	3.0	3.0	3.0	2.5

NOTE: visual quality ratings based on a scale from 1 to 5 with 1=worst, 5=least. Included in this evaluation was growth habit, foliage color/appeal, and flower quality.

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Lodging (stem breakage/weakening) was observed in the fall 2000 planting. The Crush series and Guys and Dolls had no lodging on November 1. Slight lodging was evident on the Discovery series, with moderate lodging on the Antigua, Galore, Atlantis, Perfection and Inca series. Lodging was very significant on Double Eagle and Gold Coins Mix, along with the Medallion and Jubilee series. Lodging was also most evident on the Jubilee and Medallion series in the spring 2001 planting.

Petal blight was observed on the Medallion series in the fall 2000 planting. This was the only group with major petal blight incidence before the first killing frost. In the spring 2001 planting, the Medallion series also had a large infestation of spider mites.

Conducting landscape trials to evaluate performance of annual bedding plant varieties provides useful information for greenhouse crop producers, retail garden center personnel, landscapers and the gardening consumer. African marigolds in Louisiana have potential use as a late summer/ early fall warm-season bedding plant. Good performance can be obtained at this time of year if heavy rainfall (which leads to petal blight and lodging) can be avoided. Dead-heading will be required maintenance. African marigold trials at the LSU Agricultural Center will continue for the next several years.

Heat and Sun Tolerant Caladiums

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For many years, Louisiana homeowners have turned to caladiums (*Caladium x hortulanum*) to provide summer color in shaded areas where sun-loving plants won=t perform.

They provide an excellent landscape focal point when planted in mass. They are also excellent as border plants or in containers. Caladium color combinations include various combinations of green, white, red and pink. Types include fancy leaf types and strap leaf types. Fancy leaf types are taller (13 to 32 inches) with wider leaves, and strap leaf types (under 12 inches) are shorter with narrow strappy leaves.

With the expanding urge for more color in all areas of the landscape, many homeowners and landscapers are using caladiums in full sun to partial sun situations. To do this, cultivar selection becomes a prime consideration.

While there are many caladium cultivars, selection for hot or sunny locations is limited. Many develop a brown, scorched appearance when exposed to the sun for any length of time. Greenhouse studies have shown that caladiums grown under high greenhouse heat had fewer leaves, reduced plant grade and reduced leaf color intensity. Additional studies are needed to determine cultivar suitability for heat and full sun conditions.

Seventeen cultivars of caladiums, both fancy leaf and lance or strap leaf types, were tested at the Southeastern Louisiana University Horticulture Center, Hammond, La. Three #1 bulbs were

Table 1. Evaluation of 17 Caladium cultivars

Cultivar	Type	Color		Plant Height (in.)	Overall rating (1=poor 5=excellent)
		Center	MainVein		
Candidum	Fancy	White Interveins	Green	16	2.0
Carolyn Whorton	Fancy	Lg. Rose Spots	Red	15	4.1
Fannie Munson	Fancy	Dk Rose Interveins	Rose	13	2.4
Firechief	Fancy	Dk Rose	Red	11	2.8
Florida Cardinal	Fancy	Green Margin	Red	12	3.2
Florida Sunrise	Fancy	Rose Intervein	Red	13	2.8
Florida Sweetheart	Strap	Green Margin	Rose	10	2.5
Frieda Hemple	Fancy	Red Rose	Red Rose	14	2.9
Little Miss Muffet	Strap	Green Red Spot	Dk. Rose	7	2.5
June Bride	Fancy	White	Lt. Green	13	3.2
Mrs. Arlo Nehling	Fancy	White w/Pink	Dk. Red	10	2.2
Pink Beauty	Fancy	Pink Blotches	Rose	11	3.4
Pink Gem	Strap	Green Margin	Pink	10	2.1
Red Frills	Strap	Dk. Red	Dk. Red	7	2.8
Rosebud	Fancy	Green Margins	Rose	9	2.0
White Queen	Fancy	White Interveins	Dk. Red	13	3.2
White Wings	Strap	Green	White	10	3.4

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planted in a peat pine bark mix into 6-inch azalea plastic pots and placed in the greenhouse at 65 degrees F on February 28, 2000. None of the bulbs were de-eyed. On April 12, 2000, the pots were transplanted to an outside bed where the bed medium temperature was above 60 degrees. The medium in the bed was predominately pine bark and peat with a pH of 6.2. The plants were watered as needed, and a complete fertilizer application was applied monthly. Plants were evaluated for retention of color, scorched leaves, wilting and general appearance and given a numerical assessment. The evaluations ended August 1, 2000.

While all cultivars lost some color, some did tolerate the sun and heat better than others (See Table I). The cultivars that rated above average were Carolyn Whorton, Pink Beauty, White Wings, June Bride, Florida Cardinal and White Queen. These cultivars give the homeowner, not only a range of colors for garden placement, but also options on where they can be placed in a landscape.

The Effects of Water Stress on Warm-Season Turfgrass Growth

Edward W. Bush[1] and Allen D. Owings[2]

Abstract

Four warm-season grass species, common bermudagrass (Cynodon dactylon [L.] Pers.), common carpetgrass (Axonopus affinis Chase), St. Augustinegrass (Stenophrum secondatum Walt. Kuntze.) and zoysiagrass (Zoysia japonica Steud.) were established in containers filled with an Olivia silt loam soil for 12 weeks. Grasses were maintained weekly at 5 cm before the experiment began. Water stress treatments consisted of control (field capacity), waterlogged and flooded treatments. Waterlogging and flood treatments were imposed for 90 d. The effects of water stress were dependent on grass species.

Bermudagrass vegetative growth and turf quality were significantly reduced when flooded. Common carpetgrass, St. Augustinegrass and zoysiagrass quality and vegetative growth were also reduced by flooding. St. Augustinegrass and zoysiagrass root dry weight was significantly decreased. Zoysiagrass plants did not survive 90 d of flooding.

Introduction

Common bermudagrass (*Cynodon dactylon* [L.] Pers.), common carpetgrass (*Axonopus affinis* Chase), St. Augustinegrass (*Stenophrum secondatum* Walt. Kuntze.) and zoysiagrass (*Zoysia japonica* Steud.) are commonly grown in the southeast coastal plains of the United States where excessive rainfall causes soil waterlogging and flooding for prolonged periods. Minimal research has documented the effects of waterlogging and flooding on turfgrass species. Adaptation of common carpetgrass in areas with high water tables has been documented (Heath et al., 1985); however, no research has compared the effects of waterlogging and flooding on turfgrass species.

Waterlogging is regarded as the saturation of soil pore space without covering grass stolons or leaves. Waterlogging occurs generally as a result of excessive rainfall, irrigation mismanagement and/or poor soil drainage. Slow diffusion of atmospheric oxygen into waterlogged soils may cause anaerobic soil conditions (Kawase, 1981). Decreasing availability of soil oxygen causes hypoxia (reduced oxygen diffusion) and eventually anoxia (anaerobic conditions). Soil waterlogging can cause a chemically reduced state in soils, causing toxic levels of elements to accumulate (Grineva et al., 1989).

Flooding, for the purposes of this study, is considered the complete submergence of soil and plant stolons and leaves. Submerged soils reduced Mn (IV) oxides to Mn (II), increasing water-soluble Mn^{+2} and precipitating manganous carbonate (Ponnamperuma, 1972). Manganese and Fe soil concentrations increased following as few as 7 d of waterlogged conditions (Adams and Akhtar, 1994). Increased accumulation of Fe and Mn within or on roots reduced toxic shoot levels (Jones, 1971). Root tissue of waterlogging tolerant species serves as a protective system, limiting toxic levels of Fe from accumulating in leaf tissue (Jones, 1972). Less is known about Mn; however, there seems to be a similar response with waterlogging tolerant plants.

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Hypoxia can lead to morphological and physiological disturbances within a plant. Morphological changes in flooded corn plants led to decreased physiological activity and plant death after 2 d (Grineva et al., 1989). Respiration in the roots and stem base decreased, while leaf respiration increased.

Minimal research has studied waterlogging and flooding effects on lawngrass. Bush et al. (1999) determined that centipedegrass [*Eremochloa ophuiroides* Munro. (Kunz.)] and common carpetgrass survived and recovered from 42 d of waterlogging. Fry (1991) determined that bermudagrass, St. Augustinegrass and zoysiagrass survived 55 d of inundation. Centipedegrass was the only grass not surviving after 93 d of submersion.

There has been no research comparing the response of lawngrass species to both waterlogging and flooding. Therefore, a study was established to determine the influence of waterlogging and flooding on the growth of four warm-season turfgrass species.

Materials and Methods

This study consisted of four grass species (bermudagrass, common carpetgrass, St. Augustinegrass and zoysiagrass) and three water stress treatments [control (field capacity), waterlogged and submerged]. The experiment was performed in a greenhouse structure located on the Louisiana State University Hill Farm in Baton Rouge.

Each block consisted of a control, waterlogged and submerged container and consisted of three PVC containers of each species (5 cm diameter x 15.0 cm deep) filled with a Lintonia silt loam soil with pH 6.2, 1.0% OM. Established containers were randomly assigned within each block. Turf sod was harvested and soil washed from the roots. Washed sod was planted into containers and allowed to establish for six weeks before the experiment began. Fertilizer nutrients during establishment were supplied by a 400 ppm weekly application of 21-5-20 water-soluble fertilizer.

Water stress treatments were imposed on 15 January 1996 for 90 d. Leaf blades and stolons remained above the water level for waterlogged plants, and the soil line was positioned 15 cm below water surface for submerged plants to establish water stress treatments. The control plants were watered daily as needed to maintain field capacity. Vertical leaf growth was measured using a modified turfgrass disc meter (Parish et al., 1994). Grass clippings were harvested after 90 d, forced air dried at 65BC for 5 d and weighed. Leaves, roots and stolons were harvested and rinsed with distilled water.

The experimental design was a randomized complete block design with six blocks. Analysis of variance and means separation were performed separately on each species, using SAS (SAS, Institute, 1991).

Results and Discussion

The effects of water stress depend on grass species; therefore data are presented by individual grass species.

Bermudagrass. Root dry weight for all profile depths and total dry root weight were not significantly reduced by waterlogging or submergence (Table 1). Leaf blade height was greater for waterlogged treatments compared to the submerged plants. Turfgrass quality was greatest for control plants and waterlogged plants compared to the submerged plants. Stolon numbers were higher for control and waterlogged plants compared to submerged grass. Stolon length was significantly increased by waterlogging and submergence compared to the control plants.

Table 1. Bermudagrass vegetative growth response after 90 d of water stress in a greenhouse study.

Water Stress	Soil Profile Root Dry Wt. (g) 0 - 5 cm	5 - 10 cm	10 -15 cm	Total Root Dry Wt. (g)	Leaf Dry Wt. (g)	Leaf Ht. (cm)	Turf Quality[z] (1 - 9)	Stolon #	Stolon Length (cm)
Control	3.9 a	0.6 a	0.3 a	4.8 a	5.1 a	9.5 ab	7.3 a	13.8 a	4.5 b
Waterlogged	2.2 a	0.5 a	0.3 a	3.0 a	4.4 ab	13.1 a	6.5 a	12.7 a	14.8 a
Submerged	1.1 a	0.4 a	0.2 a	1.7 a	2.5 b	5.5 b	3.9 b	3.8 b	21.5 a

[z]Means within each column with the same letter are not significantly different using DMRT at the 5% level.

Table 2. Carpetgrass vegetative growth response after 90 d of water stress in a greenhouse study.

Water Stress	Soil Profile 0 - 5 cm	5 - 10 cm	10 -15 cm	Total Root Dry Wt.	Leaf Dry Wt.	Leaf Ht.	Turf Quality[z]	Stolon #	Stolon Length
	Root Dry Wt. (g)			(g)		(cm)	(1 - 9)		(cm)
Control	1.9 a	0.7 a	0.3 a	2.9 a	6.9 a	4.6 ab	6.3 a	4.8 a	9.7a
Waterlogged	1.0 a	0.4 a	0.1 a	1.4 ab	2.8 a	5.8 a	5.0 a	1.3 b	1.6 b
Submerged	0.5 a	0.1 a	0.1 a	0.7 b	1.2 b	2.5 b	2.9 b	0.0 c	0.0 c

[z]Means within each column with the same letter are not significantly different using DMRT at the 5% level.

Common carpetgrass. Carpetgrass total root dry weight in the 5 to 10 cm profile were greater for the control plants compared to the submerged plants (Table 2). Leaf dry weight was greater for control plants compared to waterlogged and submerged plants. Vegetative height for the waterlogged plants was greater than the submerged plants. Turfgrass quality was similar for the control and submerged treatments. Stolon number and length were greatest for the control plants. Waterlogged stolon count was higher than submerged grass plants.

St. Augustinegrass. Control and waterlogged root dry weights at the 0 to 5 cm and 5 to 10 cm profile depths were greater than waterlogged and submerged plants (Table 3). Total root dry weight was greatest for control plants. Leaf height was greatest for the control plants, and waterlogged plants were taller than submerged plants. Turf quality was similar for control and waterlogged plants, but greater than submerged plants. The control plants had a higher number of stolons than the submerged plants. Stolon length of control plants and waterlogged plants was greater than submerged St. Augustinegrass.

Zoysiagrass. Root dry weight at all root profile depths and total root dry weight were greatest for the control compared to waterlogged and submerged plants with the exception of the 10 to 15 cm profile, where the control was greatest (Table 4). Leaf dry weight and height were also greatest for the control treatment. Turfgrass quality was greatest for the control followed by waterlogged, and then submerged treatments. Stolon count and length were greatest for control plants compared to the submerged zoysiagrass.

Table 3. St. Augustinegrass vegetative growth response after 90 d of water stress in a greenhouse study.

Water Stress	Soil Profile 0 - 5 cm	5 - 10 cm	10 -15 cm	Total Root Dry Wt.	Leaf Dry Wt.	Leaf Ht.	Turf Quality[z]	Stolon #	Stolon Length
	Root Dry Wt. (g)			(g)•		(cm)	(1 - 9)		(cm)
Control	1.6 a	0.5 a	0.2 a	2.3 a	7.3 a	9.5 a	6.8 a	9.5 a	9.1 a
Waterlogged	1.5 a	0.3 a	0.1 b	1.9 a	5.3 a	5.7 b	6.1 a	4.3 ab	6.2 a
Submerged	0.2 b	0.1 b	0.0 b	0.3 b	1.7 b	1.7 c	3.8 b	0.0 b	0.0 b

[z]Means within each column with the same letter are not significantly different using DMRT at the 5% level.

Table 4. Zoysiagrass vegetative growth response after 90 d of water stress in a greenhouse study.

Water Stress	Soil Profile 0 - 5 cm	5 - 10 cm	10 -15 cm	Total Root Dry Wt.	Leaf Dry Wt.	Leaf Ht.	Turf Quality[z]	Stolon #	Stolon Length
	Root Dry Wt. (g)			(g)		(cm)	(1 - 9)		(cm)
Control	1.8 a	0.6 a	0.1 a	2.5 a	6.0 a	4.0 a	6.6 a	3.8 a	6.7 a
Waterlogged	1.2 b	0.1 b	0.0 b	1.2 b	3.3 b	1.7 b	3.9 b	1.3 ab	3.0 ab
Submerged	0.5 c	0.0 c	0.0 b	0.1 c	1.8 b	0.0 b	1.0 c	0.0 b	0.0 b

[z]Means within each column with the same letter are not significantly different using DMRT at the 5% level.

Conclusions

Bermudagrass turfgrass quality and stolon growth were affected by water stress. Common carpetgrass, St. Augustinegrass and zoysiagrass turf quality and vegetative growth were reduced by flooding. St. Augustinegrass and zoysiagrass root dry weight was also decreased. Zoysiagrass plants did not survive 90 d of flooding.

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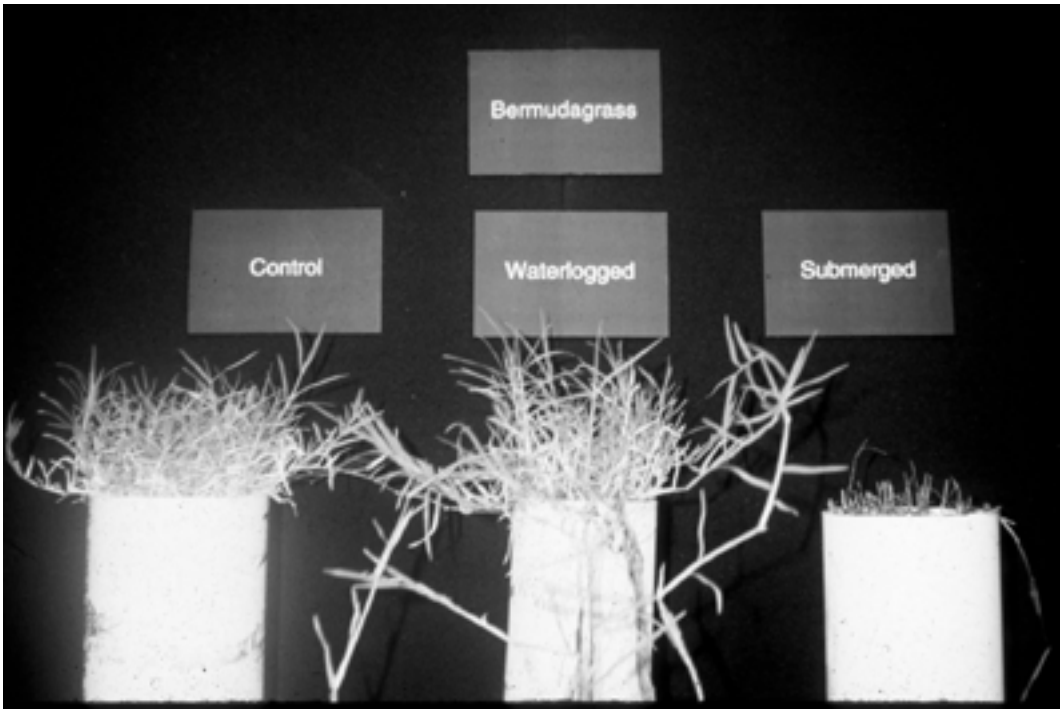

A Survey of Gingers Grown in Louisiana

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Ornamental gingers, primarily from the Zingiberaceae family, are a diverse and versatile group of plants gaining increased recognition in the flowering pot plant, landscaping and cut flower markets.

The various sizes, flower colors and post-production longevity (up to 4 weeks or longer) of these tropical and subtropical plants are adding a needed diversity to the greenhouse industry. Characteristics that make them attractive as potted plants to the floriculture industry are ease of production in the shade house or greenhouse, unique foliage, production of many flowering stems per pot, long-lasting colorful bracts, a 90- to 100-day production cycle and few disease or insect problems.

Besides potted plant use, they can be marketed for use in year-round interior landscapes and as either perennials or summer annuals in exterior landscapes, depending on the climate. The most common genera that may be used for these purposes include: *Curcuma, Globba* and *Kaempferia.*

Figure 1

Most gingers are herbaceous perennials with aromatic, short, thickened [or long, thin] rhizomes. Some of these ginger rhizomes, such as those in the genus *Curcuma* and *Globba*, have tuberous storage vessels attached by a modified underground stem that have been termed "t-roots" or "milk sacs" (Figure 1). Most of these are grown in Thailand, and rhizomes are harvested from December to April for shipment to be forced. Gingers can also be purchased in plug trays from tissue culture companies; however the *Kaempferia* spp. are the only ginger recommended for growing from a tissue-cultured plug if a finished plant is desired within 60 days.

Table 1. A botanical description of several ornamental ginger genus and species.

Species	Average Height	Inflorescence/Foliage
Cornukaempferia aurantiflora	1 foot	Leaves w/ silver feathered margins to dark maroon centers, small orange flowers
Curcuma alismatifolia	2 feet	Tulip shaped flowers, ~ 3 - 4", pink or white
Curcuma cordata	2 - 3 feet	Cone shaped flowers, ~ 4 - 5", pink
Curcuma roscoeana	2 - 3 feet	Cone shaped flowers, ~ 4 - 5", bright orange
Curcuma spp.	1 foot	Tulip shaped flowers, ~ 1 - 2", pink, pink w/green tips
Curcuma spp. 'Emperor'		Grown for variagated foliage and smaller tulip shaped white flowers
Curcuma thorellii 'Chiang Mai Snow'	1 foot	Tulip shaped flowers, ~ 2 - 3", pure white
Globba spp.	2 feet	Arching pendulate flower stalks with white, pink, dark purple, or yellow bracts
Kaempferia spp.		Grown primarily for foliage
K. gangla	lay flat	Foliage plain green with some varigation, small white flowers
K. gilbertii '3-D'	6 inches	Foliage with white margin, deep green stripes in center of leaves, small white flowers
K. sp. 'Grande'	2 - 3 foot	Foliage rounded and large with pattern upper and maroon underside
K. pulchra		
'Bronze Peacock'	6 inches	Leaves lanceolate, purple/silver variagation with bronze back
'Silverspot'	6 inches	Leaves lanceolate with silver variagation with small pink flowers
'Raven'	6 inches	Leaves lanceolate with striking silver feather and maroon underside

Those grown for flowering pot plants (see Table 1) will flower more quickly and uniformly if grown from rhizomes. If tissue-cultured plants are purchased, a fuller plant can be grown if plants are allowed to go dormant in the fall by withholding

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water as the days grow shorter and temperatures drop. Many growers then remove the dead foliage and force the ginger rhizomes in the same container the next spring — some time after February.

Once ginger rhizomes are received, they should be unpacked and inspected for damage or disease as one would any other bulbous crop. Rhizomes should be planted immediately after shipment. If they must be stored for a short period, they should be kept in cool, dry and dark storage. The longer the rhizomes are stored, the less time it takes for emergence.

As with most bulbous crops, the medium should have excellent drainage and water-holding capacity. We prefer medium that has a 50 percent peat, 40 percent pine bark, 10 percent perlite with a starter fertilizer incorporated. The soils of the native habitat of these gingers have a neutral to basic pH, so dolomitic limestone should be added to the medium to provide a pH of 7 to 7.5.

A standard container or deeper pot will provide for the best drainage and also provide room for placing the tuberous roots attached to the rhizome toward the bottom of the pot while covering the top of the rhizome with approximately 1inch of medium. Breaking the tuberous roots from the rhizome may decrease flowering and delay time to emergence. Thus, care should be taken to keep the entire tuberous root intact. A two or three-year-old rhizome planted in a 6-inch pot will produce a marketable finished plant.

Some companies do grade the rhizomes. The grading system is usually based on the number of tuberous roots per rhizome. After the initial irrigation, plants should be given a preventative fungicide treatment. Greenhouse temperatures should be kept at 85 to 90 degrees F until emergence of shoots. This will help provide for a more uniform emergence.

Figure 2

Figure 3

After emergence, lower greenhouse temperatures to less than 85 degrees F. Some gingers are boron accumulators, which may lead to marginal necrosis. Therefore plants should be fertilized with a water-soluble fertilizer low in boron or without boron such as a tropical foliage fertilizer.

For production of brightly colored bracts and deep green leaves, the 'Surprise Ginger' including *Curcuma alismatifolia*, *Curcuma cordata*, *Curcuma roscoeana* and *Curcuma thorellii* should be grown in full sun. If these species are grown under shaded conditions, the flower stems and petioles tend to elongate and topple. The bracts of the inflorescence tend to fade, and postproduction longevity is shortened. *Curcuma alismatifolia* (Figure 2) and *C. thorellii* (Figure 3) will produce a flower approximately 60 days after emergence and every 30 thereafter during the summer. *Curcuma cordata* (Figure 4) and *C. roscoeana* will produce

Figure 4

two to four large flowers during the growing season.

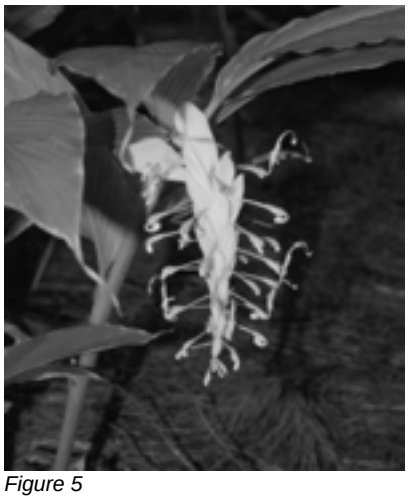

Figure 5

Most all *Globba* species and *Curcuma gracillima* grow best and flower under 30 percent shade. *Globba* species, commonly called 'Dancing Ladies,'produce flowers at the end of emerging shoots and will continue to do so during the growing season. Gingers of the genus *Globba* have reflexed bracts that are white, pink, mauve, yellow or purple with a slender, curved, yellow corolla (Figure 5). *Curcuma gracillima* produce a single inflorescence emerging from the rhizome, and it may be several months before another emerges (Figure 6).

Figure 6

The *Kaempferia* spp. are grown primarily for their beautiful foliage (Table 1). Most *Kaempferia* have a silver feather pattern in the middle of the upper side of the leaf radiating outward with various shades of green (Figure 7). Others, such as *Kaempferia gilbertii* '3 D,' have a white margin on a deep green leaf. The *Cornukaempferia aurantiflora* has a silver feather pattern on the outer edge of the leaf with a deep maroon underside . Most of the *Kaempferia* spp. produce small white, pink or orange flowers and bloom sporadically throughout the growing season. These gingers grow best under 30 percent shade or more.

As day length decreases (less than 12 hrs) and temperatures drop, flowering will cease and the plants will go dormant. As mentioned earlier, these plants can be stored dry during the winter and forced again some time after February.

Dr. Kuehny at the LSU AgCenter and Dr. Criley at the University of Hawaii are conducting studies to provide production protocols for enhancing the production of many of the gingers described in this article.

Figure 7

Acknowledgments

The author would like to thank the Fred C. Gloeckner Foundation and the American Floral Endowment for supporting some of the research that helped provide information for this article and the assistance of Mauricio Sarmiento, Maria Piler Paz and Patricia C. Branch in conducting that research.

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Ginger Sources for the Nursery Industry

AgriStarts IV Inc., 1728 Kelly Park Road, Apopka, FL 32712, 352-589-1897, www.agristarts.com.

Bill Moore and Co., 800-237-7794.

ForemostCo Inc., 8457 NW 66th Street, Miami, FL 33166, 800-456-5040, www.formostco.com.

Jungle Jewels, Hawaii, P.O. Box 4245, Hilo, HI 96720; phone/fax (808) 959-6306.

Dealing with Hollow Trees

Drew Bates[1]

There are many old trees in Louisiana with large cavities or hollow trunks. What to do about this condition is the concern of many people who want to provide the best care possible for their valued assets. The filling of tree cavities was once thought to be a proper procedure for reinforcing what appeared to be a structural weakness, but recent research indicates that filling cavities rarely benefits trees.

Tree cavities are generally the result of an old wound. Broken branches, improper pruning, lightning, brush fires and mechanical injury from machinery are common causes leading to cavity formation. The best approach to preventing tree cavities is to encourage vigor by performing proper pruning and wound repair when it is first noticed. Trees with old wounds are usually irreparable, but a few things can be done to reduce disease progression.

Trees respond to decay and other invading organisms by isolating the damaged area with a concentration of waxes, resins and oils in the surrounding cells. Beyond maintaining good health and vigor, there is no effective way to enhance the trees' natural ability to resist decay. In fact, most treatments are not only ineffective, but may actually contribute to further decay by causing physical damage.

Sealing paints and expanding foams should never be used in a cavity because they tend to crack and hold water against the wood. Disease organisms will proliferate beneath these materials, causing rot and further decay. Additionally, the problem with traditional fill materials (cement, asphalt, masonry, rocks or gravel) is that they are abrasive. When a tree sways and twists in the wind, these materials rub and break the tree's defensive walls, allowing decay to expand.

Filling tree cavities should not be considered a reliable method to strengthen or prolong the life of a tree. The best thing you can do is keep moisture-holding debris, like leaves, out of the cavity and gently scrape out any wood that is soft or decayed. It is also a good idea to check the tree periodically for termites or ants and treat with an appropriate insecticide. A licensed professional arborist can evaluate your trees for structural defects and make recommendations to remedy problems that may be hazardous.

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Landscape Performance of Miniature and Dwarf Crape Myrtle Cultivars

Allen Owings[1], Edward Bush[2],
Drew Bates[3] and Gordon Holcomb[4]

The LSU AgCenter has been actively involved in landscape evaluation of ornamental plant material for a number of years. This work provides recommendations for county agents and green industry professionals (landscape contractors, retail garden centers) to use when working with gardening consumers. One group of plants that has generated considerable interests recently has been crape myrtles.

'Sioux' crape myrtle

In Louisiana and across the southeastern United States, crape myrtles are the most popular and widely used summer flowering tree for residential and commercial landscapes. Many of us are familiar with the traditional upright growing crape myrtles available (10 to 30 feet). These include 'Natchez' (white) and 'Tuscarora' (dark pink), along with other newer cultivars, in addition to old cultivars such as 'Watermelon Red' (dark pink).

We also need to be aware, however, that miniature and dwarf size crape myrtles are also available for landscape use. Industry standards generally classify miniature crape myrtles as having a mature height of 3 feet or less and dwarf crape myrtles as being 3 to 6 feet tall at maturity.

Miniature and dwarf cultivars of crape myrtle (*Lagerstroemia indica* and *L. indica* x *fauriei*) were evaluated in LSU AgCenter studies during the 1999 and 2000 growing seasons. Cultivars evaluated in our studies included the Louisiana releases from plant breeder David Chopin that date to the late 1970s and early 1980s and new cultivars from the U.S. National Arboretum, a USDA evaluation facility in Beltsville, Md.

The primary objective in these trials was the evaluation of these miniature and dwarf crape myrtle cultivars for growth habit, flowering performance, winter damage and disease susceptibility. Two-gallon containers of 'Pixie White' (white flowers), 'Delta Blush' (pink), 'Baton Rouge' (deep red), 'Mardi Gras' (purple), 'New Orleans' (purple), 'Lafayette' (white with lavender), 'Pink Blush' (light pink), 'Purple Velvet' (deep purple), 'Orlando' (lavender), 'World's Fair' (deep red), 'Bicolor' (pink with white), 'Sacramento' (red), 'Cordon Bleu' (lavender), 'Houston'(watermelon red), 'Chickasaw' (pink lavender) and 'Pocomoke' (deep rose pink) were planted in raised beds 4 feet apart on October 30, 1998, at Burden Center in Baton Rouge. In the nursery trade, 'Baton Rouge' is also referred to as 'Beverly' and 'New Orleans' is also known as 'Passion.' Another name for 'Cordon Bleu' is 'Louisa' and 'Delta Blush' is also known as 'Pink

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Blush' although it is not the same as the 'Pink Blush' previously listed.

Plants were replicated in a randomized complete block design. The raised beds were comprised of an Olivier silt loam soil amended with aged pine bark and composted rice hulls. The beds were located in full sun, and plants received irrigation via drip application as needed throughout the growing season. Plants were mulched annually with 2 inches of baled pine straw.

Crape myrtles were fertilized annually in early spring (each April) with StaGreen Nursery Special 12-6-6 at the rate of 1 lb. N/1000 ft^2 of bed area and in mid-summer (early July) with StaGreen Nursery Special 12-6-6 at the rate of 0.5 lb. N/1000 ft^2 of bed area. Plants were not pruned (other than to remove winter-damaged stems) or dead-heading (flower removal) during the evaluation period, and no fungicides or insecticides were applied for disease or insect control, respectively. Weed control was accomplished with mulch, spot applications of Roundup and pre-emergent applications of Surflan.

Data collected during the 1999 to 2000 evaluation period included plant height, date of first flower, visual quality ratings and susceptibility to *Cercospora* leaf spot and powdery mildew. Leaf spot and powdery mildew are the two primary diseases affecting crape myrtles in Louisiana. Visual quality ratings were conducted monthly during the growing season and were based on a scale from 1 to 9, where 1=dead/unacceptable landscape performance, 3=below average landscape performance, 5=average landscape performance, 7=above average landscape performance and 9=superior landscape performance. Criteria included in visual quality ratings were a combination of growth habit, visual aesthetics, flowering and pest presence. Plant height was measured from ground level to top of tallest shoot in July of each year. Disease evaluations were conducted when diseases were the most prevalent (normally mid-spring through early summer).

Observations from 1999 and 2000 evaluations indicated that the most ideal growth habit and foliage characteristics (weeping/cascading, compactness, red foliage) were found for 'New Orleans,' 'Sacramento,' 'World's Fair' and 'Houston.' These plants also had some of the higher visual quality ratings. A desirable visual quality rating was also achieved for 'Pixie White.'

Flowering began as early as April 29 or as late as early June. 'Cordon Bleu' was the first cultivar to flower in 1999 and 2000. Other early flowering cultivars were 'Pixie White,' 'Lafayette' and 'Purple Velvet.' 'Chickasaw' and 'Pocomoke,' new cultivars released from the U.S. National Arboretum in the last five years, were among the later flowering cultivars. Flowering generally terminated by mid/late August. Typically, flowering time for dwarf and miniature crape myrtles is equal to, and in some cases earlier and longer than, traditional intermediate and tall growing crape myrtles.

With the use and promotion of miniature and dwarf crape myrtles, there are always questions as to their true mature height. 'Chickasaw' and 'Pocomoke' are truly miniature. They have the shape of a dwarf yaupon and reached heights of only 15 to18 inches after two growing seasons. These plants are advertised to have mature heights of 2 to 3 feet. Plant height after 2 years in the landscape of the other crape myrtles ranged from 20 to 52 inches, with 'Bicolor' and 'Pixie White' being the tallest growing.

Powdery mildew was not observed in the landscape plantings in 1999 but was observed in early May 2000. Slightly susceptible cultivars were 'Pixie White' and 'Bicolor.' 'Baton Rouge' and 'Purple Velvet' were moderately susceptible to powdery mildew. Approximately 1% to 10% of foliage on 'Cordon Bleu,' 'Delta Blush' and 'Pixie White' had *Cercospora* leaf spot in June 2000. In rainy years, leaf spot can cause significant defoliation when not prevented or controlled.

Some concern exists among green industry professionals pertaining to the cold hardiness of miniature and dwarf crape myrtles. In our studies, dieback caused by winter damage was observed on a number of cultivars. Major plant dieback (40% to 50% of stem growth) occurred on 'Baton Rouge,' 'Orlando,' 'Mardi Gras,' 'World's Fair,' 'Houston'and 'Lafayette.' 'Chickasaw' had 40% dieback in the winter of 1999-2000, and 'Pocomoke' had 15% dieback.

In conclusion, it is evident from these studies and consumer interest that miniature and dwarf crape myrtles have potential for increased use in Louisiana landscapes. Wholesale nurseries have limited inventory of these plants but have been increasing production and the numbers of cultivars grown over the last two to three years. Plants are available at retail garden centers during the late spring and early summer. Our observations indicate that 'Chickasaw,' 'Pocomoke,' 'Sacramento,' 'Houston,' 'New Orleans' and 'World's Fair' have the most positive landscape attributes.