SECTION 10
LANDSCAPE

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The *Magnolia* Family - Observations and Recommendations for Nursery and Landscape Use from the NCSU Arboretum

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Nature of Work: The Magnolia family is one of the oldest (over 100 million years) and most primitive of flowering plant groups, evolving from conifers with many similarities in the fruit of the two groups. It contains an important group of plants in the nursery and landscape industry with 9 genera existing which encompass over 200 wild species and innumerable selections and hybrids (1, 3, 5, 6, 7, 9, 11). The genera include *Alcimandra, Aromadendron, Elmerrillia, Kmeria, Liriodendron, Magnolia, Manglietia, Michelia, Pachylarnax* and *Talauma.* The NCSU Arboretum contains one of the largest collections of Magnolia taxa in the U.S. with over 200 types in the collection, and an excellent assortment of the hardy members of the other, more obscure genera.

Results and Discussion: The following listing discusses the Magnolia family with attention to some of the plants in our collection which are of interest or have commercial nursery potential.

Alcimandra - 1 species from the Himalayas - likely not in U. S. cultivation nor hardy.

Aromadendron - 2 species of tropical trees from Malaysia - likely not in U.S. cultivation nor hardy.

Elmerrillia - 4 species of tropical trees from Malaysia - likely not in U.S. cultivation nor hardy.

Kmeria - 2 species of sub-tropical trees from southeast Asia; likely not in U.S. cultivation nor hardy.

Liriodendron - 2 species of temperate zone trees - *L. tulipifera* from the southeastern U.S. and a similar species, *L. chinensis* from Asia. Both are in cultivation, a hybrid between them exists, and over a dozen cultivars have been selected of the American Tulip Tree. Perhaps the most potentially useful in the NCSU collection would include 'Arnold' and 'Fastigata' - columnar habit; 'Aureomarginatum' - golden variegated foliage; and 'Compactum' - a smaller and slower growing selection. Species are seed propagated; cultivars by budding or grafting on seedling understock (4).

Magnolia - About 80 species of trees and shrubs from southeastern U.S. and southeastern Asia - long cultivated for their spectacular flowers and often dramatic foliage with much hybridization and cultivar selection over the last 3 centuries. The current checklist of *Magnolia* taxa is over 100 pages in length. Over 200 taxa are included in the NCSU Arboretum collections. Over 140 taxa in England (10) and 464 taxa in the U.S. (8) are reported for commercial sale in 1996. Selected forms for discussion from the NCSU Arboretum follow:

M. ashei - huge spectacular foliage on smaller plant - usually 5-10' in height; seedlings bloom with 1' diameter flowers when only 2' tall; excellent for providing a "tropical" effect. Native to southeast U.S.

M. denudata - spectacular flowers, but very early & often frosted - best in light woods canopy for frost protection. 'Forrest's Pink' is rare; showy - propagated by grafting.

M. grandiflora - huge numbers of cultivars coming now. 'Little Gem' is not dwarf - but very long flowering;

'Hasse' is tightly columnar - difficult to propagate; 'Edith Bogue' - hardy for northern markets.

M. kobus 'Wada's Memory' - perhaps our most strongly recommended for a commercial street/shade tree. Flowers are white and not particularly elegant - though showy; but perhaps the best foliage and tree shape of the genus. Excellent form without pruning.

M. stellata - early and more shrub-like than most; 'Centennial' the most cold hardy; 'Jane Platt' and 'Chrysanthemumiflora' with very showy flowers.

M. tamaulapina - new evergreen species from Mexico; proving hardy in Raleigh; sculptural flowers.

M. virginiana - "Sweetbay Magnolia" - native; widely varied; cutivar production needed in south to match that of *M. grandiflora* of the last decade. 'Green Bay' (Don Shadow), 'Willowleaf' (Larry Lowman), and 'Santa Rosa' (Woodlanders) have been the most dependably evergreen types for us. 'Dodd's Dwarf' is the only truly smaller magnolia - potential for bonsai, patio tubs; high-grafted standards.

M. X 'Elizabeth' - deciduous, the first of the hybrid "yellow" magnolias - creamy yellow and very attractive; many other cultivars now entering market - will take time to sort them out; largest supplier is perhaps Briggs Nursery in Olympia, WA doing them from tissue culture.

M. X 'Galaxy' and 'Spectrum' - deciduous hybrids from the U.S. National Arboretum - both have excellent form with good straight trunks easily produced; we recommend them highly for commercial landscape use as good trees.

M. X loebneri 'Merrill' - deciduous tree with very fast growth, early flowering that is more frost resistant than most - spectacular flower displays almost every year; nice grown multitrunked.

M. X 'Vulcan' - new deciduous tree cultivar from New Zealand which has not yet flowered in the U.S. though being sold here - much interest among Magnoliaphiles with a reputation of being the closest to red of any Magnolia developed yet - the photos look exciting - but only time will tell if it lives up to reputation.

Manglietia - 25 species of trees and shrubs from China, the Himalayas, to Malaysia. None have been been used in mainstream horticulture in the U.S. and none are listed for sale in England - but trials in the Arboretum of a number of species now coming into this country from China and Japan show considerable potential. In May 1995, *M. yunnanensis* flowered for the first time in The NCSU Arboretum with showy white

flowers 3-4" in diameter with bright red stamens. Our 14' tree has attractive symmetrical shape, dependable evergreen foliage with long narrow leaves; and has potential for commercial production if propagation techniques can be worked out. To date we have not been able to root this species from cuttings. Our trials show it can be budded or grafted to *Magnolia grandiflora* or *M. kobus* understock. We have *M. insignis* which is reported to have pink flowers but it has not yet flowered for us. Several other species are now in trials.

Michelia - 45 species of trees and shrubs from China, southeast Asia, India and Ceylon - from widely varied habitats and with widely varied characteristics - most are evergreen species. In the U.S. - *M. figo* (banana shrub) has long been cultivated in the southeastern U.S. - useful in USDA Zones 7-9 and reaching 25' with age. 'Port Wine' and 'Stubb's Purple' are two cultivars of this species with a purple edge to each flower petal - and are likely an identical single clone which has been renamed with a second name. *M. doltsopa* is a magnificent large tree with large foliage and spectacular flowers - unfortunately useful only in milder climates of the west coast - particularly good in San Francisco. We have not seen it successfully grown in the Carolinas to date. Hybrids between these two species havebeen made and are generally listed under the heading of *M. X foggii*. We have several of these in the lathhouse of varying hardiness and potential for use.

Two newer accessions which show promise after this last extremely cold winter are *M. maudiae* and *M. yunnanensis* - neither is old enough to have flowr is old enough to have flowered for us at this point. The latter species is in production in New Zealand where it is rated highly as a compact spreading evergreen shrub with showy flowers. Most *Michelia* species are relatively easy to root from cuttings (*M. doltsopa* is an exception). The large genus warrents collection of many more of the uncultivated species and evaluation of the potentials for further hybridization.

Pachylarnax - 2 species of tropical trees from Malaysia - unlikely in U. S. cultivation and neither is hardy.

Talauma - 40 species of sub-tropical and tropical trees from the Americas and southeast Asia - few are in cultivation (some are grown in Los Angeles/San Francisco); unlikely any hardy in the Carolinas.

Significance to the Industry: Growers should make every attempt to secure and propagate superior, known cultivar clones of Magnolia to replace many of the poorly identified and inferior flower types currently being sold (4). A new comprehensive book devoted to *Magnolias* (2) is now available and should be utilized for detailed understanding of this group of horticulturally important flowering trees. Greater use should be made of selected taxa in the *Manglietia* and *Michelia* genera which have significant promise for commercial use. A listing of 32 *Magnolia* production nurseries for sources of potential stock plants is available from the: The Magnolia Society, Roberta Davids Hagen, 6616 81st St., Cabin John, MD 20818 USA (301-320-4296).

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Evaluation of Crape Myrtle Cultivars in North Florida

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Nature of Work: Crape myrtle, *Lagerstroemia* species, is a widely used shrub or small tree valued for its summer flowers, autumn color, and ornamental bark. Crape myrtle is adapted to USDA Zones 7 to 9, although some cultivars may survive in Zone 6b (Davis and Fare, 1995).

Breeding and selection programs at the U.S. National Arboretum and elsewhere have released dozens of cultivars with landscape uses ranging from trees to hanging baskets. With so many new cultivars available, growers, landscapers and consumers are faced with a wide array of crape myrtle cultivars from which to choose.

A planting of *Lagerstroemia* cultivars was established at the University of Florida's North Florida Research and Education Center (NFREC) in Monticello, Florida. New cultivars are being evaluated and compared with older cultivars for pest susceptibility, flowering, growth, and overall adaptability to the Deep South (USDA Zone 8b). Initial plantings of 34 crape myrtle cultivars were established between 1987 and 1990 (Table 1). Since then, 43 additional taxa have been added to the planting, including the Chica™) series, the "Petite" series, and most of the remaining cultivars released by the U.S. National Arboretum.

The NFREC-Monticello is located 25 miles east of Tallahassee, Florida, about 10 miles due south of the Florida-Georgia border and about 30 miles due north of the Gulf of Mexico. Annual rainfall averages about 56 inches, with much of it falling from June through September. Mean high temperatures range from 63 F in January to 91 F in July, and mean low temperatures range from 39 F in January to 69 F in August.

The evaluation planting is located on two sites having fine sand soils with low fertility and slightly acid pH. Four plants of each cultivar were planted in a random arrangement within each size group (two plants per cultivar at each planting site). Plants are being evaluated under low maintenance conditions. Plots are mulched with 3 inches of coarse pine bark and were fertilized in 1989 and 1990 at a rate of 2 pounds of actual nitrogen per 1000 square feet per year. Plants are not irrigated except after planting. Plants have been pruned once to remove dead wood, crossing branches, and to establish a multi-stem form.

Data are collected annually on plant height and width, flowering date and duration, and number of panicles at peak bloom. Other characteristics such as bark color and autumn color also are noted. In addition, cultivars are evaluated for resistance to crapemyrtle aphid and powdery mildew (Knox et al., 1993).

Results and Discussion: Table 2 lists recommended cultivars and their characteristics based on our evaluations of the cultivars listed in Table 1 (those planted before 1990). Please keep in mind that, being in the Deep South, plants have not been evaluated for cold hardiness. Also, some cultivars may have slightly different characteristics in other climatic zones or under higher maintenance regimes.

Significance to Industry: Nurserymen and landscapers will achieve a greater level of consumer satisfaction if superior cultivars of crape myrtles are identified, grown and used.

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Table 1. Cultivars by Size Group planted at the University of Florida's North Florida Research and Education Center (NFREC) in Monticello, Florida, between 1987 and 1990 (USDA Hardiness Zone 8b).

Small Shrub <4 feet in 5 years)	Medium Shrub (4 - 12 feet 10 years)	Large Shrub/ Patio Tree (12 - 20 feet in 10 years)	Tree (>20 feet)
Bourbon Street	Acoma	Apalachee	Biloxi
Delta Blush	Baton Rouge[1]	Comanche	Byers Wonderful White
Lafayette	Bayou Marie[1]	Country Red	Carolina Beauty
New Orleans	Cordon Bleu[1]	Hopi	Dallas Red
Victor	Hope	Lipan	Miami
	Pecos	Near East	Natchez
	Royalty	Osage	Potomac
	Tonto	Regel Red	Tuscarora
	Zuni	Seminole	Tuskegee
		Sioux	Twilight
		Yuma	

[1]Originally considered a "Small Shrub" but reclassified to "Medium Shrub" when growth exceeded 4 feet after 5 years.

Table 2. Recommended cultivars by Size Group from the evaluation planting at the University of Florida's NFREC in Monticello, Florida (USDA Hardiness Zone 8b).

Size Group	Cultivar	Flower Color	Mildew Resist?	Comments
Small Shrub (less than 4 feet after 5 years)	Delta Blush	Pink	No	Starts blooming late May
	New Orleans	Purple	No	Glossy leaves on a wide-spreading plant
	Victor	Red	No	Upright habit; excellent red flower color
Medium Shrub (less 12 feet after 10 years)	Acoma	White	Yes	Horizontal branching han than habit is very distinctive; cream-colored bark
	Pecos	Dark Pink	Yes	Vase-shaped habit; attractive red-brown bark
	Tonto	Red	Yes	Best red-flowering hybrid; rounded habit
Large Shrub/Patio Tree (between 12 and 20 feet after 10 years)	Apalachee	Lavender	Yes	Beautiful cinnamon-brown bark; flowers are faintly fragrant; seed capsules persist and add winter interest
	Osage	Pink	Yes	Glossy leaves and a broad-rounded form; rich red-brown bark
	Sioux Pink	Medium	Yes	Distinct upright, narrow habit; great flowers
Tree (over 20 feet 10 years)	Biloxi	Pale Pink	Yes	Outstanding rich brown after bark; vase-shaped habit and an open canopy
	Miami	Dark Pink	Yes	Chestnut-brown bark; good orange fall color
	Natchez	White	Yes	Outstanding cinnamon-brown bark; early blooming; becoming overused in the landscape

Spring Selection of Bedding Plants to Compliment Summer Blooming Trees

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Nature of Work: Three hundred-plus varieties of annuals being evaluated in the 1995 UGA Annual Trials by Armitage, *et al,* (1) were compared with the blossoms of 17 crepe myrtle cultivars. The method of evaluation entailed placing a flower panicle of each crepe myrtle cultivar next to a representative plant of each annual in the trials. Evaluations were not replicated. See Table 1 for list of crepe myrtle cultivars.

Results and Discussion: The darkened squares of Table 1 indicate the instances of greatest color compatbility. A mapnty of the annuals in the 1995 trials did not measure up to the evaluators' criteria and consequently were omitted from Table 1. For a complete listing of findings, please contact the authors.

Significance to the Industry: The value of bedding plant sales in garden center sales volumes is significant (2). Assisting customers with the selection of annual bedding plants and appropriate companion plants for spring and summer floral effect should be typical information a customer should be able to expect from a full-service nursery or garden center.

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Table 1.

	Acoma	Apalachee	Biloxi	Fantasy	Hopi	Lipan	Miami	Natchez	Osage	Pecos	Sioux	Tonto	Tuskegee	Wichita	William Tolvey	Yuma	Zuni
Ageranium																	
Blue Blanket (Blue)	■			■								■				■	
White Hawaii (White)			■			■					■	■					
Begonia																	
Alfa Bicolor (Bicolor)	■		■			■		■			■	■					
Ambassador Bicolor (Bicolor)	■							■				■					
Rum (Bicolor)	■											■					
Ambasador Coral (Coral)	■																
Ambassador Pink (Pink)	■					■						■	■		■		
Brandy (Pink)	■						■								■		
Olympia Pink (Pink)	■				■		■					■	■		■		
Baron Red (Red)	■																
Vision Red (Red)	■																
All Round Green Leaf Dark Rose (Rose)	■								■	■					■		
Baron Rose (Rose)	■								■	■							
Party Girl (Rose)	■														■		
Varsity Deep Rose (Rose)	■																
Vision Salmon (Salmon)	■																
Olympia Salmon Scarlet (Salmon)	■																
Alfa Scarlet (Scarlet)	■																
Varsity Bright Scarlet (Scarlet)	■																
Varsity Scarlet (Scarlet)	■																
All Round Green Leaf White (White)			■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Party Dress (White)								■									
Victory White (White)			■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Dianthus																	
Ideal Violet Picotee (Purple/Violet)	■																
Ideal Cherry (Red)	■																
Telstar Crimson (Red)	■																
Geranium																	
Designer Lilac Chiffon (Lilac/Violet)	■																
Gypsy (Lilac/Violet)	■							■									
Designer Pink Parfait (Pink)	■																
Maverick Star (Pink)	■																

Table 1. Continued

	Acoma	Apalachee	Biloxi	Fantasy	Hopi	Lipan	Miami	Natchez	Osage	Pecos	Sioux	Tonto	Tuskegee	Wichita	William Toovey	Yuma	Zuni
Geranium																	
Designer Bright Red (Red/Scarlet)																	
Designer Bright Scarlet (Red/Scarlet)																	
Designer Scarlet (Red/Scarlet)																	
Ringo 2000 Red (Red/Scarlet)																	
American Deep Rose (Rose)																	
Dynamo Rose (Rose)																	
Pinto Rose (Rose)																	
Morning Mist (Salmon/Coral)																	
Lucille (Salmon/Coral)																	
Showcase Light Salmon (Salmon/Coral)																	
North Star (White)																	
Gomphrena																	
Bicolor Rose (Bicolor)																	
Impatiens																	
High Energy Dazzler Blush (Blush)																	
Impulse Lilac (Lilac)																	
Deco Orange (Orange)																	
Tempo Pink Frost (Pink)																	
High Energy Dazzler Punch (Punch)																	
Impulse Bright Red (Red)																	
Deco Rose (Rose)																	
Impulse Salmon Orange (Salmon)																	
High Energy Dazzler White (White)																	
Neon White (White)																	
Marigold																	
Bonanza Flame Improved (Bicolor)																	
Antigua Gold (Gold)																	
Bonanza Gold Improved (Gold)																	
All Seasons Discovery Orange (Orange)																	
Antigua Orange (Orange)																	
Janie Deep Orange (Orange)																	
Marvel Orange (Orange)																	
Antigua Primrose (Primrose)																	
Antigua Yellow (Yellow)																	

Table 1. Continued

	Acoma	Apalachee	Biloxi	Fantasy	Hopi	Lipan	Miami	Natchez	Osage	Pecos	Sioux	Tonto	Tuskegee	Wichita	William Toovey	Yuma	Zuni
Marigold																	
Safari Yellow (Yellow)	■													■			
Nicotiana																	
Havana White (White)			■			■		■	■		■	■	■	■	■	■	
Petunia																	
Blue Carpet (Blue)	■																
Primetime Mid Blue (Blue)	■																
Sky Blue Carpet (Blue)	■																
Double Madness Burgundy (Burgundy)	■																
Butter Cream Carpet (Cream)								■	■			■	■			■	
Lavender Storm (Lavender)	■																■
Celebrity Lilac Morn (Lilac)	■					■								■			
Merlin Pink (Pink)	■																
Pink Dreams (Pink)	■						■										
Primetime Pink Morn (Pink)	■																
Spring Fever Pink (Pink)	■						■						■				■
Celebrity Red (Red)	■																
Merlin Red Picotee (Red)	■												■		■		
Primetime Scarlet (Red)	■																
Purple Wave (Rose)	■																
Rose Madness (Rose)	■																
Spring Fever Rose (Rose)	■																
Primetime Salmon Morn (Salmon)	■						■		■	■	■				■		
Merlin Salmon (Salmon)	■														■		
Celebrity White (White)	■	■	■		■	■		■	■	■	■	■	■	■	■		■
White Madness (White)	■	■	■		■	■		■	■	■	■	■	■	■	■		■
Snapdragon																	
Longshot Purple and White (Bicolor)	■								■			■	■	■	■		
Longshot Silver and Black (Bicolor)	■																
Floral Showers Deep Bronze (Bronze)	■																
Pink Bells (Pink)	■																
Red Bells (Red)	■																
Rose Bells (Rose)	■																
White Chimes (White)	■																
Vinca																	

Table 1. Continued

Vinca	Acoma	Apalachee	Biloxi	Fantasy	Hopi	Lipan	Miami	Natchez	Osage	Pecos	Sioux	Tonto	Tuskegee	Wichita	William Toovey	Yuma	Zuni
Pacifica Lilac (Lilac)																	
Pink Cooler (Pink)																	
Pacifica Punch (Rose)																	
Rose Cooler (Rose)																	
Pacifica White (White)																	

Pest Resistant Shrub Roses: The Rest of the Story

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Nature of Work: A no spray rose trial was established at the Mountain Horticultural Crops Research and Extension Center, Fletcher, NC in 1994. An average of 1.32 in. of rainfall per week during that rainy growing season (April through October) was recorded. Results from this trial were presented at the 1995 Southern Nurserymen's Association Research Conference (Bir).

Canes of roses in this trial were pruned to a length of approximately 15 inches in early March 1995 with weakest canes removed. Thereafter, the test was continued under the same cultural conditions reported earlier.

Results and Discussion: Very little disease was experienced during the 1994 growing season. However, April through October 1995 was even wetter than 1994 with an average of 1.36 in. of rainfall per week. Infestations of blackspot (*Diplocarpon rosae*) and *Cercospora* leaf spot became a major problem on some cultivars while adjacent plants of other cultivars, often with foliage touching, remained free of disease.

The only insect pest noted was Japanese beetle. Only one cultivar, 'Sarah van Fleet,' had foliage damaged by Japanese beetle. Three cultivars, all with white flowers, had petals damaged by Japanese beetles. These cultivars were 'Albo-plena,' 'Blanc Double de Coubert,' and 'Rugosa alba' with the most damage on 'Rugosa alba.'

Powdery mildew (*Erysiphe cicharocearum*) was a problem only on 'Sarah van Fleet.' Petal blight (*Botrytis cinerea*) was an occasional problem on 'Linda Campbell' and a continuing problem on 'Roserarie de la Hay'. None of the other cultivars displayed symptoms of either of these disease problems.

The major disease problem of roses in the humid southeastern United States is blackspot (Dirr). This, as well as a leafspot caused by *Cercospora sp.*, infested five cultivars, two of which were so severely affected as to be mostly defoliated by early September 1995. All of the Meidiland roses in the test, 'Alba Meidiland,' 'Bonica,' 'Pink Meidiland' and 'Scarlet Meidiland' plus 'Linda Campbell' were susceptible to blackspot. 'Linda Campbell' and 'Pink Meidiland' were nearly without leaves by the end of the 1995 growing season. These same cultivars were all susceptible to the *Cercospora* leaf spot, which developed about mid-season in 1995. 'Bonica' was slightly affected. 'Alba' and 'Scarlet Meidliland' displayed the leafspot at an intermediate level but continued to be vigorous growers. 'Linda Campbell' and 'Pink Meidiland' were most susceptible to this leafspot as well as blackspot.

Significance to the Industry: Shrub roses are being touted to the gardening public as excellent choices for reducing pesticide use in the garden while still enjoying beautiful flowers (Springer, Verrier 1996). Unlike many other shrub roses, all of the cultivars in this trial were repeat bloomers. One, 'Fru Dagmar Hastrup' produced at least three distinct crops of pink flowers followed by large, scarlet hips so that flowers and hips were prominent at the same time in mid summer.

Pests were demonstrated to be a problem on some shrub rose cultivars in this test. In areas of the southeast prone to regular rainfall and high humidity 'Rosarie de la Hay' should be avoided since it is petal blight prone. 'Linda Campbell' and 'Pink Meidiland' should similarly be avoided in areas where blackspot and *Cercospora* leaf spot are a problem. 'Bonica,' 'Alba Meidiland' and 'Scarlet Meidiland' were susceptible to both of these diseases but continued to be vigorous growers displaying good resistance under conditions highly favorable to disease development. 'Sarah van Fleet' had occasional infestations of Japanese beetle and powdery mildew but these were only an irregular nuisance.

The following cultivars had only minor pests or no pest problems at all: 'Albo-plena,' 'Blanc Double de Coubert,' 'Fru Dagmar Hastrup,' 'Rugosa alba,' and 'Topaz Jewel.' 'Topaz Jewel,' which is allegedly of questionable hardiness (Verrier 1991), survived 0 F. with no protection and displayed no injury.

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Streptocarpus and Hiemalis Begonia in Coir-Amended Landscapes

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Georgia

Nature of Work: Several large growers have expressed interest in marketing streptocarpus (*Streptocarpus johannis*) and Hiemalis begonias (*Begonia X hiemalis* Fotsch.) as plant materials for shaded landscapes in the southeast. Similar interest was expressed in utilizing coir, coconut pith, as a landscape soil amendment. Plugs of 'Hilda' and 'Najade' Hiemalis begonia and 'Hera' and 'Niobe' Olympus Streptocarpus were provided by Mikkelsens, Inc. (Ashtabula, OH). Plants were potted up on 14 April 1995. Height and width of four plants per treatment in each replication were measured at 2 and 4 weeks after planting We evaluated streptocarpus and Hiemalis begonia growth during greenhouse production in Metro-Mix 360 prepared by O.M. Scotts with peat or coir, fertilized twice weekly with 200 ppm N (Peters 20-10-20), and found no differences in growth or performance. These same plants were planted out in 50% shade to evaluate landscape performance of streptocarpus and begonia in unamended, bark-amended, or coir-amended Georgia Piedmont clay.

In the landscape, each amendment (unamended, bark, or coir) was added to a 6' x 6' plot in a randomized complete block design with three replications. The coir bricks (O.M. Scotts, Marysville OH) were wetted with tap water in a wheel barrow and the loose material was applied to attain a uniform 3" depth. The ground pine bark (Old Natures Helper, Cummin GA) was not wetted, but evenly applied to the beds to 3" depth. Unamended plots served as the controls. An 18" alley separated the two planting areas, one for begonias and one for streptocarpus. A 12" alley separated the individual amendment plots within each crop. A two-cycle rotary hoe was used to thoroughly incorporate the amendments into the soil. The unamended plots were tilled to create similar soil condition.

Four plants of each cultivar from each greenhouse treatment were randomly assigned to a landscape amendment and planted on 12" centers on 1 June 1995. Border plants were planted around the edges of the plots to reduce edge effects. The entire planting site was mulched with pine bark mini-nuggets to a depth of about 2". Plants were fertilized with a hozon applicator at 200 ppm N (Peter's 20-10-20) with each watering, two to three times per week, depending on environmental conditions. The four plants of each cultivar were measured at 4, 8, 12, 16, and 20 weeks after planting for vegetative height and width in the landscape. Plant quality was rated on a continuous scale (0 = very poor to 100 = excellent).

Results and Discussion: The interaction of media amendment (during greenhouse production) and soil amendment in the landscape was generally nonsignificant. In the landscape, height and width of 'Hilda' begonia plants grown in the unamended plots was greater than that of plants grown in either of the amended plots at 4 weeks after planting (WAP), but not at later measurement dates. Growth of 'Najade' did not consistently respond to the soil amendment. The quality rating of the begonia plants at 4 WAP was excellent but unaffected by soil amendment. However, quality ratings and plant height declined with heat-related stress and increased disease incidence as the summer progressed (Table 1).

Streptocarpus suffered more heat-stress injury, including leaf scorch and wilting, in the landscape than seen on the begonias. Plants recovered as temperatures moderated (Table 2). Landscape soil amendment had no significant effect on streptocarpus plant height or width in the landscape. Quality ratings of plants grown in coir or bark amended beds were occasionally greater than those of plants grown in unamended beds.

Significance to the Industry: Replacing peat with coir in the MM 360 media did not affect the growth of the Hiemalis begonias and Olympus streptocarpus plant species used in this study. Due to the heat stress response of these plants, this trial probably did not allow for a good evaluation of the coir amendments in the landscape. However, the heat stress provided evidence of non-adaptability of these species generally used as pot crops to landscape conditions in the Southeast.

Table 1. Average quality ratings and height of two cultivars of Hiemalis begonia plants grown in the landscape in Georgia.

Weeks after planting	Quality rating[z]		Plant height (cm)		Avg temp[y] (max/min°F)
	'Hilda'	'Najade'	'Hilda'	'Najade'	
4	96	93	18.5	16.2	85/63
8	63	81	15.9	18.1	93/70
12	58	54	19.9	15.7	89/70
16	62	49	21.5	15.6	81/62
20	58	47	23.1	15.8	74/51

[z] Continuous scale 0 = poor to 100 = excellent.

[y] Average daily max/min temperatures for the 4 weeks prior to the data collection.

Table 2. Average quality ratings and height of two cultivars of Streptocarpus plants grown in the landscape in Georgia.

Weeks after planting	Quality rating[z]		Plant height (cm)		Avg temp[y] (max/min°F)
	'Hera'	'Niobe'	'Hera'	'Niobe'	
4	69	57	8.5	7.2	85/63
8	14	6	7.4	5.0	93/70
12	36	15	7.9	4.5	89/70
16	65	36	10.0	5.8	81/62
20	60	37	10.2	6.0	74/51

[z] Continuous scale 0 = poor to 100 = excellent.

[y] Average daily max/min temperatures for the 4 weeks prior to the data collection.

Copper Treatment of Pot-In-Pot Production Containers Reduces Post-Harvest Stress of 15-Gallon Thundercloud Plum

J. Roger Harris, Alex Niemiera
Virginia

Nature of Work: Pot-In-Pot (P&P) production of trees (Parkerson, 1990) continues to become increasingly adopted by southern growers. Tree roots respond favorably to the buffered conditions below-ground and show little damage from hot or cold temperatures, commonly seen in above ground container-grown trees. The favorable root environment in the P&P system produces a tree with a healthy root system, but the roots are not acclimated to above ground conditions. Garden center managers and landscapers have voiced concerns over the possibility of death of young roots after harvest due to heat stress when container sidewalls are exposed to sunlight (Charlie Parkerson, personal communication). Death of these roots can potentially limit establishment into the landscape.

Treatment of the interior of production containers with Spin Out™ (Griffin Corp., Valdosta, Ga.), a latex paint mixed with cupric hydroxide, has been shown to be effective in preventing root deflection around container sidewalls (Krieg and Witte, 1993). Since roots are prevented from circling around containers, they are potentially shielded from the harmful effects of heat build up just inside the container sidewalls after harvest. We tested the effectiveness of Spin Out™ on the prevention of post-harvest physiological stress of *Prunus cerasifera* 'Thundercloud' (Thundercloud plum) grown in a P&P system at Lancaster Farms nursery in Suffolk, Va. Trees were planted as 6 foot bare-root liners and grown for one growing seasons in 15-gal. containers either treated with Spin Out™ (copper-treated) or not (not-treated). On 8 September, 1995, we removed 12 trees of each treatment from the socket containers and placed them above ground in full sun. We evaluated the trees for two days by measuring daily stem sap flow of 2 trees of each treatment with the Flow 32 system (Dynamax, Houston TX) and by periodically measuring stomatal resistance of 4 trees of each treatment with a null balance porometer (LI-1600, LICOR, Lincoln, Neb.). Temperature inside the container sidewall of 4 trees was monitored with thermocouples. Sap flow, stomatal resistance and sidewall temperature were measured for two days after harvest. All trees were left in-place until 27 Sept., when they were shipped to the Virginia Tech Urban Horticulture Center P&P nursery near Blacksburg, Va. and placed back into in-ground socket containers for additional sap flow and stomatal resistance measurements. Eight trees of each treatment were planted into a nursery row on 16 Oct. On 26 Aug., 1996, all planted trees were dug, and all new roots were removed back to the original rootball and dried to a constant weight. Stem diameter and height growth were also assessed.

Results and Discussion: No treatment effect was evident for sap flow or stomatal resistance for the first two days after harvest. Air temperatures were unusually cool during this period, and potential for stress was probably low. Temperature just inside the container sidewall reached a maximum of 111°F, despite that air temperatures were unseasonable cool during this period. Although temperatures in this range can injured or kill roots in container-grown plants (Ingram et al., 1989), the effect on stomatal resistance or stem sap flow was not immediately apparent. Above-ground exposure during hotter weather may have resulted in even higher sidewall temperatures and resulted in more immediate stress.

Measurements taken approximately two weeks later indicated that Spin Out™ treated trees were less stressed than not treated trees. Stomatal resistances of 21 s • cm^{-1} and 6 s • cm^{-1}, and sap flow rates of 0.079 g • cm^{-2} per day and 0.021 g • cm^{-2} per day (flow through stems per unit leaf area) were recorded for not-treated trees and treated trees, respectively. Treatments were statistically different at $p \leq 0.05$ for stomatal resistance and sap flow. Trees that had been grown in the Spin Out™ -treated containers were apparently much less stressed than those that were grown in the conventional not-treated containers. It is not clear if the stress on not treated trees was due to an accumulation of exposure to above-ground conditions or a single exposure to very unfavorable conditions since no measurements were made between two days after harvest and the shipment to Blacksburg. However, under conditions of this experiment, Thundercloud plums that were grown in the P&P system in copper-treated containers showed much less evidence of physiological stress than those grown in conventional not-treated containers when exposed to unshielded above-ground conditions.

Growth data from those trees planted in the nursery row were variable, and did not indicate that the trees which were less stressed before planting grew more than those which were more stressed (data not shown). Exposure was accomplished during a relatively cool period, and exposure time was much less than in some retail settings. Harvest and exposure during a hotter part of the summer or for a longer time may have resulted in more permanent effects. Although sap flow and stomatal resistance was not measured after planting, the effects of the increased physiological stress on not-treated plants was apparently transitory.

Significance to Industry: Treatment of P&P production containers with copper paint resulted in trees which showed much lower signs of post-harvest physiological stress than those not treated with copper. Differences between treated and not-treated plants was not evident two days after harvest, but were clearly present after two weeks. Stomatal resistance and lowered stem sap flow of not-treated trees was over 3 times that of copper-treated trees. This protection against stress on copper-treated plants was probably due to a lack of active root growth against container sidewalls, which can become very hot when plants are exposed to the sun after harvest. Rapid handling of Thundercloud plums and protection from the sun is required to prevent post-harvest stress on not-treated plants. However, no differences between treatments on root, height and trunk diameter growth was evident 9 months after planting.

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Influence of Transplant Time on Growth and Embolism Recovery for Turkish Hazelnut and Tree Lilac

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Virginia

Nature of Work: Survivability and growth of tree transplants are major concerns for both horticultural producers and retail consumers. Modifications in plant water status, resulting in early post-transplant stress, are the most important factors governing the establishment of landscape plants (1, 2). A large number of a plant's roots may be lost or damaged during the harvest of field-grown nursery stock (7), and the ability of the plant to quickly regenerate those roots may influence the plant's capacity to overcome water stress and therefore survive transplanting (6).

Sperry et al. (1988) report that water stress is a primary cause of xylary embolism. Embolisms increase as trees enter the dormant season and may be as great as 89% in mid-winter (5). Since most field-grown trees are harvested when dormant, plants may be severely embolized at transplanting. Failure of the plant to quickly regrow roots lost at harvest may result in the inability of the plant to recover from dormant xylary embolism and may lead to even higher embolism levels as a result of transplant-induced drought stress. The objective of this experiment was to evaluate the influence that root severance and season of harvest have on growth and recovery from dormant embolism for two landscape trees.

Two-year-old bareroot Turkish hazelnut and tree lilac seedlings were transplanted into bottomless 3 gal. containers placed into a Groseclose silty loam at the Urban Horticulture Center (Blacksburg, VA) in March, 1995. Three transplanting treatments (fall, spring, or not transplanted) were randomly assigned to the trees. Additionally, at each transplant date, plants were root-pruned to remove 50% of the root system or the root system was left intact.

Height and stem diameter were determined at initiation of the experiment and monthly (April to July) after shoot growth began. Days to budbreak were determined for each tree based on date of spring transplant. Initial root dry weights were determined from a random sample of trees. Root dry weights were then recorded in May, 1996, after budbreak to determine spring root growth. Measurements of hydraulic conductance (3) were taken in November, 1995 (prior to fall transplanting), December, 1995(two weeks after fall transplanting), March, 1996 (prior to spring transplanting), April, 1996 (two weeks after spring transplanting), and May, 1996 (one month after budbreak).

Results and Discussion: Root pruning had no influence on height or stem diameter for Turkish hazelnut (Table 1). Root pruning had no influence on height or stem diameter for tree lilac for the April measurement, but both parameters were reduced for the May, June, and July measurements (Table 1). Root pruning did not influence post-transplant root growth or date of budbreak for Turkish hazelnut or tree lilac (data not shown). Root pruning influenced embolism only for the March, 1996, sampling (data not shown). Removal of 50% of the root system resulted in 83% more embolism than removal of none of the root system. Root pruning had no influence on embolism for tree lilac (data not shown).

Season of transplant had no influence on April, 1996, height and April and May, 1996, stem diameter measurements for Turkish hazelnut (Table 1). Transplanting, regardless of date, reduced height of Turkish hazelnut for the May sampling and reduced height and stem diameter for the June and July measurement compared to trees that were not transplanted (Table 1). Spring transplanting reduced height and stem diameter compared to fall transplanting for tree lilac for the April and May measurement (Table 1). Non-transplanted trees had superior height and stem diameter growth compared to transplanted trees for the June and July growth measurement (Table 1). Season of transplant had no influence on spring root growth for Turkish hazelnut or tree lilac (data not shown). Season of transplant had no influence on budbreak for tree lilac, but fall transplanting increased the time to budbreak compared to trees transplanted in the spring or not transplanted (data not shown). Season of transplant resulted in higher levels (76%) of embolism for the March sampling date compared to non-transplanted Turkish hazelnut (data not shown). Spring transplanting resulted in higher levels of embolism compared to fall transplants (63%) and non-transplanted controls (59%) (data not shown).

Significance to Industry: Success in the transplant of urban tree species are major concerns for the horticulture industry. Transplanting changes the water status of the tree, and these changes may reveal themselves as reductions in plant growth. By determing how hydraulic conductance is influenced by different transplanting practices, cultural practices can be developed to maximize the survival of landscape trees. The results of this experiment indicate that fall transplanting of Turkish hazelnut increased embolism, increased time to budbreak, and decreased shoot growth compared to non-transplanted controls. Spring transplanting increased embolism and decreased shoot growth compared to non-transplanted tree lilac.

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Table 1. Height and stem diameter for Turkish hazelnut and tree lilac as influenced by season of transplant.

Season of transplant	Height (cm)	Stem diameter (mm)
Turkish hazelnut		
Fall	89.7b[z]	17.0b
Spring	83.5b	16.6b
Control	130.0a	28.9a
Tree lilac		
Fall	88.4b	16.3b
Spring	74.1c	14.3b
Control	110.4a	22.9a

[z] Means within columns having the same letter for individual species are not different according to Fisher's Protected Least Significant Difference ($p \leq 0.05$).

Using New Nursery Crops Research Plants for Diverse Institutional Goals

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North Carolina

Nature of Work: The mission of The NCSU Arboretum is to enrich and expand urban and residential landscapes by promoting a greater diversity of superior and better adapted landscape plants for creative, environmentally sound landscapes. To this end, over the last 20 years in excess of 9,000 accessions of plants have been collected from over 55 countries throughout the world, eva over 55 countries throughout the world, evaluated for environmental tolerance to N.C. conditions and for ornamental potential. At this point, ca. 20,000 plants a year are produced in the research nursery of The NCSU Arboretum with only a very few of these ultimately destined to become a permanent part of the arboretum collection. NCSU university policy forbids any sale of excess plants to generate revenue as is done in many public gardens and other university programs. University sales of tax dollar produced plants may create political conflicts when commercial nurserymen feel these sales compete with their products on the open market. Destruction of rare and valuable germplasm which has potential for diverse uses is also not a desirable option. During the last 10 years a variety of programs have been instituted at The NCSU Arboretum which distribute excess nursery and arboretum collection research plants for varied institutional goals. Some of thesrplants for varied institutional goals. Some of these programs are briefly presented here.

Results and Discussion: Distribution methods and techniques to dispose of excess research plants include the following concepts:

NCAN Members Distribution - Movement of promising plants from the arboretum to the hands of commercial nursery is at the heart of the NCSU Arboretum program (1). Each year, selected plants are propagated in quantities of ca. 200 of each plant, packaged into “gift packs” containing 20-40 different plants, and are taken to the summer trade show meeting of the North Carolina Association of Nurserymen in Asheville, NC. Gift packs are distributed to nurserymen during the meeting for trial of plants in the diverse conditions throughout N.C. This program has been in place for 17 years and over 60,000 plants of over 350 different taxa have been distributed

Commercial Nurserymen Collections - A unique program of The NCSU Arboretum is to allow commercial nurserymen to collect excess propagation materials - seed, cuttings, divisions, etc. - of plants growing in the arboretum collections - under the supervision of arboretum staff with advance notice. Over three million cuttings have gone from the arboretum in this manner to be used for stock blocks for further buildup by nurserymen. Although focused on N.C. growers because of travel proximity, growers do visit form throughout the U.S. to obtain desired materials.

Shipment to Commercial Nurserymen - Distant nurserymen may not be able to travel to access the collections directly. The arboretum also provides a service of providing limited amounts of propagation material upon request which is collected by volunteers or arboretum staff and mailed to nurserymen.

Sharing with Academic Researchers - Plants and propagation materials are shared with a diverse range of faculty and graduate students both on the NCSU campus and at institutions across the U.S. and around the world. Depending on the quantities of plants needed and nature of the research, such materials may be either gathered at the arboretum or shipped to cooperators. An excellent example is the sharing of promising trees with NCSU researchers Ranney and Bir in a N. C. state-wide tree evaluation program (3) where trees are planted in selected test sites across the state in a diverse range of habitats and conditions. Others have gone to extension programs such as the Certified Plant Professional Collection created by Powell in Raleigh (2), or agent "mini-arboreta" at county extension offices for locales for local promotion to growers.

Sharing with Public Gardens and Institutions - A wide range of plants in considerable quantity is shared with public gardens ranging from community parks to national leading institutions. Prime examples would include Riverbanks Btion to Individuals for Institutional and Program Goodwill - At various times a variety of gift plants are presented to garden writers who can promote newly introduced plants in their writings and publications, to administrators and legislators who are reotanical Garden, Columbia, SC and the Atlanta Botanical Garden, Atlanta, GA which annually send their staff to the arboretum to collect plants from the garden and nursery for their collections and displays. A dramatic new phase of this program occurred in winter of 1996 with the movement of 24 specimen (10'-24') rare trees which were tree spaded and moved to the new N.C. Arboretum near Asheville. This program will accelerate in the coming two years as large numbers of trees must be removed from the arboretum collections to facilitate construction of a new education center. These specimen plants will also go to the N.C. Art Museum in Raleigh and to the NCSU campus as well. Smaller plants have long been moved to the NCSU campus for use by landscape students and grounds personnel where campus space allows growth to mature tree size not possible on the limited land available at the arbod grounds personnel where campus space allows growth to mature tsize not possible on the limited land available at the arbod to select the plants of their choice to take home. Some 200-400 people participate in this event which takes about 5 minutes to clear over 5,000 plants from inventory.

Distribution to Individuals for Institutional and Program Goodwill - At various times a variety of gift plants are presented to garden writers who can promote newly introduced plants in their writings and publications, to administrators and legislators who are responsible for the arboretum well-being, and to significant donors who support the programs in various ways - as a means of thanking such individuals for their active support.

Distribution to Members of the Friends of the NCSU Arboretum - over 70% of the operational budget of the arboretum research program comes from individuals and businesses who annually subscribe to the Friends of The NCSU Arboretum membership program. For goodwill and as a membership benefit, and as a means of cleaning the nursery annually of excess unneeded plants before the need to go to the effort of overwintering storage (as well as disposing of miscellaneous plants which have lost their tags or identities, etc.), each fall excess plants are placed in a ribboned off field on a specified and advertised day, and at a given time members are allowed to select the plants of their choice to take home. Some 200-400 people participate in this event which takes about 5 minutes to clear over 5,000 plants from inventory.

The Connoisseur Plant Distribution - to encourage membership support of the arboretum at higher levels than normal individual rates, a program was instituted in 1992 where members contributing at a $100 or higher annual level could receive an "catalog and order form" of rarer and choicer ("Connoisseur") plants for shipment to their home. This allowed support by individuals and organizations across the U.S. who could not travel to the free plant distribution to still receive treasured plants from the arboretum. This program, modeled on the "Signature Plants" program of the Brooklyn Botanical Garden program managed by Robert Hays, has been immensely opular and now accounts for nearly 30% of the memberhsip income for the arboretum. Form 40-60 rare plants are discussed in the mailed listing, members indicate their top 5 choices and return the list to the arboretum, and the top rated available plant is then shipped to the members home. In 1996 a trial was made of offering more plant choices for higher levels of donations with promising results which will be explored further in the future.

Significance to the Industry: Most nursery/ornamental plants research programs generate excess plants beyond the needs of the program, or plants which terminate their usefulness in the program once used for research or evaluated. These plants are normally discarded, or in some cases sold. In a time of limited traditional support for academic research programs, ways to benefit such programs need exploration to maximize the work and benefits that can be achieved with the resources at hand. The above discussion shows some concepts to use excess research plants as a valuable institutional resource without resorting to sales programs which may compete with local commercial nurseryman.

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Performance of Ivy Cultivars Under Tennessee Landscape Conditions

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Tennessee

Nature of Work: There are hundreds of cultivars of ivy. Most are *Hedera helix* but a few are selections of *H. canariensis, H. nepalensis, H. pastuchovii,* and *H. rhombea*. One of the most complete collections in the USA is in Lebanon, Ohio. It contains over 400 cvs (1). Though many ivies have been developed for interior and topiary use, there is considerable interest in determining landscape hardiness and performance especially of new cvs. In fall 1992, we obtained two rooted cuttings of each of the 184 cvs. in the Longwood Gardens collection. We potted them and grew them under greenhouse conditions until spring 1994, at which time most plants were vigorously growing in two gallon containers. We selected 110 of the most vigorously growing cvs for planting outdoors under Tennessee landscape conditions. We killed 5' wide strips of bermuda and other vegetation with glyphosate, then rototilled as deeply as possible with a Kubota tractor and tiler. Plots were oriented east-west. We purchased lath lattice work trellises (4'x8') and attached them to a framework erected down the middle of each group of plots. We laid out 2.5'x2.5' plots on each side of the trellis and edged them with landscape timbers. We then planted two replications of 110 ivy cvs, setting them so the surface of the media ball was about three inches under the surface of the soil, per recommendation of the American Ivy Society. Each plant was set directly under the trellis, with one half the vine set toward the sunny side of the trellis and one half to the shady side. Plants were immediately watered and the plots mulched with hardwood bark. Plants were fertilized with one tablespoon of Osmocote 14-14-14 dibbled into the soil on both sides of the trellis. Most plants established well and data on % coverage of each plot was collected in summer 1995 and 1996. A grid of five rows and five columns of 6"x6" squares was placed over each plot. The number of squares totally and partially covered by foliage was counted and % coverage calculated. Data for the two replications were averaged. As plots filled in, they were periodically pruned to keep them from invading adjacent plots.

Results and Discussion: As expected, all the ivy cvs. filled in quicker on the shady side of the treLlis compared to the sunny side. The 30 cvs that covered the plots quickest are listed in Table 1, ranked in order of % coverage of the shady side in 1995. By 1996, these 30 cvs had all achieved 95% to 100% coverage of the shady plot. There were 13 cvs that achieved 95% or better coverage of the sunny plots. These were the most sun tolerant of the group tested and should be considered for ground cover use in sunny exposed areas by landscape architects, landscapers, and gardeners. These 30 cvs offer a palette of leaf shapes, color, size, and texture to create interest in otherwise bland ivy ground cover plantings. Some cultivars reverted to parental types ('Alt Heidelberg', 'Iantha') and were thrown out of consideration. All ivies listed in the table appear to be stable. If there is ever any question, samples can be collected and checked for trueness to name by the American Ivy Society, which is the registration authority for *Hedera*. AIS regularly publishes new registrations and definitive cultivar descriptions, photographically illustrated, in its Bulletins (2). AIS supports hardiness trials and ivy display collections in California, Florida, Maryland, Illinois, Ohio, Tennessee and Virginia. For those who wish to purchase certain ivy cvs, AIS maintains a list of wholesale and retail commercial members (AIS, P.O. Box 2123, Naples, FL 33939-2123). Perhaps less important than the table of outstanding performers is a list of those cvs to avoid. Those that died or achieved less than 20% coverage under Tennessee landscape conditions, presumably due to lack of hardiness are: (cvs of *H. helix* unless otherwise noted) *H. canariensis* 'Gloire de Marengo', *H. canariensis* 'Margenia Maculata', 'Calico', 'Helena', 'Henrietta', 'Kolibri', 'Mini Ester', 'Nice Guy', 'Perle', 'Silver King', 'Yumin', *H. nepalensis* 'Suzanne', 'Zebra', and *H. rhombea* 'Variegata'.

Significance to Industry: There are always questions about the hardiness of new cultivars, or of a given cultivar compared to dozens or hundreds of others. This trial tested 110 ivy cultivars for three growing seasons under landscape conditions. The winter of 1995/96 caused winter injury to many woody and perennial plants, including evergreen ground covers like ivy. The 30 cultivars listed in the table are those that established quickest in sun and shade. They survived and recovered from winter best. They should be considered for widespread groundcover usage in Tennessee (USDA Zone 6b) and other areas with similar or milder climates.

Acknowledgment: Appreciation is expressed to the American Ivy Society for supplemental grant funding for this research.

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Table 1. Percent coverage of a 2.5'x2.5' plot on the sunny vs. shady side of a 4' trellis in 1995 and 1996 by selected ivy cultivars planted summer 1994.

	% coverage of 3'x3' plot				class
	shady		sunny		of
species, 'Cultivar.' & AIS reg. #	1995	1996	1995	1996	ivy*
Hedera helix 'Laubfrosch' 81-225	100	100	83	100	I
Hedera helix 'Manda Crested' 88-221	100	100	66	100	C
Hedera helix 'Maple Leaf' 84-11	99	100	69	100	I
Hedera helix 'Olive Rose' 81-141	98	100	67	83	BF,C
Hedera helix 'Serenade' 81-205	97	100	79	100	V,I
Hedera helix 'Carolina Crinkle' 88-267	97	100	61	96	C
Hedera helix 'Ustler' 79-68	95	100	78	99	C
Hedera helix 'Spear Point' 88-060	94	100	43	81	B
Hedera helix 'Paper Doll' 88-229	94	100	62	80	V
Hedera helix 'Appaloosa' 88-193	93	100	60	98	V,C
Hedera helix 'Ralf' 88-234	93	100	80	100	H
Hedera helix 'Telecurl' 66-244	92	100	67	98	C
Hedera helix 'Hibernica' 88-55	91	100	38	94	I
Hedera helix 'Big Deal' 88-194	90	100	74	100	C
Hedera helix 'Plume D'Or' 79-84	90	100	52	98	BF
Hedera helix 'Green Ripple' 88-213	90	100	37	97	C,F
Hedera helix 'Galaxy' 81-120	88	100	62	98	BF
Hedera helix 'Harrison' 86-71	87	100	38	85	I

Hedera helix 'Jack Frost' 79-292	86	100	43	89	V,C
Hedera helix 'Cyrano De Bergerac' 88-151	85	100	64	93	O
Hedera helix 'Manda Fringette' 88-277	84	99	47	92	F
Hedera helix 'Star' 88-243	83	100	61	92	BF
Hedera helix 'Asterisk' 80-80	81	100	71	85	BF
Hedera helix 'Teardrop' 88-153	81	100	55	90	H
Hedera helix 'Albany' 80-40B	80	100	49	88	I
Hedera helix 'Needlepoint' 88-226	78	95	57	83	BF
Hedera helix 'Stuttgart' 88-234	78	100	45	83	C
Hedera helix 'Ivalace' 88-215	77	100	37	80	C,M
Hedera helix 'Kolbold' 82-49	65	96	42	88	M,BF
Hedera helix 'Dragon Claw' 88-198	64	100	39	85	C

* C - Curlies. Leaves undulated, frilled, pleated, or curled.
BF - Birds Foot. Long prominent terminal lobe, basal & lateral lobes absent or reduced.
F - Fan. Leaves broad or fan shaped, lobing reduced.
I - Ivy. Typical five-lobed ivy leaves.
M - Miniatures. Small leaves usually less than one inch long.
V - Variegated. Variegated leaves, marginal, veinal, specks, flecks, blotches.
O - Oddity. Do not fit into any other category, as erect, congested or mounding types.

Landscape Professionalism in North Carolina

M.A. Powell
North Carolina State University

Nature of Work: The demand for landscape services has increased at a tremendous rate over the last few years because of the strong economy and increase in the general population growth (1986-6.5 million,l996-7.5 million, 2000-estimated 8 million). This has an impact on all aspects of the green industry: design, installation, maintenance and irrigation services and related suppliers such as topsoil and organic amendments, seed, sod, woody and herbaceous plant materials. Because of this increase in demand for services, many landscape and allied businesses have been started. Many have no experience and /or have had no formal training. This often results in sub-standard business and technical practices which reflects poorly on the whole industry.

Results and Discussion: North Carolina landscape professional registrations include landscape architects and landscape contractors. Upon successfully completing the exams individuals and firms can use the title landscape architect and /or landscape contractor. Currently there are 412 and 700 respectively. This represents a very small percentage of the total landscape industry. Technically, with the current ,voluntary registration laws, there is no way to know exactly who is in the landscape business. The proverbial 'pickup truck and lawn mower' theory is alive and well. The best information comes from the N.C. Department of Agriculture which by law, keeps track of all pesticide applicators. Currently there are 8733 Commercial Pesticide Applicators with approximately 70% or 6113 being in Ornamentals and Turf. Educational programs by NCSU and the Cooperative Extension Service address these problems. Working closely with the Nurserymen (NCAN) and Landscape Contractor's Associations (NCLCA), numerous educational opportunities are provided for members and non-members. Two relatively new programs are underway. The Certified Plant Professional program is administered by NCAN. This is directed to growers and garden center operators. There are currently 777 Certified Plant Professionals since the June exam. The Certified Landscape Technician (CLT) is a new project for NCSU and NCLCA. This program is designed to promote the safety and technical skills of landscape workers. Certification can narrow the field and enhance a companies competitive edge. Being certified lets the client know that a company promotes professionalism, knowledge and qualifications they need to get the best value for their landscape investment. Certification also enhances respect among other professionals who employ landscape contractors. Educational programs offered by NCSU and county agents in cooperation with the professional associations will enhance professionalism in the landscape industry. Landscapers will become more knowledgeable and clients will be the recipients of better services and products.

Performance of Warm Season Lawn Grasses Under Shaded Conditions

Mark R. LeBlanc, James N. McCrimmon, Andrew C. Williams, and Edward W. Bush
Louisiana

Nature of Work: Residential lawns are an important portion of the turfgrass industry. Homeowners represent the majority of spending in the turf and ornamental industry. A 1991/92 survey by the University of Florida estimated turfgrass cash expenses in Florida to be $7.25 billion with 75% of total turfgrass areas estimated to be associated with residential lawns (4). This and similar studies illustrate the importance of residential lawn care to the turfgrass maintenance industry in the southeastern United States. Residential lawns are often landscaped areas combining trees and shrubs with turfgrass sometimes resulting in the need to grow turfgrass in shaded areas. Establishing and maintaining turfgrass in the shade is one of the most challenging problems facing turfgrass managers and homeowners alike.

Of the major warm season turfgrasses, St. Augustinegrass (*Stenotaphrum secundatum*) has been found to be the most shade tolerant. Zoysiagrass (*Zoysia* sp.), centipedegrass (*Eremochloa ophiuroides*), and carpetgrass (*Axonopus affinis*) are intermediate in shade tolerance (2, 3). St. Augustinegrass is one of the most commonly used turfgrasses in the south since it competes well with weeds and under proper cultural practices, provides high quality, low maintenance lawns. St. Augustinegrass was estimated to make up 36% of the turfgrass area and 72% of the sod grown in Florida in 1991/92 (4). The objectives of this study are to evaluate 25 cultivars of St. Augustinegrass and other warm season grasses for shade tolerance under natural tree shade.

Plugs of 25 varieties of St. Augustinegrass, four cultivars of zoysiagrass , common carpetgrass, and common centipedegrass were planted beneath a stand of spruce pine trees (*Pinus glabra*) on August 3, 1994 at the Burden Research Plantation in Baton Rouge, Louisiana. The amount of light penetrating the tree canopy was estimated, using a pyranometer, to be 15% of full sun. Plugs 4.25-inch in diameter were established on an Olivier silt loam on three foot centers in a randomized complete block design with four replications. Plots were irrigated only to prevent wilting and soil moisture was monitored using 12-inch soil tensiometers. For four months, mowing height was maintained at 4-inches to prevent scalping. During the fifth month, the mowing height was lowered to 3.5-inches and remained at this height for the duration of the study. Approximately one year after planting, percent coverage was quantified by determining the colonization of a 4-foot2 area. Plants were harvested and shoot dry weight, total stolon length, and total stolon number were determined.

Results and Discussion: An experimental St. Augustinegrass variety labeled 'TR 6-10' performed best under natural tree shade (Fig. 1a,b). It significantly (Duncans $P \leq 0.05$) out performed all other grasses for total stolon length, total stolon number, and total shoot dry weight and ranked first for each of these, as well as for % coverage. However, this grass was not among the commercially available varieties listed by the USDA in 1995 (1). Of the 25 St. Augustinegrass varieties planted under tree shade, ten are listed by the USDA as commercially available (1). These include 'Delmar', 'Raleigh', 'Jade', 'Sunclipse', 'Seville', 'FX-261', 'Floralawn', 'FX-33', 'Floratam', and 'FX-10'.

Of the commercially available varieties, only three ranked in the top ten based on % coverage: 'Delmar' (4) (numbers following varieties represent ranking out of 31 grasses), 'Mercedes' (8), and 'Raleigh' (10) (Fig. 1a). The ten grasses that ranked lowest in % coverage included four commercially available St. Augustinegrass varieties: 'FX-10' (28), 'Floratam' (26), 'FX-33' (24), and 'Floralawn' (23). The remaining grasses in this group included: 'El Toro' (21), 'Emerald' (29), and 'Meyer' (31) zoysia, *Z. matrella* (30), centipedegrass (25), and carpetgrass (27).

Centipedegrass, carpetgrass, 'Emerald' and 'Meyer' zoysiagrass, and *Z. Matrella* ranked in the lower ten for dry weight, total stolon length, and total stolon number. For shoot dry weight, 'Delmar' (2), 'Mercedes' (5), 'Raleigh' (9), 'Jade' (8), and 'Bitterblue' (6) ranked in the top ten (Fig. 1a). 'Jade' (2), 'Mercedes' (7), and 'Delmar' (10) were among the top ten for total stolon number (Fig. 1b). For total stolon length, only 'Jade' (3) and 'Mercedes' (10) ranked in the top ten (Fig.1b). 'Floratam' and 'FX-10' fell in the lowest ten for all measured variables. 'Floralawn' and 'FX-33' were in the lowest ten for % coverage (Fig. 1a) and total stolon number (Fig.1b).

In this study, 'TR 6-10' was the most tolerant grass to natural tree shade. It performed significantly (P=.05) better than all other grasses studied for three of the four variables. Release and distribution of this variety to the landscape industry would be beneficial. Of the commercially available varieties of St. Augustinegrass, 'Delmar', 'Jade', 'Mercedes', and 'Raleigh' appear to be the most tolerant to shaded conditions. 'Floralawn', 'FX-33', 'Floratam', and 'FX-10' appear to be especially intolerant of shade compared to other St. Augustinegrass varieties. When compared to St. Augustinegrasses, centipedegrass and carpetgrass seem to be similarly intolerant of natural tree shade. 'El Toro' zoysiagrass performed poorly in shade compared to St. Augustinegrass; however, it was the most shade tolerant zoysiagrass in this study.

Significance to Industry: Knowledge of the relative shade tolerance of St. Augustinegrass varieties would be very useful to home owners, landscape professionals, and sod growers. Since the combination of turfgrass and shade is often unavoidable, data on which grasses to use in the shade and which grasses to avoid is important information for turf users. A variety more shade tolerant than the grasses currently available would provide landscape professionals with a better choice when faced with shade problems and would provide sod growers with an additional product to offer their customers. A turfgrass that is well adapted to the shade and that has not been exploited commercially could be very valuable to the industry.

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Fig. 1a

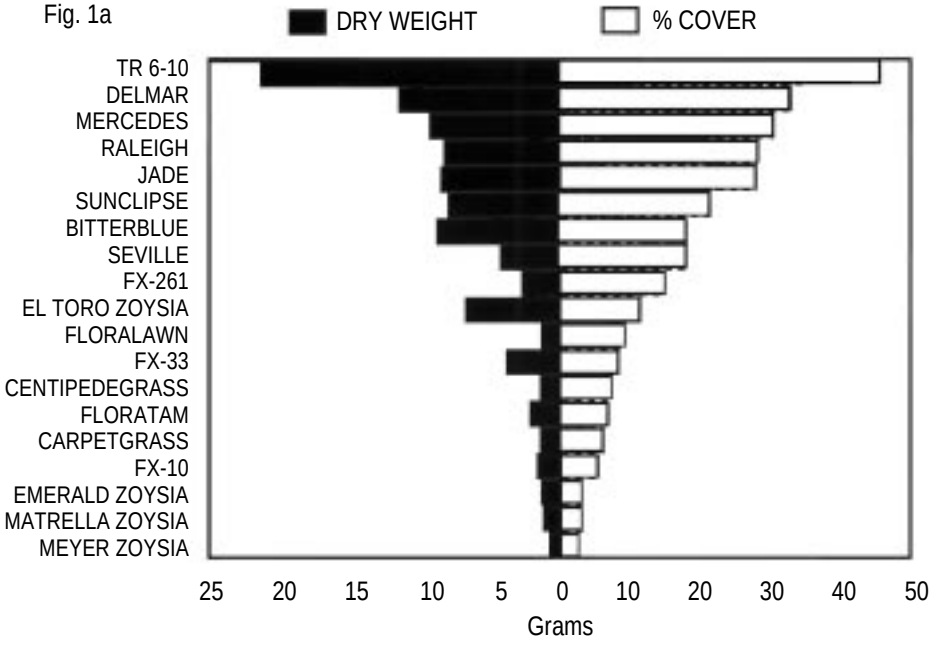
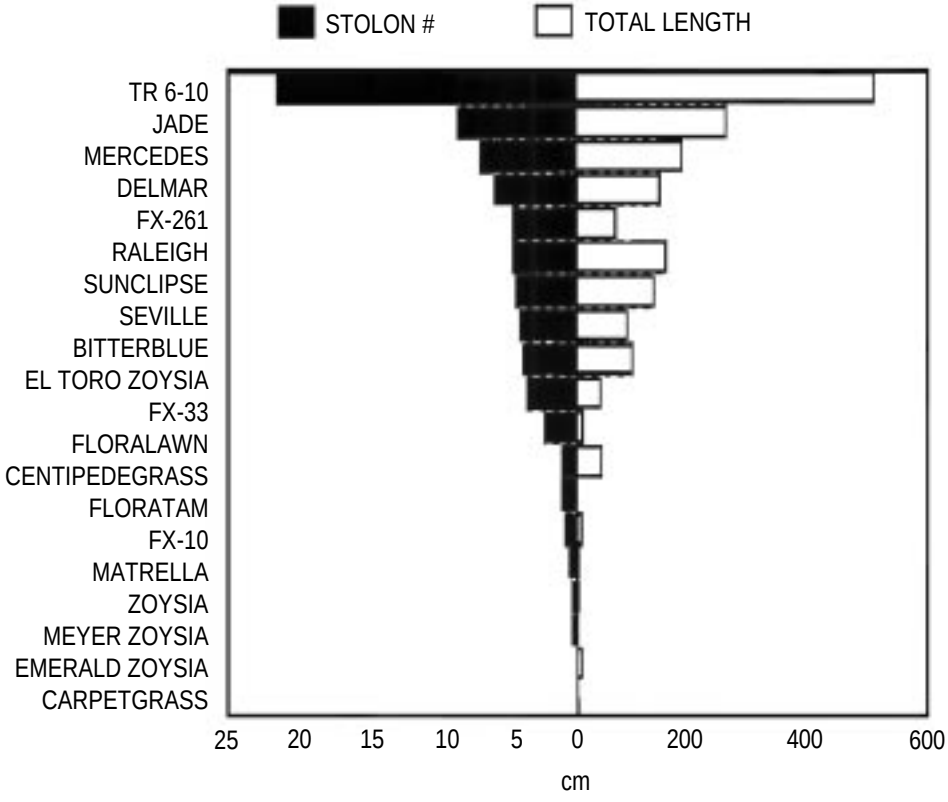

DRY WEIGHT
% COVER
TR 6-10
DELMAR
MERCEDES
RALEIGH
JADE
SUNCLIPSE
BITTERBLUE
SEVILLE
FX-261
EL TORO ZOYSIA
FLORALAWN
FX-33
CENTIPEDEGRASS
FLORATAM
CARPETGRASS
FX-10
EMERALD ZOYSIA
MATRELLA ZOYSIA
MEYER ZOYSIA
25 20 15 10 5 0 10 20 30 40 50
Grams

Fig. 1b


STOLON #
TOTAL LENGTH
TR 6-10
JADE
MERCEDES
DELMAR
FX-261
RALEIGH
SUNCLIPSE
SEVILLE
BITTERBLUE
EL TORO ZOYSIA
FX-33
FLORALAWN
CENTIPEDEGRASS
FLORATAM
FX-10
MATRELLA
ZOYSIA
MEYER ZOYSIA
EMERALD ZOYSIA
CARPETGRASS
25 20 15 10 5 0 200 400 600
cm

Development of a Regional Landscape Management Association

Hubert P. Conlon
Tennessee

Nature of Work: The Tri-Cities region of Northeast Tennessee is a sprawling metropolitan and rural area comprising the cities of Bristol, Kingsport, Johnson City and Elizabethton. The University of Tennessee Extension Service and TN Department of Agriculture have identified 132 full and part-time businesses engaged in the maintenance (management) of residential and commercial landscapes. According to the Better Business Bureau in Johnson City (pop. 51,000) the lawn and landscape industry ranks second (below the home improvement contractors) in the numbers of customer complaints.

In November 1993 two landscapers contacted 40 or more landscape companies to meet and discuss the industry status. Within three months the Mountain Empire Landscape Professionals Association (MELPA) was organized. Their identified needs were: 1) to educate all members and non-members, 2) to work together cooperatively and 3) to improve the public image of the lawn and landscape management industry.

Discussion and Results: Although it is easy to start a lawn and landscape management business in Tennessee, membership includes taking a pledge to adhere to the "Code of Ethics" and "Landscaping Code" of the association as listed below. Applicants must be sponsored by two current MELPA members and final approval is voted by the board of directors.

MELPA agenda at their monthly meetings is primarily educational. Most of the association's business is conducted by the board of directors and reported in their monthly 4-page newsletter as are special events such as the annual summer picnic and Christmas party or public service projects such as the entire landscaping of the new Ronald McDonald house.

A salaried executive secretary manages the daily business of the association including the layout and mailout of the monthly newsletter, membership recruitment, contacting educational speakers and any other business as directed by the president and board of directors.

Current membership is forty-five lawn and landscape businesses, their employees and affiliate members (governmental and municipal employees and college students). Currently under discussion is the development of an associate membership classification to attract industry suppliers such as greenhouse growers, nurserymen and hard goods (fertilizers, mulch, tools, equipment and vehicles).

After two years the immediate rewards of MELPA have been to build comraderie, trust and cooperation among its members. Education remains the primary goal, to improve professionalism and build public trust about the lawn and landscape industry in Northeast Tennessee and Southwest Virginia. While still competitive in bidding for lawn and landscape contracts, several members now subcontract work among each other.

Significance to the Industry: The landscape management industry is unregulated in Tennessee. There is no state-wide association although educational programs are offered annually by the University of Tennessee Turfgrass Association and Professional Grounds Maintenance Association chapter in Nashville. There are two other regional associations in Chattanooga and Memphis. In 1995 ETHLA, serving the Knoxville area, voted to dissolve after 30 years.

The future of MELPA and other regional associations across Tennessee will depend on their ability to attract new members, provide continual education to its members and enforce its ethics and landscape codes. MELPA members display their logo when advertising to general contractors and residential and commercial customers.

CODE OF ETHICS PLEDGE OF THE ASSOCIATION

As A Member I Pledge:

1. To promote the benefits of the ornamental horticulture and landscape professions in improving the aesthetic and environmental quality of the Northeast TN - Southwest VA - Western NC Mountain Empire Region.

2. To foster a positive image of the lawn and landscape design and management professions.

3. To conduct myself and my business in a just and honorable manner.

4. To deal fairly and justly with the public, client, employees, employers and fellow members.

5. To condemn all practices which tend to discredit or injure the public regard of the ornamental horticulture and landscape professions.

6. To strive constantly and diligently to improve my qualifications, knowledge and proficiency in the- ornamental horticulture and landscape field.

7. To adhere to the by-laws of my association and to foster its objectives.

LANDSCAPING CODE

1. We will not knowingly offer our services for sale at below cost of production for the purpose of destroying or hindering competition.

2. We will not falsely advertise our products or services.

3. We will not imitate the trademarks, trade names, or other identifying marks of other landscape professionals.

4. We will accept “The AAN Horticultural Standards” as the standard of grading for nursery stock.

5. We will not knowingly enter into illegal contracts, secret rebates, refunds, commissions, credits or unearned discounts for the purpose of injuring competition.

6. We will not speak disparagingly of our competitors or of their work.

7. We will clearly state our conditions of sale or replacement in case of dispute, and will make every effort to rectify the difference between us and our customers in a fair and reasonable manner.

PLEDGED BY _____ DATE _____