

SECTION 10 LANDSCAPE

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Hydroseeding Strategies for Wildflower Establishment

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Nature of Work: Planting instructions for wildflowers often suggest that hydroseeded wildflowers should be conducted in two steps: seeds with 5 to 10 percent of mulching fiber and the balance of fiber applied as mulch in the second step. This approach (1,2) ensures optimal seed/soil contact and minimizes over-circulation of the seed through pumps and paddles. In addition, thickness and weave fabrication of erosion mats are often pondered by hydroseeding technicians since wildflower dicots may not penetrate densely fabricated mats used in grassing steep slopes.

During February, 1994 a test site was selected on a 3 to 1 west facing slope. Soil type was Cecil clay with a pH of 5.8. Soil preparation consisted of a fall application of Roundup (2) and shallow rototilling. Treatments included (1) conventional (once over) hydroseeding with wheat straw erosion mat on top, (2) conventional hydroseeding with recycled nylon mat on top, (3) two-step hydroseeding, (4) conventional hydroseeding (wood fibers) at 5 ounces of wildflower seed per 1,000 square feet, and (5) conventional seeding at 2X seeding rate (10 ounces per 1,000 square feet). Wildflower seed mix planted was Willamette Southeast Mix applied with a Finn hydraulic seeder.

Customary management practices were followed and data was collected for wildflower plant stands expressed as plants per square yard and wildflower color ratings compiled on a monthly basis over the bloom seasons.

Results and Discussion: There were no significant differences in wildflower species performance during two bloom seasons. Erosion mats formulated from wheat straw and recycled polypropylene were not a detriment to emergence of wildflower seedlings. During the bloom seasons of this test, satisfactory color performance of the mix was derived from all treatments, indicating that higher seeding rates did not result in increased color by the various species. Higher seedling populations in 2X seeded plots and both erosion mats did not result in superior performance of these treatments.

Significance to Industry: Seed costs are a significant part of wildflower establishment costs. Results of this study indicates that increased seeding rates are not necessary in hydroseeding wildflowers. Thus, the popularity of wildflower color beds and meadows continue to be cost efficient.

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Table 1. Performance of hydroseeded wildflowers, 1994-1995.

Treatment	Plants per square yard ¹	Color Rating ²
Conventional, non-hydroseeded	45	4.3
Straw erosion mat	75	4.5
Nylon erosion mat	75	4.5
Two step hydroseeded	39	4.3

¹ Mean of five replicates

² Rated monthly on scale where 5 = excellent, 3 = good, 1 = poor

Rhaphiolepis 'Eskimo' for Southeastern Piedmont Environmental Landscapes

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Nature of Work: Rhaphiolepis is a very popular coastal landscape plant for south Atlantic, Gulf Coast, and California regions. This evergreen taxa with spring blooms is touted for salt spray, sandy soil, and drought tolerance. Two main constraints of Yeddo Hawthorn are lack of cold tolerance and susceptibility to Entomosporium leafspot (2).

Results and Discussion: Plant characteristics of 'Eskimo' closely resemble *Rhaphiolepis x delacourii*, a hybrid of *R. indica* and *R. umbellata*. Mature plant size is five feet x eight feet with compact growth habit in sunny locations. Leaves are lustrous green with a purplish cast. Flowers are light pink at opening and fade to white at maturity. This cultivar has survived -3°F in landscape plantings and 5°F in laboratory freeze tests (1,3). These data indicate that Eskimo is adapted to winter temperatures of climatic zone 7b. In addition, this new cultivar shows near immunity to Entomosporium leafspot, a common problem in shade plantings with poor air drainage (2).

Significance to Industry: 'Eskimo' Rhaphiolepis is an improved cultivar with a high degree of leafspot resistance and cold tolerance. These characters extend the adaptability range into the Southeastern piedmont. Cuttings have been distributed to interested propagators in the Georgia Green Industry and plants of the cultivar are presently offered by Wight Nurseries, Cairo, GA.

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Evaluation of Warm Season Perennial Grasses for Low Maintenance Landscapes

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Nature of Work: The use of warm season perennial grasses, especially native grasses, in low maintenance landscapes has become very popular. These grasses are very adaptive for use in wildflower meadows as well as open prairie-like areas that presently exist in parks and roadside backslopes and shoulders (1,2). Evaluation studies of warm season perennial grasses was initiated in 1992 at the Sandhill Research and Education Center of Clemson University near Columbia, SC. Field plots were planted in a Lakeland sand soil type.

The initial study compared 4 cultivars of switchgrass (*Panicum virgatum*), and one cultivar each of indiagrass (*Sorghastrum nutans*), big bluestem (*Andropogon gerardii*), and little bluestem (*Schizachyrium scoparium*). Two cultivars of switchgrass, 'Alamo' and 'Kanlow', and the little bluestem cultivar, SCS #9029926 were selected for further testing. The selection process included plant height, duration of lodge-free stands, plant color (summer, fall and winter) and the year to year regeneration of the plots without reseeding.

In 1994, a new study was established to compare 4 cultivars of little bluestem ('Pastura', 'Aldous', 'Cimmoner' and SCS #9029926), 'Alamo' switchgrass and 'Haskell' sideoats grama (*Bouteloua curtipendula*) in both direct seeded and transplanted plots. The direct seeded plots received 10.0 lbs pure live seed (PLS)/ acre on May 9, 1994. Seeds were planted into plug trays (1 inch x 2.25 inch plug size) in a greenhouse for later transplanting into field plots (July 18, 1994) using spacing of 9 inches on center. All plots were provided overhead irrigation as needed to maintain growth and remain in a low maintenance profile. Fertilizer (25 lb N/ acre) was applied twice in the seeded and once in the transplanted plots. All data was collected in late summer (September) except for the biomass which was collected in December. This study is ongoing with anticipated termination at the end of 1996.

Results and Discussion: The initial field evaluation started in 1992 provided the necessary data to develop the study begun in 1994. The data in Table 1 shows the various parameters used to evaluate the numerous cultivars in the study.

In comparing the 4 seeded little bluestem cultivars (Table 1), the SCS #9029926 was the superior cultivar with 'Aldous' the best of the commercially available cultivars. The plant height and growth evaluation of the plugged cultivars shows that only 'Cimmoner' was significantly shorter and weaker. Biomass data for the little bluestems again pointed out the superiority of the SCS #9029926 and the acceptability of 'Aldous'. The SCS #9029926 has excellent plant color starting with a blue-green shade in mid- to late summer changing to a bright reddish orange in the fall with good color through the winter. The plant remains erect throughout the growing season into the winter.

'Alamo' switchgrass was the most vigorous of all the perennial grasses studied in terms of plant height, plant coverage, and biomass in seeded plots and growth evaluation and plant height in the transplanted plots (Table 1). The overall appearance of the plants is attractive in color and texture with moderate plant height. The seedhead finalizes the appearance by being attractive but not massive. The fall and winter colors are similar to the SCS little bluestem.

'Haskell' sideoats grama is not well suited for the sandy soils with high summer temperatures. It may do better in a different soil type.

Significance to Industry: The data indicates that selected cultivars of little bluestem and switchgrass can be successfully grown in the sandy soil types. Both of these grasses are considered to be native to the southeastern US. This plant material can be used for low maintenance landscape plantings especially where a native or naturalized appearance is desired such as wildflower meadows and prairie-like areas. The production of these grasses by the nursery industry will be necessary to supply the potential demand in the future.

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Table 1. Measurements of growth indices for several perennial warm season grasses. 1994.

Grass Species	Plant Ht. In	Plant Coverage,%	Plug Evaluation	Plug Ht. In	Biomass Lbs/ Acre
Little bluestem cultivars					
SCS #9029926	37.61 AB	96.67 A	3.86 AB	6.80 B	3250 B
'Pastura'	29.76 C	56.67 B	3.45 B	4.88 B	866 C
'Aldous'	35.90 ABC	68.33 B	3.57 B	5.75 B	2004 BC
'Cimmeron'	30.63 BC	50.00 B	1.88 C	2.29 C	914 C
'Alamo' switchgrass	41.77 A	100.00 A	4.27 A	14.66 A	9458 A
'Haskell' sidecoats grama	8.27 D	50.00 B	3.57 B	4.60 BC	N/A
P =	0.01	0.05	0.05	0.05	0.05

Plug evaluation based on a 1-5 scale (1= dead, 2= stunted, 3= green w/full leaves, 4= expanding w/new lvs. and 5= expanding w/runners).

Means not followed by a common letter within a column are significantly different at the P level at the bottom of each column using the Duncan's Multiple Range Test.

The North Carolina Association of Nurserymen and NCSU Arboretum Program for Superior Plant Promotion

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North Carolina

Nature of Work: The North Carolina Association of Nurserymen has instituted a formal program to select, propagate, and promote selected plants from the arboretum - modeled somewhat on the very successful University of British Columbia Botanical Garden program. A selection committee of nurserymen evaluates candidate plants from the arboretum collections, plants are built up in initial numbers by selected propagators and are distributed to other growers throughout the state for final buildup to commercial quantity. NCAN prepares brochures and promotional materials to help sales of the item when it reaches market stage.

Results and Discussion: In 7 years of the program, 122 plants were offered as candidates by The NCSU Arboretum, 37 were selected for initial trial by NCAN, and 24 plants remain in the program to date. The following listing discusses plants selected over the past 7 years and indicates their present status in the commercial nursery industry.

1987 Candidates (30 candidates proposed by NCSU - 4 initially selected by NCAN, 3 went to production)

Rosa X 'Petite Pink' - A semi-evergreen to deciduous shrub with white/pink flowers in early summer to 3'. Easily propagated by softwood cuttings under mist. (Zone 6-9). Plants to retail markets in 1990.

Liquidambar styraciflua var. *rotundiloba* - "the fruitless sweetgum" - a deciduous tree with purple fall foliage color. Propagated by tissue culture, softwood cuttings, and t-budding on seedling understock. (Zone 5-9; Important factor is latitude for photoperiod control of hardening and dormancy - not recommended north of Washington, DC). Entered retail markets 1991.

Illicium parviflorum - A Florida native broadleaved evergreen shrub to 10' with insignificant yellow flowers in summer. Propagated by semi-hardwood to hardwood cuttings at most any time of year. (Zone 6-9). Plants to retail markets in 1990.

1989 Candidates (17 candidates proposed by NCSU - 4 initially selected by NCAN, 3 went to production)

Acanthopanax sieboldiana 'Variegata' - White variegated foliage deciduous shrub to 8'; very tough - sun or shade, wet or dry. Propagated by semi-hardwood cuttings under mist in summer. (Zone 4-8). Plants in retail markets in 1993.

Ilex X 'Carolina Cardinal' - A NCSU Arboretum named selection - origin unknown; likely an *I. serrata* hybrid. Deciduous shrub holly with low horizontal growth; fruits heavily when young. Easy from semi-hardwood cuttings during summer under mist. (Zone 4-9). Plants in retail markets in 1993.

Syringa oblata var. *dilatata* - The most heat-tolerant of all lilacs; deciduous shrub to 10'; flowers very early in spring, lavender fragrant flowers. Best by tissue culture, but can be rooted from cuttings in a very narrow time zone of about one week when extremely soft new tender growth. (Zone 3-8). Production buildup still under way - not yet in retail markets.

1990 Candidates (18 candidates proposed by NCSU - 8 initially selected by NCAN, 2 went to production).

Ardisia japonica 'Chirimen' - Broadleaved evergreen herbaceous groundcover for eastern half of state - to 6". Very easy from terminal cuttings at any time of year, or by division of clumps to the spreading rhizomes. (Zone 7-9). Plants in retail markets in 1993.

Hydrangea macrophylla 'Pia' - Dwarf deciduous hydrangea shrub to 2-3' with pink flowers. Very easy from softwood cuttings under mist in summer. (Zone 6-9). Plants in retail markets in 1993.

1991 Candidates (18 candidates proposed by NCSU - 7 initially selected by NCAN - 7 to production or still in buildup for eventual sale).

Campsis grandiflora 'Morning Calm' - Deciduous flowering vine from Korea - large showy orange-red flowers through summer. Best by softwood cuttings in early summer under mist. Adult wood more difficult to propagate than juvenile. (Zone 6-9). Plants to retail markets in 1994.

Euscaphis japonica - Deciduous ornamental tree from Korea to 30'; compound foliage; showy red fruit; purple winter bark with white striping. Seed propagation with possible double dormancy - takes cold treatment; period of warm; second cold; or can be rooted from softwood cuttings under mist in early summer. (Zone 6-9). In buildup production and not yet available for retail markets.

Ilex X 'Carolina Sentinel' (originally designated 'Hollyhedge') - A NCSU Arboretum named selection - origin unknown; foliage about half way between 'San Jose' and 'Foster #4'. Evergreen holly with fastigate habit for hedge use; red fruit; fast. Very easy from hardwood cutting at most any time of year. (Zone 6-9). Plants to retail markets in 1994.

Loropetalum chinensis var. *rubrum* - Broadleaved evergreen shrub to 10' from China; purple foliage with hot-pink flowers. Easy from semi-hardwood cuttings at most any time of year under mist. (Zone 7-9). Plants to retail markets in 1994

Sinojackia rehderiana - Deciduous flowering tree with excellent foliage; white flowers in spring; tough, fast and easy. Roots easily from softwood cuttings under mist in summer but difficult to keep alive through first winter after rooting. (Zone 5-9). Still in production buildup - a few plants in retail market but not yet commonly available.

Thuja plicata 'Hogan' - Conifer evergreen tree for Leyland cypress hedging replacement; fast, durable. Roots well from hardwood cuttings - best in winter but can be done in summer on mature wood. (Zone 5-8). Plants in buildup; a few entered commercial markets in 1995.

Viburnum awabuki 'Chindo' - A NCSU Arboretum named selection discovered in Korea during 1985 U. S. National Arboretum expedition. Broadleaved evergreen shrub to 15'; red fruit; screening or small tree; eastern half of N. C. Very easy from any kind of cuttings at any time of year. (Zone 7-9). Plants in retail markets in 1994.

1992 Candidates (16 candidates proposed by NCSU - 2 initially selected by NCAN; neither remain).

1993 Candidates (11 candidates proposed by NCSU - 5 initially selected by NCAN and remain in trial).

Chrysanthemum weyrichii - herbaceous perennial groundcover with pink flowers in early summer. Propagated by division of spreading rhizomes. (Zone 5-9). In commercial buildup and not yet available in trade.

Gardenia 'Klein's Hardy' - cold-hardy, single-flowered broadleaved evergreen shrub with fragrant white flowers. Easy from hardwood cuttings at most any time of year. (Zone 6-9). In commercial buildup and not yet widely available in trade - a few plants are being sold.

Nyssa sinensis - deciduous shade tree from China - fast and tough. Seed propagation with cold stratification. (Zone 5-9). In commercial buildup and not yet available in trade.

Photinia villosa 'Village Shade' - A NCSU Arboretum named selection; deciduous small tree to 20' with white flowers in spring, outstanding leathery dark green foliage, and showy red fruit in fall/winter. Propagated by semi-hardwood cuttings under mist in summer. (Zone 5-9). In commercial buildup and not yet available in trade.

Raphiolepis umbellata 'Blueberry Muffin' - Free of leaf-spot diseases which affect industry *R. indica* cvs. in the southeast; white flowers and black fruit on broadleaved evergreen shrub; foliage purples in winter. Very easy from semi-hardwood to hardwood cuttings under mist at most any time of year. (Zone 6-9). In commercial buildup; a few to commercial market in 1995.

1994 Candidates (12 candidates proposed by NCSU - 4 initially selected by NCAN and remain in trial).

Amsonia hubrechtii - Threadleaf Bluestar. Native herbaceous perennial; blue flowers; fine lacy foliage; brilliant yellow fall color. Softwood cuttings under mist in summer. (Zone 5-9). In commercial buildup and not yet available in trade.

Lonicera nitida 'Silver Beauty' - 'Silver Beauty' Boxleaf Honeysuckle. Chinese broadleaved evergreen shrub; new European cultivar with silver variegated leaves. Very easy from softwood cuttings under mist in summer. (Zone 7-9). In commercial buildup and not yet available in trade.

Magnolia virginiana 'Santa Rosa' - 'Santa Rosa' Sweetbay Magnolia. Native evergreen flowering tree; white flowers; large evergreen foliage; vigorous growth. Roots in moderate percentages (20-40%) with softwood cuttings under mist in summer; or can be budded/grafted on seedling understock. (Zone 6-9). In commercial buildup and not yet available in trade.

Taxus chinensis - Chinese Yew. Chinese conifer shrub/tree; heat tolerant; fast growing; potential Christmas tree use and hedging with shearing. Roots readily from semi-hardwood to hardwood cuttings under mist at any time of year. (Zone 5-9). In commercial buildup and not yet available in trade.

Significance to the Industry: The NCAN/NCSU Arboretum plant introduction and promotion program diversifies the existing industry by seeking to add new plant products which are not in commercial production. Through teaching growers, retailers, and the consuming market about production and utilization characteristics of unfamiliar plants, new markets are created and a more diverse landscape results. Of the 24 plants promoted to date, the following 7 have been the most commercially successful: *Rosa* X 'Petite Pink'; *Liquidambar styraciflua* var. *rotundiloba*; *Illicium parviflorum*; *Ilex* X 'Carolina Cardinal'; *Hydrangea macrophylla* 'Pia'; *Campsis grandiflora* 'Morning Calm'; *Ilex* X 'Carolina Sentinel'; *Loropetalum chinensis* var. *rubrum*; and *Viburnum awabuki* 'Chindo'. Of more recent selections, the most likely to achieve widest success in the future are the *Raphiolepis umbellata* 'Blueberry Muffin' and *Taxus chinensis*..

Wisteria Evaluations in the NCSU Arboretum

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Nature of Work: Vines have experienced a marked increase in market popularity in recent years for use on screening trellises and fences, for groundcovers, for covering walls, and for use in patio containers. The vigor of most vines have made them a more difficult and awkward group of plants for the nursery production and retailing markets to handle with often rampant growth and resulting control and confinement issues to master. The public often feels that as a group they are uncontrollably aggressive and must be used with great restraint or in areas where high pruning maintenance can be provided. A wide range of both deciduous and evergreen vines exists with diverse ornamental characteristics, seasons of interest and growth rates (3,4,9,10,13).

Wisteria is almost synonymous with the South as a symbol of the region, and both planted and naturalized populations lend much color and fragrance during the spring flowering season. Two American and three Asian species exist which produce inflorescences of varying lengths with flower colors from white through rose, pink, lavender, and to deep purple with some bi-colored cultivars (1,6,11,13). Some 70 cultivars have been described (12), and 35 taxa are currently listed for sale in the largest United States source reference (5), and 43 taxa are listed for the English market (8). The taxonomic confusion in this group of plants is probably greater than almost any other group of woody plants in the American horticultural field with difficulties even at the species level (6,7). Valder devotes an entire chapter to taxonomic issues and provides a new key to the species which is the most comprehensive yet created (12). In addition, problems of multiple renaming of Japanese clones with varied English names, propagation of local origin seedling types, and loss of clonal identity in accidentally propagating understock from grafted plants has occurred. Many unnamed, color-form ('Pink', 'White') clones are propagated and sold which take many years to first flowering and are often of poor to moderate quality even when flowering is achieved. Over the years, The NCSU Arboretum has acquired over 20 clones of *Wisteria* with about 15 currently under evaluation for cultural and ornamental characteristics in USDA Zone 7.

Results and Discussion: The following list summarizes 20 taxa either listed in literature or observed in The NCSU Arboretum and gives their general ornamental attributes. Taxa currently in The NCSU Arboretum collection are indicated by **bold type**.

Wisteria brachybotrys (*W. venusta*) Sieb. & Zucc. - "Silky *Wisteria*." One of two species native to Japan and much rarer in cultivation than *W. floribunda* with only the white form ('Shiro Kapitan') in general cultivation outside Japan. Violet, pink and mauve-pink flowered cultivars also exist. It has much broader racemes than *W. floribunda* with heavy textured flowers and rich fragrance.

Wisteria floribunda (Willd.) DC. - "Japanese Wisteria". Native to Japan and in literature as early as 712 but cultivated long before that in the gardens of Japan. Although long known and greatly admired, it did not enter western cultivation until 1830. Today it is the most widely grown wisteria with by far the largest number of selections and cultivar variants in garden culture. Significant cultivars in more common use include:

Wisteria floribunda 'Domino' ('Issai') - light blue flowers are produced in quantity on young plants - a favorite clone for use in bonsai or potted shrub culture.

Wisteria floribunda 'Honbeni' ('Rosea'; 'Honey Bee Pink') - lavender pink flowers on an old clone in cultivation in the west since 1903. Reported to need correct pruning and training for best flowering which may account for less showy performance at The NCSU Arboretum; but rated by authorities as one of the best wisteria cultivars.

Wisteria floribunda 'Macrobotrys' (many clonal names) - noted for its exceptionally long racemes of flowers - exceeding 3 feet in length on well grown plants and rated as "one of the world's great garden plants" (12).

Wisteria floribunda 'Mon Nishiki' ('Variegata') - cream-spotted variegated foliage and pale blue-lavender flowers. In spring the foliage can be interesting but in the heat of the south the variegation fades to green by midsummer.

Wisteria floribunda 'Royal Purple' ('Black Dragon') - young flowering and blooms early in the season with the darkest purple flower color of any wisteria.

Wisteria floribunda 'Shiro Noda' ('Longissima Alba') - a white flowered form similar to 'Macrobotrys' above with exceptionally long racemes of flowers.

Wisteria floribunda 'Violacea Plena' - a very old cultivar introduced into the U.S. before 1875, and the only double-flowered wisteria. One of the darker colored cultivars. More difficult to get to flower as a young plant than many and requires correct culture for best results.

Wisteria frutescens (L.) Poir. - "American Wisteria". Native to the Southeastern U.S. from Virginia to Florida. The first *Wisteria* to be known in Europe (1724) and the one to which the generic name was first applied by Linnaeus. It has violet-purple flowers and is less vigorous and invasive than Asian species and is more easily controlled in the landscape. Significant ornamental trait differences are its later flowering when foliage has emerged on the plant, and the much shorter racemes. It can have significant merit in use by combining it with the Asian species to extend the flower display season with this species blooming some weeks after the Asian species have finished.

Wisteria frutescens 'Nivea' ('Alba') - A white flowered clone first described in 1854.

Wisteria frutescens 'Amethyst Falls' - A selected form found in Oconee County and introduced by Head-Lee Nursery of Seneca, SC. It has deeper colored amethyst flowers and tends to rebloom at times through the summer.

Wisteria macrostachya (Torr. & A. Gray) Nutt. - "Kentucky Wisteria". First described in 1838 and occurs naturally from Louisiana to Illinois. Taxonomically it overlaps somewhat with *W. frutescens* and various authorities debate its separate species vs. botanical variety status. 'Macrostachys' means "long spikes" in reference to its longer racemes than *W. frutescens*. It is also even later flowering than *W. frutescens* and can be used to further extend the flower display period in mixed plantings. It is the hardiest wisteria species and can be grown dependably in the Chicago area. Several cultivars have been named from natural variants by Louisiana Nursery.

***Wisteria macrostachya* 'Clara Mack'** - A white flowered cultivar which flowers prolifically and at a young age.

Wisteria sinensis (Sims) Sweet - "Chinese Wisteria". Cultivated in China for over a thousand years, with the first description in western literature in the early 1700's, with subsequent introduction to Europe in 1816. Although a number of cultivars are described, little significant variation exists except for the two main violet and white color forms. The most important cultivars include the following:

***Wisteria sinensis* 'Alba'** - a white flowered form with long racemes of flowers which hang down close to the rachis giving a narrow appearance to the racemes.

***Wisteria sinensis* 'Amethyst'** - sold by Duncan & Davies Nursery of New Zealand, this cultivar is the most strongly scented of all wisterias and is rated by Valder as an excellent plant sufficiently distinct to warrant cultivation (12).

***Wisteria sinensis* 'Caroline'** - sold by Duncan & Davies Nursery of New Zealand under this species name - but is considered to either be *W. floribunda* or a hybrid by other authorities. It has somewhat bicolor deep violet flowers and is an extra early flowering clone useful to add to the spread of the season. In The NCSU Arboretum it has been an outstanding plant with precocious and extremely heavy flowering, and intense fragrance. Highly recommended.

***Wisteria sinensis* 'Consequa'** - a soft blue-violet flowering clone which was introduced from a Chinese merchant's garden of this name in 1830. Rated by Valder as "one of the great garden plants of all time."

***Wisteria sinensis* 'Jako' ('Reindeer)'** - a white flowered clone with strongly scented flowers. Often first of the clones to flower in The NCSU Arboretum with very heavy flowering. Highly recommended.

Propagation of *Wisteria* can be achieved by seed, softwood cuttings, dormant hardwood cuttings, root cuttings, layering, whip-and-tongue or cleft grafting, and chip budding (2,12). In a notable negative quote (4), the use of seed is discouraged: "Seed-raised plants are variable and, with bad luck, may take up to twenty years to bear late

flowers of poor quality, that are then obscured by foliage." Grafting on seedling stock of *W. floribunda* is widely practiced in Asian production and the vigorous understock frequently overgrows the scion cultivar, causing a major source of misnamed cultivars in the trade. With modern rooting hormones and intermittent mist technology, rooting of softwood cuttings throughout the summer is the simplest and most recommended procedure for commercial production. Wisteria are essentially insect and disease free in common useage.

Significance to the Industry: Growers should make every attempt to secure and propagate superior, precocious flowering, known cultivar clones of *Wisteria* to replace many of the poorly identified and difficult-to-flower types currently being sold. The first comprehensive English language book devoted to *Wisteris* (12) is now available and should be utilized for detailed understanding of this group of horticulturally important deciduous vines. The author, who has 40 years of practical nursery experience in collecting and growing this group, rates the following as the ten best wisterias: *W. sinensis* 'Consequa', *W. brachybotrys* 'Murasaki Kapitan' and 'Shiro Kapitan', and *W. floribunda* 'Honbeni', 'Kuchibeni', 'Lawrence', 'Macrobotrys', 'Royal Purple', 'Shiro Noda', and 'Violacea Plena'. Greater use should be made of the two native American species, especially for use in combination with the Asian types to extend flowering period of a given display area.

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Ornamental Plant Cultivars Which Have Been Selected, Named and Introduced by the NCSU Arboretum

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North Carolina

Nature of Work: The NCSU Arboretum has collected over 9,000 accessions of ornamental landscape plants from 55 countries since 1977. During the past twelve years, The NCSU Arboretum has distributed over 60,000 plants to nursery growers and nurserymen have collected an estimated two million cuttings and divisions from the arboretum collections. It is estimated that *ca.* 250 different plants are currently in commercial production as a result of The NCSU Arboretum programs. Although the arboretum does not have a formal breeding program for new variety development, selections of seedling variants and mutations differing from standard existing cultivars have been made for formal naming and introduction to preserve them. They are distributed to cooperators and interested nurseries. Some remain collector curiosities, while others have significant commercial value.

Results and Discussion: The following listing briefly summarizes the origin, characteristics, and potentials of 29 ornamental landscape plant taxa named by The NCSU Arboretum.

- Bignonia capreolata* 'Tangerine Beauty' - a color variant of this broadleaved evergreen vine native to the southeastern U.S. with flower color halfway between the normal yellow-orange of the wild species and the brick red cultivar 'Atrosanguinea'. Blooms in late spring with sporadic bloom through the summer. Very easy from softwood to hardwood cuttings under mist in summer. Likely USDA Zones 6-9.
- Camellia* X 'Carolina Moonmist' - from a cross between *C. sasanqua* and *C. oleifera* made by Dr. Fred Cochran of the NCSU. A broadleaved evergreen shrub with very large, single, pink-rose flowers in October. Very easy from hardwood cuttings at most any time of year. Likely USDA Zones 6-9.
- Campsis grandiflora* 'Morning Calm' - a deciduous flowering vine selected in Korea in 1985 with large showy orange-red flowers through summer. Best by softwood cuttings in early summer under mist. Adult wood more difficult to propagate than juvenile. USDA Zone 6-9.
- Cercis yunnanensis* 'Celestial Plum' - a selection of a Chinese deciduous flowering tree with very heavy flower set solidly covering stems in spring with rich plum purple flowers. Generally multiple trunked to about 15'. It can be propagated by softwood cuttings under mist. Best in full sun. Likely USDA Zones 6-9.
- Cornus angustata* 'First Choice' - a selection of the new Chinese species of evergreen, bract-flowered dogwood which does not turn purple or roll leaves in winter sun. Propagated by semi-hardwood cuttings under mist. Sun or light shade but flowers best in sun. Likely USDA Zones 7-9.
- Cornus kousa* 'Little Beauty' - a selection from the 1985 Korean expedition with dense twiggy growth and smaller than normal flowers for smaller urban gardens or container display. Easy from softwood cuttings under mist in summer. Best flowering in full sun but will grow in light shade. Likely USDA Zones 5-9.

- Cornus mas* 'Spring Glow' - small deciduous tree with yellow fragrant flowers (earlier, larger and showier) superior to existing cultivars. Thick leathery foliage which remains attractive until frost. Easy by softwood to semi-hardwood cuttings under mist. Species native to eastern Europe. Best in sun. Likely USDA Zones 5-9.
- Ilex cornuta* 'Autumn Fire' - a seedling variant grown from a population of the Chinese holly collected in Korea in 1985. This female seedling varies by the fruit turning red much earlier in fall than do most *I. cornuta*. Propagated by hardwood cuttings at in mid-late summer or all winter under mist. Likely USDA Zones 6-9.
- Ilex* X 'Carolina Cardinal' - a seedling variant of deciduous holly which is presumed to be an *I. serrata* hybrid. Selected for very heavy fruit set and fruit persistence until spring, and for a lower, more spreading habit than most cultivars. Easily propagated by softwood to hardwood leafy cuttings in summer under mist. Best in sun. Likely USDA Zones 5-9.
- Ilex* X 'Carolina Sentinel' - a seedling hybrid evergreen holly with small foliage somewhat similar to *I. X 'San Jose'*, abundant red fruit, very rapid growth and a columnar habit. It was selected and is marketed as a hedge and screening plant. Easily propagated by leafy stem cuttings under mist. Sun or light shade. Likely USDA Zones 6-9.
- Illicium anisatum* 'Pink Star' - a seedling variant of a broadleaved evergreen shrub with more anthocyanin pigment in the plant than normal for the species resulting in crimson new shoot growth and flowers which are distinctly pink in the bud stage and gradually fading to white as flowers open and age. Semi-hardwood to hardwood cuttings root well under mist. Best in light shade and will grow in full sun. Species is native to Asia. Likely USDA Zones 7-9.
- Illicium mexicana* 'Aztec Fire' - a superior seedling selected from a population of plants grown from seed wild collected in Mexico by Yucca Do Nursery, Waller, TX. It exhibits vigorous growth, large showy red flowers, and consistent reblooming. Broadleaved evergreen shrub native to Mexico. Semi-hardwood to hardwood cuttings root well, though slowly under mist. Best in light shade and will grow in sun. Likely USDA Zones 7-9.
- Jasminum beesianum* 'Goldsport' - a vegetative mutation "sport" discovered on a plant in The NCSU Arboretum which has golden variegated foliage. The species is a semi-evergreen viney shrub with pink flowers that are produced sporadically all summer. Easily propagated by leafy stem cuttings at most any time of year. Best in full sun but will grow in light shade. The species is native to China. Likely USDA Zones 6-9.
- Juniperus horizontalis* 'Lime Glow' - a golden groundcover juniper originally found by NCSU graduate student, Larry Hatch on a Raleigh landscape plant. Typical growth habit of this species - reaching about 8" in height with excellent color even through the heat of summer. Propagated by stem hardwood cuttings under mist - best in winter. Best in full sun. Likely USDA Zones 4-8.
- Koelreuteria paniculata* 'Beachmaster' - a seedling from a 1985 Korean accession of deciduous trees growing on primary ocean dunes. This one exhibited rapid suckering spread, low growth and ability to flower at a young age. Selected for use in coastal beach areas. Propagated by root cuttings. Best in full sun. Likely USDA Zones 5-9.

- Lagerstroemia fauriei* 'Fantasy' - a seedling plant in the arboretum from the original Japanese collection distributed by the U. S. National Arboretum in the 1950's. It was selected for the upright, tree-form growth habit, excellent white flowers for the species, and red bark - and is promoted as a small tree. Semi-hardwood cuttings under mist in summer - not as easy to root as most crepe myrtles. Best in full sun. Hardiness depends on summer heat, nutrition and water in the autumn hardening period - in the eastern U.S. likely USDA Zone 6-8, with surprisingly less cold adaptability in deeper south areas.
- Lagerstroemia fauriei* 'Townhouse' - a chance seedling of the above plant which has the darkest red bark of any crepe myrtles seen. Semi-hardwood cuttings under mist in summer - roots better and more easily than 'Fantasy' above. Best in full sun. Hardiness as described above for 'Fantasy'.
- Melia azaderach* 'Jade Snowflake' - a chance seedling of this Chinese deciduous tree discovered near San Antonio, Texas by Scott Odgen. The foliage is heavily variegated white in a most attractive pattern. It is most highly colored in full sun and when it first emerges in spring - with gradual fade to green in the summer heat. Easy from softwood cuttings under mist in early summer. Best in full sun. Likely USDA Zones 7-9.
- Nyssa sylvatica* 'Dirr Selection' - a wild seedling noted by Dr. Michael Dirr near Athens, GA with exceptional large leathery foliage and brilliant red fall color. Clonal propagation easy with grafting or budding on seedling understock. Best in full sun. Native southeastern U.S. species. Likely USDA Zones 5-8.
- Photinia villosa* 'Village Shade' - a seedling selection of a deciduous small tree with white spring flowers, excellent summer foliage, and red fruit in fall. Selected for the "under powerlines" small tree market. Easy from semi-hardwood cuttings in summer under mist. Best in full sun. Species is native to Asia. Likely USDA Zones 5-9.
- Pinus taeda* 'Nana' - a group of genetic dwarf seedling Loblolly pines originally grown from seed collected from a "witches broom" on a plant in the wild. Most grow at about 1/4 to 1/5 the growth rate of the normal species and are 15-25' tall after 45 years of growth. They must be grafted and are more difficult than most pines. Must be grown in full sun. Native to the southeastern U.S. Likely USDA Zones 6-9.
- Pittosporum tobira* 'Tall 'N Tough' - a seedling from 1985 Korean expedition, and the only one to not freeze to the ground in 1994. Tall, vigorous, profuse fragrant white flowers, and showy red fruit in fall are characteristics. Easy from semi-hardwood cuttings. Likely USDA Zone 7-9.
- Quercus phillyreoides* 'Emerald Sentinel' - a seedling selection of a rare Asian species of evergreen oak with rapid growth (to 3' per year!) with an upright, almost-fastigate growth habit. This species has been the most cold hardy and consistently evergreen of the evergreen oaks in our trials. It propagates from cuttings - a factor which has limited the development of cultivar oaks. Best in sun. Likely USDA Zones 6-9.
- Raphiolepis umbellata* 'Blueberry Muffin' - a seedling variant from seed gathered in the 1985 Korean expedition. It has attractive disease-free evergreen foliage which turns deep purple in winter (in full sun), white flowers, and attractive blue-purple fruit. It is hardier than most *R. indica* cultivars and should be useful in USDA Zones 6-9. Very easy from hardwood cuttings at most any time of year. Best in full sun but will grow in light shade.

Styrax japonicum 'Crystal' - deciduous flowering tree arising as a chance seedling from the 1985 Korean expedition with crisp white flowers on purple-black pedicels highlighted against black-green foliage for striking appearance in flower. Very easy from softwood to semi-hardwood leafy cuttings under mist in summer with no difficulty in keeping them through the first winter after rooting. Best in sun, but will grow in light shade. Species is native to Asia. Likely USDA Zones 5-9.

Styrax japonicum 'Emerald Pagoda' (Originally named 'Sohuksan') - deciduous flowering tree from the 1985 Korean expedition with much larger foliage and flowers than any other cultivars now existing. Best propagated by budding or side veneer grafting as cuttings tend to be easy to root, but difficult to keep alive thorough the first winter after rooting. Likely USDA Zones 5-9.

Ternstroemia gymnanthera 'Burnished Gold' - broadleaved evergreen shrub with golden foliage which originally was found as a seedling variant in a large population of plants at Turtle Creek Nursery in N. C. The color is at its best quite handsome and striking. Propagated by hardwood stem cuttings. Best in light shade but will grow in full sun. Species is native to Asia. Likely USDA Zones 7-9.

Ulmus alata 'Lace Parasol' - a seedling variant of the native winged elm deciduous tree which was found by a nurseryman in the wild near Chapel Hill, NC in the 1940's. At 45 years of age it remains about 8' tall and 12' wide with beautiful weeping branches and attractive "winging" on the stems. Relatively easy from softwood cuttings under mist in early summer, or it can be grafted on elm understock. Likely USDA Zones 6-9.

Viburnum awabuki 'Chindo' - a broadleaved evergreen shrub with white flowers and red fruit in autumn. Selected from landscape seedling populations in Korea in 1985 for its superior fruit display. Very easy from leafy stem cuttings at any time of year and very fast growing. Species is native to Asia. Likely USDA Zones 7-9.

Significance to the Industry: The plants selected, preserved, named, and distributed by The NCSU Arboretum add variety to existing ornamental plant palettes. Of the 29 plants named to date, the following 8 have been the most commercially successful:

Bignonia capreolata 'Tangerine Beauty', *Campsis grandiflora* 'Morning Calm', *Ilex* X 'Carolina Cardinal', *Ilex* X 'Carolina Sentinel', *Lagerstroemia fauriei* 'Fantasy', *Lagerstroemia fauriei* 'Townhouse', *Styrax japonicum* 'Crystal', *Styrax japonicum* 'Emerald Pagoda', and *Viburnum awabuki* 'Chindo'. Others with potential to achieve commercial success in the future are: *Cercis yunnanensis* 'Celestial Plum', *Cornus angustata* 'First Choice', *Cornus kousa* 'Little Beauty', *Cornus mas* 'Spring Glow', *Photinia villosa* 'Village Shade', *Raphiolepis umbellata* 'Blueberry Muffin', and *Ulmus alata* 'Lace Parasol'.

The NCSU Arboretum Evaluation of Southwestern U.S. and Mexico Native Plants

J. C. Raulston, John Fairey and Carl Schoenfeld
North Carolina/Texas

Nature of Work: Over the last 20 years, the NCSU Arboretum has received over 9,000 accessions from 55 countries for trials of adaptation and ornamental merit at Raleigh, NC in USDA Hardiness Zone 7. Traditionally southeastern U.S. native plants and Asian species have been most important in nursery/landscape industry importance. A cooperative relationship has recently developed between The NCSU Arboretum and Yucca Do Nursery of Waller, TX for evaluation of new plants discovered in their extensive explorations of the southwestern U.S. and Mexico. To date, over 55 collecting expeditions have been made in Mexico alone. Originally it was felt that this geographic region would have little promise for adaptability of plants to the Piedmont of North Carolina with likely problems of root rotting in heavy clay soils during summer rains, and lack of winter hardiness. In reality, many outstanding plants are emerging from this testing and merit further consideration by nurserymen.

Results and Discussion: The following listing covers 21 plants or plant genera evaluated over the past 5 years which have performed well at The NCSU Arboretum and briefly indicates their characteristics, performance and commercial potential.

Acer skutchii - fast and vigorous growing species of maple with large foliage which has tolerated heavy clay soils and is cold hardy to at least 4F. Can be rooted from softwood cuttings.

Agave parryi - a very widespread geographic range species with several botanical varieties. In The NCSU Arboretum trials since 1981 from other sources and very hardy, surviving the record winter of -9F. Beautiful blue foliage. Propagation by seed or plant offsets. Many, many other species worthy of trial.

Beschorneria septemprionalis - a little-known genera of yucca-like woody lilies found primarily in the shade of forest areas. This species flowered for the first time at NCSU in 1995 and was one of the highlights of the year with spikes of spectacular red and green flowers, followed by chartreuse spherical seed pods.

Cercis canadensis ssp. *mexicana* (Mexican Redbud) - one of the best plants to emerge from this testing. Significant for the small glossy foliage and compact growth habit. Unlike most eastern redbuds, this species can be rooted from softwood cuttings and has already moved into commercial production and use.

Clethra pringlei - an evergreen species of this fine genera of plants with white fragrant flowers, eventually making a tree in its native habitat. Initially looks promising in USDA Zone 7, and will certainly be useful in Zone 8. Can be rooted from softwood cuttings.

Cornus florida ssp. *urbuniana* (Mexican Dogwood) - an unusual ecotype of the eastern dogwood characterized by flowers in which the bracts are fused and held together as the "flower" opens, creating an open sphere resembling a Chinese lantern. Has not yet flowered at NCSU but is growing well to date. Likely propagated by softwood cuttings.

- Dasyliiron* sp. (Sotols) - a large and widely varied group of woody lilies rarely grown in the eastern U.S. but showing great promise in trials. Physically similar to yuccas with longer and narrower leaves which is often toothed.
- Eryngium umbellifera* - a herbaceous evergreen perennial with blue-purple flowers and dramatic cut-leaf foliage of great textural beauty - growing 12-18" tall and making colonies of spreading plants. Leaves are spiny and defend the plant well against animals, including humans.
- Fagus mexicana* (Mexican Beech) - very rare and new to cultivation. The initial promise is very good with marked tolerance of heat stress. Potential problem of frost damage from early emergence from dormancy in spring. Commercial use will be limited by lack of seed stock until fruiting plants are available in cultivation.
- Hamamelis mexicana* (Mexican Witch Hazel) - very rare and new to cultivation. In Mexico this flowers in summer with foliage and seed pods on the plant at the same time; in N.C. it is more likely to flower at some point during winter but this is yet to be seen. The clone in cultivation has unique creamy white flowers filaments. Has been easy to root from softwood cuttings which grow off rapidly.
- Ilex rubra* - a beautiful 15-25' evergreen, red-fruited tree in its native habitat of the San Carlos mountains; proving to be slow in growth in N.C. Seed and cutting propagation have been used during collection from the native site; and cuttings have rooted well.
- Illicium mexicanum* (Mexican Anisetree) - this evergreen, maroon-red-flowered plant has been in American commerce, apparently from a single clone collected in Mexico many years ago. The plants tested in this program have been the first source identified, wild-collected materials available. The seedling batch was widely variable, and one superior seedling was selected and named 'Aztec Fire' for buildup and release to nurserymen. Hardy in USDA Zone 7-9.
- Magnolia tamaulipana* (Mexican Evergreen Magnolia - originally introduced as *M. scheidiana*) - a beautiful evergreen tree with heavy textured, fragrant, sculptural white flowers. Three different clones are growing successfully in The NCSU Arboretum but have not yet flowered. Can probably be propagated by budding or grafting on *M. grandiflora* seedling understock for commercial production.
- Mahonia chochoaca*, *gracilis*, and *lanceolatus* - widely varying species of "Grape-Hollies" with *M. chochoaca* growing in full sun on dry stressed soil, and the other two more often seen in light to heavy shade on better soils with more moisture. The later two seem more likely to have commercial potential with beautiful fragrant yellow flowers in mid-winter. *M. lanceolatus* has 18" panicles of flowers which continue to develop and open at the tips while blue fruit matures at the base of the flowering spike.
- Manfreda* sp. - a large group of "herbaceous agaves" which die to the ground in winter and develop often dramatic and beautiful foliage in summer, with exotic flowers in a variety of white, yellow, green, purple, and brown colors. Easy from seed or division of colonies. Potential for the cut flower market.
- Muhlenbergia dumosa* - (Bamboo Muhly Grass) - a dramatic and very beautiful plant of fine texture, with appearance of a clumping bamboo arching to 3-4' tall and 4-6' wide from the base. Has been hardy in USDA Zone 7. Fast from seed, or clumps can be divided. Has quickly moved into the N.C. nursery industry following promotion two years ago.

- Nolina* sp. - a large group of woody lilies with appearance half-way between yuccas and grasses; texturally very beautiful plants for the landscape. Most have proven to be excellent plants in our trials with interesting flower spikes of creamy to white flowers.
- Philadelphus* sp. (Mexican Mock-Oranges) - an almost unknown, and often yet unidentified taxonomically, group of deciduous shrubs with varying growth habits and flowering characteristics. All have excellent fragrance and some have pink coloration and darker colored "eyes". Most have finer texture than the Asian types now commonly grown. Easy from softwood cuttings and of commercial potential.
- Quercus* sp. (Mexican Oaks) - an enormous group of widely variable plants with over half of all North American oak species occurring in Mexico. Plants range from deciduous to evergreen, and from tiny groundcovers to majestic trees. All tried at this point have done surprisingly well in our nursery of heavy clay soils subject to flooding. *Q. canbyi* is fine textured with red oak type scalloped foliage, very rapidly growing with up to 6' per year. *Q. polymorpha* is quite variable (as the name indicates) with large, thick leathery semi-evergreen foliage, more moderate in growth with 1-3' per year. *Q. risophylla* is perhaps the most beautiful with heavily textured and scalloped foliage which emerges with pink-bronze color on new shoots - evergreen to deciduous depending upon winter temperatures encountered. Hardy to at least 5F. Commercial potential of oaks often depends on availability of acorns for seed propagation. Early trials indicate some of the Mexican oaks have potential for cutting production.
- Styrax glabrescens* var. *pilosus* (Mexico Styrax) - a very rare small tree with showy white flowers. Related (likely an ecotype) to *S. grandifolia* native to the southeast U.S. but with larger foliage and flowers. Easy from softwood cuttings and of commercial potential. Apparently hardy in USDA Zone 7.
- Stryax youngae* - an extremely rare Texas 3-4' shrub thought extinct for over many decades and recently rediscovered in a Mexican population. It has grown well (in a raised, well-drained bed) at The NCSU Arboretum and produces outstanding white flower displays in spring. Probably from softwood cuttings, but our plant now produces good seed crops as well.

Significance to the Industry: The addition of Texas and Mexico native plants to The NCSU Arboretum plantevaluation, introduction and promotion program has been extremely producing in potential of many new plant products which are not in commercial production. Of the 21 plants or plant genera discussed above, the following 7 have the greatest commercial potential at present: *Cercis canadensis* ssp. *mexicana*, *Dasyllirion* sp., *Eryngium umbellifera*, *Illicium mexicanum*, *Mahonia gracilis*, *Manfreda* sp., *Quercus risophylla*, and *Muhlenbergia dumosa*.

No Spray Rose Trial

R. E. Bir, T. G. Ranney, R. K. Jones and J. E. Shelton
North Carolina

Nature of Work: Successful gardening with roses in the humid southeastern U. S. has a tradition of requiring a regular pest management program. Among the problems cited when growing roses in the southeast are blackspot, canker, mildew, Japanese beetles, aphids, thrips and deer (Dirr). Shrub roses are alleged to have fewer of these problems. However, ninety cultivars of just one species are listed by Verrier.

In an attempt to evaluate twelve commonly available shrub roses which are marketed as being carefree or low maintenance, a no spray rose trial was established at Mountain Horticultural Crops Research and Extension Center, Fletcher, NC. Bare root plants were obtained in early summer 1993, planted into 3 gallon containers in a container medium consisting of 8 pine bark:1 sphagnum peat to which 7 lbs of dolomitic limestone and 1.5 lbs of Micromax per yard was added and thoroughly mixed prior to planting. Osmocote 18-6-12 controlled release fertilizer was applied topdressed the day after planting at the rate of 50 g. per pot. Winter protection was provided in an unheated white plastic covered greenhouse.

Three plants of each cultivar were established in unamended soil beds in early April 1994 in a completely random design then pruned to a cane length of approximately 15 inches. Plants were mulched with compost then fertilized a week after planting with Osmocote 18-6-12 at the rate of 3 lbs Nitrogen per 1000 sq. ft. No irrigation or pesticides were applied to this rose bed in 1994. Sixty-eight and two tenths inches of rainfall was recorded at MHCREC during 1994 with 40.9 inches falling during the April through October growing season (1.32 in. per week).

Monthly visual evaluations for plant performance were collected. Maximum height and width measurements were recorded in December 1994.

Results and Discussion: Comments regarding individual plants follow. Plant habit and general attractiveness were considered as important as pest resistance. It should be noted that plants of 'Alba Meidiland' and 'Scarlet Meidiland' were vigorous growers, achieving an average width of over 10 ft. in one growing season in the bed. Both cultivars tip layered into the mulch creating a colony of each cultivar.

Alba Meidiland - A low growing plant with abundant leathery dark green leaves which grew to an average of 11.8 ft. wide in one year while tip layering repeatedly in mulch. Small double white flowers appeared from June until autumn.

Alba-plena - A selected mutation of *Rosa rugosa* 'Alba.' Flowers are double, pure white and fragrant. It has dark green foliage and a dense, low habit growing up to 4 ft. tall. This cultivar does not produce hips. Fall foliage is yellow to orange. Overall, a consistently attractive plant.

Blanc Double de Coubert - Similar to 'Alba-plena'. Flowers are semidouble to double, pure white with showy yellow stamens. It is a vigorous grower with glossy, dark green foliage which turns yellow in fall.

- Bonica** - This was the first introduction in the Meidiland series and the first shrub rose ever to win All American Rose Selection honors. Flowers have medium pink buds that open to fully double and pastel pink 3 in. wide. Flowers are produced throughout the season but most heavily in spring. Hips are bright orange-red. Habit is upright and arching. Grew to three ft. high by five ft. wide in one year. No fall foliage color change.
- Fru Dagmar Hastrup** - Most attractive cultivar overall in tests so far. It produces abundant, season long blooms. The single flowers are fragrant and pale pink with showy yellow stamens. Large, plentiful tomato-red hips are produced in full color by mid summer. Foliage is rich dark green turning an excellent yellow to orange in fall. Possesses a neat mounding habit at 3.5 ft. in one year.
- Linda Campbell** - This vigorous grower has flopping canes that occasionally break in the wind. Crimson flowers, mid green foliage and fewer thorns than other rugosas make this the red flowering rose that first attracts visitors' attention. It grew to three ft. tall by six ft. wide in one year.
- Pink Meidiland** - The single 2 to 2.5 in. diameter coral pink with white center flowers open from spring to frost and are followed by small reddish fruits. This was the smallest bush of the Meidiland roses in the test with an upright habit, growing to three ft. tall by six ft. wide in one year.
- Roseraie de l'Hay** - A cultivar of a sport of *R. rugosa* 'Rosea.' Numerous large fully double fragrant flowers appear in clusters in June then sporadically throughout the season. Few hips developed. It grew four feet tall and wide with an open habit after one year.
- Rugosa alba** - This cultivar of unknown origin had single, white 4 in. slightly fragrant flowers with showy yellow stamens. Orange hips became apparent late in the growing season. This bush has an open upright habit growing to four feet high and wide in one year. Fall foliage is a clear yellow. Spring vegetative growth is slowest to begin of all the roses tested.
- Sarah van Fleet** - A hybrid with large, double, rose-pink fragrant flowers. Hips are small, green and unattractive. The sprawling, open habit was very leggy. It grew to 4 ft. high by 5.5 ft. wide in one year.
- Scarlet Meidiland** - Plentiful double 1.5 to 2.0 in. diameter scarlet flowers appeared in early summer then occasionally until frost. Abundant glossy rich green foliage was produced on a bush averaging 2.5 ft. tall by 10.1 ft. in a year. This cultivar tip layered into mulch occasionally but not nearly as often as 'Alba Meidiland.'
- Topaz Jewel** - This is one of the few yellow flowered rugosa roses and a favorite of visitors. It was a recurrent bloomer with 4 in. diameter semidouble, light yellow flowers and showy orange stamens. It possessed a dense, bushy habit growing to 3.5 ft. tall and wide after one year.

Significance to the Industry: During the 1994 growing season, none of the plants in the test displayed blackspot or canker. Powdery mildew (*Erysiphe cicharocearum*) was a problem only on the cultivar 'Sarah van Fleet.' Petal blight (*Botrytis cinerea*) was a consistent problem on 'Linda Campbell' and 'Rosarie de l'Hay' but may have been reduced or controlled by judicious removal of spent blooms.

All plants became infested with aphids during the spring flush of growth but no growth distortion resulted, possibly because aphid predators in the form of ladybugs arrived soon after the aphids. Japanese beetles were a problem on the foliage of only 'Sarah van Fleet' but they were consistently a problem in consuming flower petals, particularly on *Rugosa alba*.

Contrary to the performance of other shrub roses, all of these were repeat bloomers. Some, such as 'Fru Dagmar Hastrup' produced at least three distinct crops of flowers followed by hips so that flowers and hips were prominent at the same time after mid summer.

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Pansy Performance in Alabama

Darby Quinn, Bridget Behe and Jimmy Witt
Alabama

Nature of Work: Pansy cultivar selection for commercial and residential landscape changes as new cultivars become available. The purpose of this study was to evaluate new pansy cultivars for use in the Alabama landscape. Ninety-nine pansy cultivars were observed from fall 1993 through spring 1994, whereas 161 pansy cultivars were observed from fall 1994 through spring 1995 in an All-America Selections (AAS) Display Garden at the E.V. Smith Research Center in Shorter, Ala. (latitude 32 ° 30' N, longitude 85° 40'W). This site was located in growing zone 8 (1).

In 1993-1994, the beds were ground-level with black plastic mulch and were drip irrigated with 200 parts per million of nitrogen 20-10-20 fertilizer as needed until March 23, 1994. In 1994-1995, raised beds, approximately 9 inches above the soil surface, were used with overhead irrigation and a pre-plant incorporation of controlled-release fertilizer. Both years the beds were fumigated with methyl bromide, and the soil was tested and amended the previous spring. Prior to each study, the area had been planted with a summer Annual Trial Garden.

Seeds of the entries were donated by several companies and grown by a single commercial producer in Alabama. Twelve plants of each cultivar were planted in two rows of six each and were planted 9 inches on center. The outside four plants were used as guard rows. The inside eight plants were evaluated bimonthly from Dec. 5, 1994, through Mar. 27, 1995. They were rated each time by the same person using a 1-5 scale. Flowering plants were rated primarily based on their floral displays, but size, shape, and freedom from insect or disease blemishes were also considered. Ratings were made in whole number units.

Results and Discussion: November and December of 1993 were warmer and drier than the normal with average air temperatures of 53.3 and 45.6, respectively, and average monthly rainfall of 3.7 and 3.9 inches (3). January was cooler and wetter than normal with an average monthly temperature of 41.6 and monthly rainfall of 5.2 inches. February and March of 1994 were cooler and drier than normal with average monthly temperatures of 51.3 and 56.6, respectively, and monthly rainfall of 4.2 and 6.6 inches, respectively. Overall, weather during this trial period was warmer and drier than normal.

In December of 1994, there were 2.4 inches of rain less than normal and 3.7 degrees warmer than normal, and the solar radiation measured 2319 W/sq. m. In January of 1995, there were 0.49 inches less rainfall than normal, 3.4 degrees warmer than normal, and 2730 W/sq.m. solar radiation. February 1995 had 0.76 inches less rainfall than normal, 2 degrees warmer than normal, and 3488 W/sq.m. solar radiation. In March of 1995, there were 2.0 inches of rain less than normal, 4.5 degrees warmer than normal, and 4150 W/sq.m. solar radiation. This was a warmer, drier winter than normal.

Yellow and blue cultivars in general received higher ratings in 1993-94 than other color groups (Table 1). Accord Clear Yellow had the highest peak rating of the yellow cultivars, while Jewel Yellow had the highest average rating of the yellow cultivars. Jewel Light Blue had both the highest peak rating and average rating of all the cultivars rated. The best purple pansy cultivar was Fama See Me. Watercolor Melange was the highest peak and average (with Roc Orange) orange pansy cultivar. The best white cultivar was Jewel White. It also peaked earlier and held its peak for a minimum of two weeks. Accord Rose was rated the best rose colored cultivar, while the top red was Accord Red Blotch. The best performing mix of pansy cultivars rated was Imperial Antique Shades.

In 1994-95, the best yellow with a face for early flowering and showy blooms was Springtime Yellow Marble (Table 2). The best solid yellow was Universal Plus Yellow. The best blue with a face was tied between Fama Dark Eyed Blue, Rally Deep Blue with Blotch, Happy Face Blue, Roc Blue with Light Flag, Bingo Blue with Blotch, and Skyline Blue with White Flag. The highest performing solid blue pansy was tied between De Chalon, Fama True Blue, Universal Plus True Blue, Imperial Silver Blue, Universal Plus Beaconsfield, and Roc Light Blue. For the purple pansy with a face, Majestic Giants Purple, Imperial Purple and White, Fama See Me, and Universal Plus Violet Blotch tied for the peak and best performance. Bingo Deep Purple, Springtime Black, and Atlas Purple were the best performing solid purples. The best orange pansy with a face was Imperial Orange Prince, while the best solid orange was tied between Imperial Orange, Rally Orange, and Fama Orange. In the white class, Happy Face White was the best with a face. The top white without a face was Rally Pure White. The best pink with a face was Imperial Pink Shades. The best rose with a face was Universal Plus Rose Blotch, and the best solid rose was Crystal Bowl Primrose. Tied in first for the reds with a face were Delta Carmine with Blotch, Maxim Red and Yellow, Majestic Giants Scarlet Bronze Shad, Majestic Giants Red, and Yellow and Universal Plus Red Wing. Clear Sky Red was rated number one for best solid red pansy. Medallion Mix was the best cultivar mixed with a face. A tie for the longest and most floriferous solid mixed pansy was between All Sky Mix, Delta Pure Colors Mix, and Universal Plus Mixture.

Significance to the Industry: Many of the new pansy cultivars performed well in our testing location with several cultivars in each color category performing equally well. Results varied from the first trial year to the second. The change from plastic mulch and drip irrigation came at the request of industry professionals who could better use the results from a trial conducted on raised beds and utilizing overhead irrigation. Under those conditions, we would recommend Universal and Imperial series. Cultivars from both of those series performed well during the second year of the evaluation, in terms of peak and average flower ratings.

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Table 1. Pansy cultivar performance in 1993-1994.

Color and Cultivar (Source) ¹	Face	Peak Rating	Average Rating	Peak Date
<u>Yellow</u>				
Accord Clear Yellow (Gold)	n	4.0 ²	2.4	3/21
Jewel Yellow (Takii)	n	3.9	2.5	3/21
<u>Blue</u>				
Jewel Light Blue (Takii)	n	4.6	2.8	3/21
Azure Blue (Clause)	n	3.6	2.3	3/21
<u>White</u>				
Jewel White (Takii)	n	3.0	2.1	2/21 to 3/7
Universal White (Gold)	n	2.8	1.7	3/21
<u>Purple</u>				
Fama See Me (Benary)	y	4.2	2.5	3/21
Jewel Purple Face (Takii)	y	3.4	2.4	3/21
<u>Rose</u>				
Accord Rose Blotch (Gold)	y	3.9	2.2	3/21
Regal Rose w/Blotch (Sakata)	y	2.8	1.9	3/21
<u>Red</u>				
Accord Red Blotch (Gold)	y	3.4	2.1	3/21
Fama Red (Benary)	y	3.1	2.1	3/21
<u>Orange</u>				
Watercolor Melange (Clause)	n	3.9	2.4	3/21
Roc Orange (S&G)	n	3.4	2.4	3/7 to 3/21
<u>Mixed</u>				
Imperial Antique Shades (Takii)	n	3.4	2.1	3/21
Accord Mix (Gold)	n	3.1	2.0	3/21

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Table 2. Pansy cultivar performance in 1994-95

Cultivar (Source)³	Face	Peak Rating	Average Rating	Peak Date
<u>Yellow</u>				
Springtime Yellow Marble (Clause)	y	3.1 ⁴	4.8	3/13, 3/27
Universal Plus Yellow Blotch (Gold)	y	3.1	4.6	3/13, 3/27
Delta Pure Primrose (Vaughn)	n	2.9	4.4	3/27
Universal Plus Yellow (Gold)	n	2.9	4.6	3/27
Crystal Bowl Yellow (Wrights)	n	2.9	4.6	3/27
<u>Blue</u>				
De Chalon (Clause)	n	2.8	5.0	3/13, 3/27
Fama True Blue (Benary)	n	2.8	5.0	3/13, 3/27
Universal Plus True Blue (Gold)	n	2.8	5.0	3/13, 3/27
Imperial Silver Blue (Vaughn)	n	2.8	5.0	3/13, 3/27
Universal Plus Beaconsfield (Gold)	n	2.8	5.0	3/13, 3/27
Roc Light Blue (S&G)	n	2.8	5.0	3/13, 3/27
Fama Dark Eyed Blue (Benary)	y	2.8	5.0	3/13, 3/27
Rally Deep Blue with Blotch (PanAm)	y	2.8	5.0	3/13, 3/27
Happy Face Blue (Bodger)	y	2.8	5.0	3/13, 3/27
Roc Blue with Light Flag (S&G)	y	2.8	5.0	3/13, 3/27
Bingo Blue with Blotch (PanAm)	y	2.8	5.0	3/13, 3/27
Skyline Blue with White Flag (S&G)	y	2.8	5.0	3/13, 3/27
<u>White</u>				
Happy Face White (Bodger)	y	2.7	4.9	3/27
Rally Pure White (PanAm)	n	2.5	4.0	3/27
Delta White with Blotch (Vaughn)	y	2.5	4.9	3/27
<u>Purple</u>				
Bingo Deep Purple (PanAm)	n	2.8	5.0	3/13, 3/27
Springtime Black (Clause)	n	2.8	5.0	3/13, 3/27
Atlas Purple (Bodger)	n	2.8	5.0	3/13, 3/27
Majestic Giants Purple (Vaughn)	y	2.8	5.0	3/13, 3/27
Imperial Purple and White (Vaughn)	y	2.8	5.0	3/13, 3/27
Fama See Me (Benary)	y	2.8	5.0	3/13, 3/27
Universal Plus Violet Blotch (Gold)	y	2.8	5.0	3/13, 3/27
<u>Rose</u>				
Crystal Bowl Primrose (Wrights)	n	2.8	5.0	3/13, 3/27
Bingo Light Rose (Pan Am)	n	2.8	5.0	3/27

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<u>Red</u>				
Clear Sky Red (S&G)	n	2.8	5.0	3/13, 3/27
Delta Carmine with Blotch (Vaughn)	y	2.8	5.0	3/13, 3/27
Maxim Red and Yellow (Vaughn)	y	2.8	5.0	3/13, 3/27
Majestic Giants Scarlet Br. Shad (Vaughn)	y	2.8	5.0	3/13, 3/27
Majestic Giants Red and Yellow (Vaughn)	y	2.8	5.0	3/13, 3/27
Universal Plus Red Wing (Gold)	y	2.8	5.0	3/13, 3/27
Delta Pure Red (Vaughn)	n	2.8	5.0	3/27
<u>Orange</u>				
Imperial Orange (Vaughn)	n	2.8	5.0	3/13, 3/27
Imperial Orange Prince (Vaughn)	y	2.8	5.0	3/13, 3/27
Rally Orange (PanAm)	n	2.8	5.0	3/13, 3/27
Fama Orange (Benary)	n	2.8	5.0	3/13, 3/27
<u>Mix</u>				
Medallion Mix (Clause)	y	2.8	5.0	3/13, 3/27
All Sky Mix (S&G)	n	2.8	5.0	3/13, 3/27
Delta Pure Colors Mix (S&G)	n	2.8	5.0	3/13, 3/27
Universal Plus Mixture (Gold)	n	2.8	5.0	3/13, 3/27
Happy Face Mixture (Bodger)	y	2.8	5.0	3/13, 3/27
Fama Mix (Benary)	y	2.8	5.0	3/13, 3/27
<u>Pink</u>				
Imperial Pink Shades (Vaughn)	y	2.5	5.0	3/27

¹ **Seed Sources:** (Benary) Benary, (Clause) Clause, (Gold) Goldsmith, (S&G) Sluis and Groot, (Takii) American Takii.

² **Rating Scale:** 1 = small display of foliage with no flowers; 2 = adequate foliage with no flowers or few buds showing; 3 = adequate to large amount of foliage and a relatively small floral display; 4 = sufficient foliage and floral display to be attractive in the landscape; and 5 = superior floral display and sufficient foliage display.

³ **Seed Sources:** (Benary) Benary, (Bodger) Bodger, (Clause) Clause, (Gold) Goldsmith, (PanAm) Pan American, (S&G) Sluis and Groot, (Takii) American Takii, (Vaughn) Vaughn, (Wright) Wright's Greenhouse and Nursery, Inc..

⁴ **Rating Scale:** 0 = plant died; 1 = small display of foliage with no flowers; 2 = adequate foliage with no flowers or few buds showing; 3 = adequate to large amount of foliage and a relatively small floral display; 4 = sufficient foliage and floral display to be attractive in the landscape; and 5 = superior floral display and sufficient foliage display.

Cold Hardiness Evaluation of Eight Crapemyrtle Cultivars

Edgar Davis and Donna Fare
Tennessee

Nature of Work: Crapemyrtle is a valued landscape plant for its massive show of flowers and picturesque trunk. In middle Tennessee, Zone 6b, crapemyrtle usually dies back to the ground each year due to winter injury. This results in higher maintenance cost since the dead branches must be pruned out. Therefore, a crapemyrtle that is more cold hardy would be beneficial to the industry.

This project was conducted to determine if some of the more recent crapemyrtle cultivars would survive in zone 6b with less winter damage. *Lagerstroemia indica* x *Lagerstroemia fauriei* cultivars 'Acoma', 'Carolina Beauty', 'Comanche', 'Hopi', 'Osage', 'Tonto', 'Tuscarora', and Regal Red a selection of *Lagerstroemia indica* were evaluated for growth and winter hardiness. 'Tuscarora', 'Carolina Beauty', and Regal Red are considered tree forms 7 to 10 m in height. 'Comanche' and 'Osage' are intermediate forms 4 to 6 m in height. 'Acoma', 'Hopi' and 'Tonto' are semi-dwarf 1.5 to 3.5 m in height (1).

'Hopi' is the most cold hardy of the semi-dwarf cultivars withstanding -30C without injury (3). It has also been reported that 'Acoma', 'Comanche', 'Osage', 'Tonto', and 'Tuscarora' have all withstood -23C without injury (1,2,3,4).

Three replications of eight plants of each cultivar were planted into a Mountview silt loam on 21, April 1993. All cultivars were fertilized at the rate of 50 lbs. of N per acre each year using 10-10-10. No irrigation was applied.

At the end of each year, growth indices (GI) ($GI = ht + w1 + w2/3$) were measured. Shoot dieback was measured each spring after leaves had unfurled. Also, total number of shoots with winter injury were counted in the spring of 1995.

Results and Discussion: In the fall of 1993, 'Acoma' and 'Osage' were the most vigorous with 58.6 and 59.0 cm respectively of overall shoot growth. While 'Carolina Beauty' and Regal Red had the least amount of growth with 39.9 and 40.9 cm respectively. The winter of 1994 our lowest temperature was -23C in January, and a late February ice storm caused shoot injury to ground level in all cultivars.

After the 1994 growing season, 'Osage' had the most over all growth at 155.4 cm, and Regal Red had the least growth at 71.7 cm. The low temperature for the winter of 1994 was -17C. In May 95, shoot dieback was measured, and 'Comanche' was the most severe with 38.1 cm. 'Acoma' and Regal Red had no dieback and 'Hopi' had little dieback with 0.6 cm. All of the other cultivars had > 20 cm of dieback.

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'Acoma' and Regal Red had no shoots with dieback in 1994. 'Hopi' also performed well with 0.1 shoots with injury. 'Tuscarora' had the largest number of shoots 10.2 with winter injury. 'Osage' and 'Comanche' had 7.9 and 5.6 shoots respectively with injury.

Significance to Industry: These results indicate that 'Acoma', 'Hopi' and Regal Red had the least amount of dieback during the 1994 winter. With less dead branches to remove, maintenance costs are reduced following a mild winter. All of the other cultivars in this test would be more costly to maintain in years when they do not dieback to ground level because of the higher number and severity of pruning cuts.

Table 1. Growth responses of selected crapemyrtle cultivars in Tennessee.

Cultivar	1993 GI	1994 Dieback	1994 GI	1995 Dieback	1995 # Shoots Dieback
Acoma	58.6 za	84.4 b	107.6 c	0.0 d	0.0 e
Carolina Beauty	39.9 d	98.3 a	95.7 cd	27.7 abc	3.2 d
Comanche	46.8 c	85.9 b	128.5 b	38.1 a	5.6 c
Hopi	43.35 cd	52.3 d	88.0 d	0.6 d	0.1 e
Osage	59.0 a	78.0 c	155.4 a	26.1 bc	7.9 b
Regal Red	40.9 d	76.1 c	71.7 e	0.0 d	0.0 e
Tonto	51.5 b	74.5 c	121.6 b	20.3 c	3.0 d
Tuscarora	46.9 c	75.2 c	119.8 b	35.8 ab	10.2 a

z mean separation within columns by DMRT, @ 5%

GI = GI-initial

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North Carolina Certified Plant Professional Program

M.A. Powell
North Carolina

Nature of Work: Professionalism describes the industry environment for the '90's. The leaders of the landscape and nursery industry realize the importance of professionalism and improved quality of goods and services. All parts of the industry are striving to improve the credibility of their particular speciality. Landscape architects are now required to obtain recertification credits to renew their licenses (just as the pesticide applicators must obtain their credits). More and more landscape related professions are becoming registered landscape contractors. There are plans to develop a Certified Landscape Technician program in 1996 for landscape employees.

The North Carolina Association of Nurserymen began a certification program primarily for garden center employees in 1983, which initially was called Certified Plantsman. There are presently 670 people who have passed the exam. This program has been successful in the past and is becoming more and more creditable as a benchmark of competence among industry related businesses. This program is currently known as Certified Plant Professional. Most private garden centers and mass merchandisers require their garden center department employees to be or to become Certified Plant Professionals. They are recognized with a certificate and uniform decal. A salary adjustment by the employer is typically rewarded, once the exam is passed.

Discussion and Results: It is rather easy to get into the nursery, garden center or landscape business, and folks quickly realize that success depends on becoming a professional and hiring employees with professional skills. The Certified Plant Professional exam is offered 3 times per year. The passing rate is about 50%. As a way to improve on the success rate of this exam, there have been several educational programs offered by NCSU Horticulture Extension Faculty. The exam has a written part (200 questions) and a plant identification part. The plant list includes the most popular trees, shrubs, groundcovers, vines, annuals and perennials. It also includes turfgrass and interior plants. There are 326 plants on the entire list.

A collection of these plants was begun in the fall of 1994 and is 95% complete. This has proven to be quite a resource for students preparing for the exam. Each plant is labelled with the correct scientific name and common name. The collection is open to the public and is accessible through the NC SU Arboretum. County agents in several regions across NC have offered a complete study course for exam preparation. In 1994, 12 agents took a 3 week summer school course in plant identification and successfully completed the exam later on that summer. Many now offer local workshops on CPP study preparation and several have begun their own study collection.

The Certified Plant Professional program is one example of professionalism in the "green industry". The North Carolina Association of Nurserymen and the North Carolina Landscape Contractors Association are committed to promoting professional certification and registration programs with the faculty support of NCSU.

Two New Landscape Plants; Chuck Hayes Gardenia and Virginia Beautyberry

Daniel C. Milbocker
Virginia

Nature of Work: Hardiness and extended flowering were combined in a seedling selection of *Gardenia jasminoides* syn. *G. Florida*, *G. radicans* and *G. augusta*. Large berry size and large clusters of berries were combined in a seedling from cross pollination of *Callicarpa japonica* and *C. tosaensis*. These improvements have increased the aesthetic value of gardenia and beautyberry for landscaping purposes.

An individual single flowered gardenia plant was a sole survivor of a hard freeze in the Cavalier nursery owned by Charles Hayes. It was cross pollinated with a double flowered type until a seedling population containing double flowered types was developed. These were evaluated for day length response, hardiness, floriferousness and compactness.

Callicarpa japonica is the commonly grown beautyberry introduced from Japan. It is hardier than the native beautyberry, *C. americana* and has comparably large violet berries. Another beautyberry, *C. tosaensis* more recently introduced from Japan by F. Myers of the National Arboretum, bears a larger number of smaller berries per cluster. A seedling population from the cross pollination of *C. japonica* and *C. tosaensis* was evaluated for plants with improved shrub character, berry size and cluster size.

Results and Discussion: One gardenia seedling was found that combined temperature tolerance, double flowering, compactness and was relatively insensitive to daylength. Low temperature tolerance increased hardiness and high temperature tolerance decreased flower bud abortion and increased floriferousness. Double flowering increased the aesthetic value of the flowers. Shortened leaf length was associated with broader leaves and shorter internodes which produced a dense compact plant. Insensitivity to daylength combined with high temperature tolerance allowed the continuation of flowering over a longer spring season and during the return of cool fall weather. The plant with this combination of characteristics was named 'Chuck Hayes'.

One seedling was selected from the callicarpa cross pollination that combined the berry size of *C. japonica* with the larger cluster size of *C. tosaensis*. The inflorescence, ordinarily quite inconspicuous, was large enough to attract attention. Its greener and less purple foliage tended to contrast well with its pink flowers. Flowering continues throughout the summer making beautyberry somewhat attractive as a flowering plant. The large loose clusters of larger sized berries greatly enhanced its attractiveness during the fall and early winter seasons. From a distance, the berries appear to be a mass of late blooming flowers. The plant bearing this attractive combination of characteristics was named Virginia Beautyberry.

Significance to the Industry: Two improved landscape plants, gardenia and beautyberry are now available for nursery production and landscaping.