SECTION 3
FIELD PRODUCTION

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Effect of Aisle Cover Crops on loss of 2,4-d and Simazine Applied to Red Maples

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Nature of Work: Increasing consideration of the offsite effects of soil erosion might require nurserymen to increase the utilization of soil conservation practices. A study was conducted to determine the effect of various aisle cover crops on tree growth and soil erosion and loss of fall applied simazine and 2,4-D. In the spring of 1991 an experimental field plot was established at the Tennessee Tech University Farm on a Typic Paleudult with a silt loam surface texture and a 5% slope. A randomized complete block design was utilized including four aisle covers: clean tilled, crimson clover, annual ryegrass, and ‘Appalow’ lespedeza. Appalow is a low growing lespedeza that produces decumbent stems that generally do not exceed 1 ft. in height. The plots were 10 ft. wide, 50 ft. long, ran east to west, red maple liners were planted down the center of the plots in the spring of 1991. A 8 in. wide weed free strip centered on the tree rows was maintained using applications of glyphosphate and hoeing. The trees were grown using standard nursery tree production practices. Runoff monitoring plots were established in one replication. Metal strips were placed around the borders of each plot to maintain integrity of the runoff samples. A collection trough constructed out of PVC pipe was placed at the base of each plot which funneled the runoff through an H flume and across a chosocton wheel, which took a 1.5% subsample of the runoff and channeled it into a glass container. Attached to the H flume was stilling well containing a float attached to a flow recorder. On September 8, 1992 2,4-D and simazine were applied to the weed free strips in the crimson clover, annual ryegrass, and Appalow Lespedeza plots, and over the entire area of the clean tilled plots. Simazine and 2,4-D were applied using a calibrated back pack sprayer at a rate of 4.48 Kg AI/Ha each. This resulted in 24.8 g of simazine and 2,4-D being applied to the clean tilled plot and 3.7 g of each to the crimson clover, annual ryegrass, and Appalow lespedeza plots. Tree height and caliper were measured after leaf fall in the fall of 1992. Runoff was collected through from June 1992 through April 1993 and analyzed for sediment, 2,4-D, and simazine content. From June 1992 through April 1993 21 runoff events occurred as the result of 98.4 cm of rain ranging from 1.0 to 8.3 cm/event.

Results and Discussion: Total runoff, sediment runoff 2,4-D runoff, and simazine runoff for June 1992 through April 1993 from each of the plots are presented in Table 1. The effect of the aisle cover crops on runoff and soil loss were similar to what has been previously observed. Greater runoff was observed from the clean tilled and Appalow lespedeza plots than from the crimson clover and annual ryegrass plots. Soil loss was greatest from the clean tilled plots (14,208 kg/ha) and least from the Appalow plot (692 kg/ha). More than twice as much soil was lost from the annual ryegrass plot compared to the crimson clover plot. Approximately 15% of the 2,4-D and simazine applied to the clean tilled plot was removed from the plot in runoff compared to 20% from the crimson clover plot and 1% from the Appalow plot. Approximately 23% of the simazine applied to the annual ryegrass plot was removed in runoff, but only 2.6% of the 2,4-D was lost this way. Though a greater percentage of the simazine applied to the crimson clover and annual ryegrass plots was lost in runoff compared to the clean tilled plot, the total simazine lost from the clean tilled plot was approximately 4.5 times greater than from the crimson clover or annual ryegrass plots.

The effect of the aisle cover crops on tree height and caliper growth are shown in Table 2. Generally the trees in the crimson clover plots out performed those in the other plots, however none of the differences were statistically significant. Further years of growth will be needed to confirm this trend.

Significance to Nursery Industry: The data presented shows that soil erosion and herbicide loss from tree nurseries can be greatly reduced by utilizing an aisle winter cover crop maintaining soil productivity and reducing offsite effects of tree nurseries. Also it was shown that appalow lespedeza might be suitable as a perennial aisle cover for some tree species.

Table 1. Total runoff, sediment runoff, 2,4-D runoff, and simazine runoff for June 1992 through April 1993 from each of the plots

		Clean Tilled	Crimson Clover	Annual Ryegrass	Appalow Lespedeza
Runoff Volume	Kl/ha	2,526	1,900	2,140	2,528
Sediment Runoff	Kg/ha	14,208	1,884	4,654	692
2,4-D Runoff	g/ha	813.2	165.2	20.6	1.2
Simazine Runoff	g/ha	804.9	164.5	186.8	17.5

Table 2. Mean tree height and caliper measurements from the fall of 1992.

Aisle cover	Height cm	Caliper mm
Clean Tilled	105	11.8
Crimson Clover	114	12.6
Annual Ryegrass	98	11.7
Appalow Lespedeza	108	11.4
LSD 0.05	21	1.9

Soil Nitrate Movement in a Drip Irrigated Field Shade Tree Nursery

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Nature of Work: Nitrate concentrations greater than 10 ppm exceed drinking water standards in the US and at least 9 other nations (Terblanche 1991). Reports disagree concerning whether agriculture is a major contributor to nitrate pollution (Kilmer 1974, Owens 1992, Thomas 1992, Weil 1990), yet the public continues to perceive that agriculture is a major threat to drinking water supplies (Hauck 1990).

Field nurseries are a highly visible part of agriculture yet their role in contributing to nitrate pollution is unknown. In fact, trees, shrubs and sod have been suggested as filters and a sink for nutrient runoff from agricultural lands (Lowrance 1984, Magdoff 1992). The following research was undertaken to determine whether a field tree nursery utilizing drip irrigation and dry ammonium nitrate fertilization was contributing to increased levels of nitrates in the soil.

The experimental site was located on a Cecil sandy clay loam soil (clayey, kaolinitic, thermic Typic Hapludult) at Mize Nursery in Polk Co., N.C. Three field locations were selected in a newly established shade tree nursery to determine the amount of movement of inorganic nitrogen through the soil. Soil cores were removed after summer fertilization and during the winter from three distances (6 in, 18 in, and 36 in) away from each tree location. Soil cores were taken with a 6 foot long 2 inch diameter solid metal tube equipped with a hardened tip. Tubes were inserted into the soil to a depth of 5 feet using a jackhammer equipped with an apparatus designed to both be placed into the upper end of the tube and withstand the blows of the hammer. Tubes were removed with an industrial jack equipped with a locking mechanism attached to the tube. Soils were removed from the tubes and separated by depth (0-4, 4-10, 10-20, 20-30, 30-40, 40-50, 50-60 inches). All soil samples were placed in a plastic zip-lock bag and frozen within 8 hours. Soil samples were analyzed for ammonium-N and nitrate-N by thawing the soil sample, shaking 10 grams of soil and 30 mls of 1 N KCl solution for 30 minutes then filtering the extract. The liquid filtrate was then analyzed on a Technicon Autoanalyzer II for ammonium-N and nitrate-N using standard spectrophotometer methodology (Technicon Industrial Systems, 1978 a & b). All data represents the means of three replicates.

Samples were collected February 2, 1990 prior to planting, in December following the 1990 and 1991 growing seasons as well as one week after mid summer fertilizer application during 1991. Fertilizer was applied in a ring 6 to 10 inches from trees in June 1990, then banded 15 to 18 inches from the base of the tree in late winter as well as summer 1991. Fertilizer was applied as ammonium nitrate (33.5-0-0) at the rates of 0.5 oz. N/tree in 1990 and summer 1991; and 1.0 oz. N/tree winter 1991. Tree population per acre was approximately 1250.

Trees were grown in 3.5 ft. wide bare soil rows which were maintained with directed sprays of Roundup. Strips between rows were maintained at 3.5 ft. wide in a sod of mixed grasses which was mowed as needed. Irrigation was supplied via single drip emitters adjacent to trees. Irrigation water was drawn from a pond into which nearly all runoff from the nursery flows. Nitrate levels in pond water were monitored throughout the experiment.

Results and Discussion: Nitrate levels in this former bermudagrass hayfield before any trees were planted (February 2, 1990), did not exceed 5 ppm at any depth above sixty inches (Fig. 1). However, following the first growing season with trees in the field nitrate levels at a distance of six and eighteen inches from the base of the tree were in excess of 10 ppm at depths above 30 inches with the greatest concentration being at a depth of 20 inches when measured six inches from the tree (Fig 2). Nitrate levels at 36 inches from the tree were not above 10 ppm at any depth.

Corings done during the growing season of 1991, one week following fertilizer application, indicate nitrate levels of a different magnitude. Nitrate levels at a distance of six inches were approximately 20 ppm to a depth of fifty inches (Fig. 3). However, cores taken 18 inches from the tree indicate nitrate concentrations of 130 ppm at a depth of 4 inches, rapidly declining to 40 ppm at a depth of 10 inches and gradually declining to around 20 ppm at lower depths. At 36 inches from the tree, in the sod, the highest concentration was 25 ppm at 4 inches deep, gradually declining to under 10 ppm. Corings following the 1991 growing season (fig. 4) indicate a decreased concentration of nitrates at six inches from the tree since 1990 with an increased level 18 inches from the tree. Nitrate concentrations beneath the sod, 36 inches from the tree, were low.

These results reflect the following: 1. Nitrate concentrations are highest in the vicinity of applied fertilizer (6 in from the tree in 1990, 18 in. from the tree in 1991) even when tested nine months after fertilizer application. Nitrites do not appear to have much lateral movement under test conditions. 2. The high concentrations of nitrates measured one week after fertilizer was applied in summer 1991 had declined by that winter. This fertilizer was probably used by the crop and other plants in the field since levels at a greater depth in the soil or further from the plant were lower when measured later in the season. 3. Trees are not using all the nitrates being applied since nitrate concentrations are increasing, particularly at a depth of 30 inches at a distance of both 6 and 18 inches from the tree. 4. Sod appears to be very effectively maintaining nitrates at low soil levels. 5. Nitrate levels in the pond never exceeded 1 ppm.

Significance to Industry: 1. Nitrate concentrations in field nursery soils were shown to increase during the first two years of normal shade tree production. This indicates that more nitrogen fertilizer was being applied than the crop could use, leading to the potential for nitrate pollution of groundwater. 2. Sod appears to be an effective barrier to nitrate movement. Concentrations of nitrates beneath sod were always low plus water that flowed over grassed waterways to reach the pond did not result in increased nitrate concentrations in pond water. Therefore, grass seems to be effectively preventing the movement of nitrates across the nursery.

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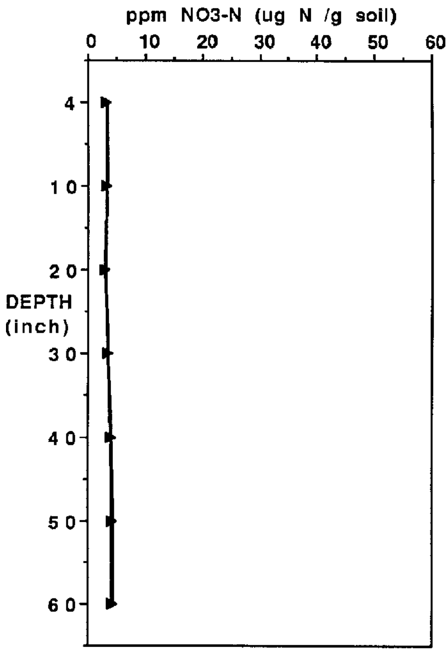

FIGURE 1. SOIL NITRATE CONCENTRATION FEBRUARY 2, 1990

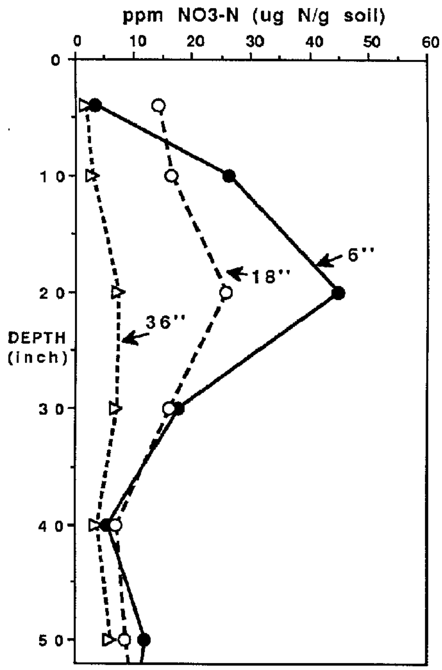

FIGURE 2. SOIL NITRATE CONCENTRATION DECEMBER 1990.

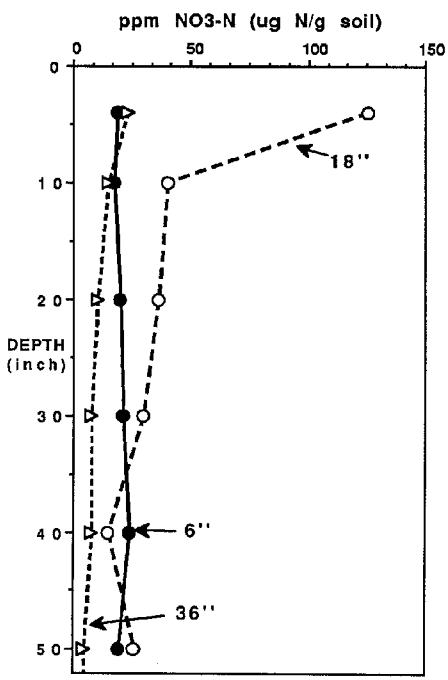

FIGURE 3. SOIL NITRATE CONCENTRATION JULY 1991.

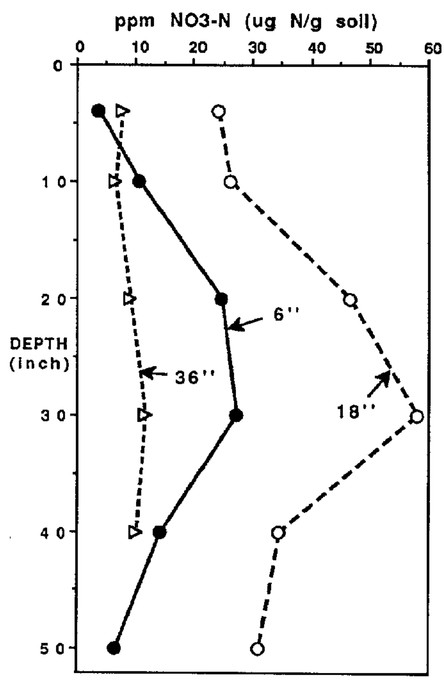

FIGURE 4. SOIL NITRATE CONCENTRATION DECEMBER 1991.

Optimizing Shade Tree Production: Groundcover, Nitrogen Rate, and Timing of Nitrogen Application

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Nature of Work: Although groundcovers are commonly used in field nurseries to prevent soil deterioration and improve trafficability, they can inhibit growth of woody perennials. Competition for nitrogen (N) is second only to water as a major factor in growth reductions (6). This is supported by several studies involving grass cover (3, 4). Fewer studies have been conducted with broadleaf plants, but in general, broadleaf plants interfere with growth of woody species less than grass (1). Effects of competition on plant growth were previously attributed to both root and shoot competition but there were few supporting data. More recently, root competition is thought to be more important than shoot competition (7).

Studies examining the effect of soil fertility on competition between groundcovers and trees have produced conflicting results. Duffy (1974) suggested that competition between seeded grasses and loblolly pine *(Pinus taeda* L.) could be reduced by increasing fertility. However, Fober and Giertych (1971) reported that competition from annual bluegrass *(Poa annua L.)* had a negative effect on the growth of Norway spruce *[Picea abies* (L.) Karst] seedlings, particularly where nutrition was optimum. Therefore, the objective of this study was to determine the effect of four groundcovers on the growth of *Acer rubrum* ‘October Glory’ with various levels of N and timings of N application.

The experiment, a split plot in a randomized complete block design with four replications, was conducted at the Mountain Horticultural Crops Research Station, Fletcher, NC. The main plots were four groundcovers and three rates of nitrogen. The subplots were three timings of N application.

In July 1988, the Codorus loam was fumigated with methyl bromide, 196 g/m^2 (4.0 lbs/100ft^2), and amended to meet the pH and fertility (excluding N) levels recommended for shade tree production (N. C. Dept. of Agric.). Individual plots were 3.7 m x 11 m (12 ft x 36 ft) with 1.2 m (4 ft) between each plot. Each plot was subdivided into three subplots, 3.7 m x 3.7 m (12 x 12 ft). Four liners of *Acer rubrum* ‘October Glory’ were hand-planted 1.2 m (4 ft) apart in rows centered down the middle of each subplot on May 3, 1989. The middle two trees were used to determine treatment response while the remaining two trees were used as buffers to separate treatments. Height and stem diameter measurements were taken 15 cm (6 in) above the soil surface immediately after planting. This point was marked on each tree, and was used for subsequent measurements on Dec. 14, 1989, December 1, 1990, and March 3, 1992.

Nitrogen rate and timing of N application. The nitrogen rates varied by year. Nitrogen rates applied in the first year were 28, 56, and 112 kg/ha (25, 50, and 100 lbs N/a); nitrogen rates in the second year were 56, 112, and 224 kg/ha (50, 100, and 200 lbs N/a); and nitrogen rates in the third year were 84, 168, and 335 kg/ha (75, 150, and 300 lbs N/a). The three timings of N application were: (1) 100% applied in early spring (April), (2) 50% applied in spring (April) and 50% in fall (Oct.), and (3) 25% in spring (April) and 75% in fall (Oct.) (also referred to as timings 1, 2, and 3, respectively). Ammonium nitrate (33.5% NH_4NO_3) was broadcast on each subplot according to the prescribed rate and timing.

Groundcovers. The four groundcovers (GC) were tall fescue (TF) *(Festuca arundinacea* Schreb. 'K-31'), crimson clover (CC) *(Trifolium incarnatum* L.), Korean lespedeza (KL) *(Lespedeza stipulacea* Maxim.), and bare soil (BS). Tall fescue was planted on Sept. 7, 1988 at 10.1 kg/ha (9 lbs/a). Crimson clover, a winter annual, was planted in Sept. in 1988, 1989, 1990, and 1991 at 28 kg/ha (25 lbs/a). Korean lespedeza, a summer annual, was sown in April in 1989, 1990, and 1991 at 28 kg/ha (25 lbs/a). The rows in all plots were maintained free of vegetation at a width of 1 m at all times. The BS groundcover and all rows were maintained free of vegetation with glyphosate.

Data were subjected to analysis of variance and regression analysis where appropriate. Treatment means were separated using LSD ($p = 0.05$), where applicable.

Results and Discussion: Height growth was not affected by N rate or timing of N application. The lack of height differences was not surprising because height growth in woody species is often not responsive to fertility. Three years after initiation (YAI), height growth was suppressed by TF compared to the other GC (data not presented).

Stem diameter was affected by GC and N rate. Stem diameter of trees grown in TF was reduced one YAI compared to the other 3 GC (data not presented). This data supports similar reports that grasses are more competitive than broadleafed vegetation. However, at two and three YAI, the effect of GC on stem diameter of red maple 'October Glory' was dependent upon the timing of N application. At three YAI, stem diameter was reduced by TF compared to all other GC when 100% of the N was applied in the spring (Table 1). Stem diameters were equal in CC, KL and BS. However, when N was split 50% spring and 50% fall, BS had greater stem diameter than CC and KL. Similar to timing 1, TF had the smallest stem diameter within timing 2. With timing 3 (25% spring, 75% fall), stem diameter of trees grown in BS and CC were not different. Korean lespedeza was smaller than BS while TF had the smallest stem diameter. In this study, there was no shoot competition since the GC was at least 0.5 m from the trees. Thus, stem diameter was reduced via root competition.

Timing of N application did not affect stem diameter of any trees except for those growing in TF. Stem diameter of red maple ‘October Glory’ grown in TF were smaller in timing 3 (25% spring and 75% fall) compared to timings 1 and 2 (data not shown). Thus, if trees are being grown in TF, at least 50% of the N should be applied in the spring before TF begins active growth for maximum growth. Grasses have been shown to be very competitive N scavengers.

At three YAI, the effect of N rate on stem diameter was dependent upon GC. Stem diameter of red maple ‘October Glory' increased linearly with increasing N rate when grown in TF (data not presented). This suggests that it is possible to partially compensate for the competitive effects of TF by increasing the N rate. At the lowest N rate [84 kg/ha (75 lbs/a)], stem diameter of trees grown in BS were greater than trees grown in CC and KL, illustrating that all living covers have the potential to reduce growth depending upon the N rate. However, at 168 kg/ha (150 lbs/a), stem diameter of BS, CC, and KL were equivalent. Thus, it was possible to compensate for N competition by increasing the N rate. At 335 kg/ha (300 lbs/a), trees in KL were smaller that trees in BS and CC which may be reflective of the differences in the season of active growth. Crimson clover achieves maximum growth in early spring and senesces in early summer, while KL is actively growing from spring until the first frost. The positive attributes of a living GC must be weighed against the potential loss in tree growth. By properly choosing the GC and adjusting the N rate for the increased N demand, it appears to be possible to produce trees with a living GC.

Significance to Industry: By properly choosing the groundcover and adjusting the N rate for the increased N demand, it appears to be possible to produce trees with a living groundcover with no loss in crop growth. Recommendations of nitrogen rate and timing of nitrogen application should consider the vegetation management program. Less N is needed if the grower has a broadleaved groundcover. In addition, certain GC, such as perennial grasses, have the potential to reduce crop growth via root competition even at high rates of N.

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Table 1. Effect of groundcover within each timing of N application three years after treatment initiation on stem diameter of red maple 'October Glory'.

	Timing[z]		
	1	2	3
Groundcover	Diameter (mm) 3 YAI[y]		
Bare soil	51.7 a[x]	53.5 a	52.7 a
Crimsonclover	51.6a	49.8 b	52.0 a
Tall fescue	46.5 b	45.7 c	42.0 c
Korean lespedeza	50.3 a	50.4 b	48.6 b

[z]Timing of N application. Timing 1 = 100% NH_4NO_3 applied in spring, 2 = 50% applied in spring and 50% in fall, and 3 = 25% in spring and 75% in the fall.

[y]YAI = years after treatment initiation.

[x]Means followed by the same letter within each timing are not significantly different by Fisher's lsd, 5% level.

Field Evaluation of Mayhaw Varieties and Selections

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Nature of Work: Interest in the commercialization of mayhaws (Crataegus opaca and Crataegus aestivalis) has increased dramatically in the southeastern United States over the last several years. The process of selecting mayhaws from native stands has lead to the availability of numerous mayhaw varieties and selections. Unfortunately, the vast majority of these selections have been evaluated only in native stands for fruiting characteristics.

The Calhoun Research Station of the Louisiana State University Agricultural Center has been conducting mayhaw research since 1989(1). A mayhaw research orchard was established in 1992 with the primary purpose being to evaluate available varieties/selections for fruit characteristics, flowering, growth habit, and disease/insect pressures. Currently, 50 mayhaw varieties are planted and additional entries are being added on a continuing basis. Trees were planted in March 1992 as one-year-old grafted plants. Trees are drip irrigated and planted in full sun on 20’x 20' centers.

Flowering and date of full leaf were recorded for all mayhaw varieties/selections planted in the Calhoun Research Station mayhaw orchard during the spring of 1993 (Table 1). Trees were considered in full leaf when half of the emerged leaves were fully expanded, while dates of flowering included consecutive days with at least one open flower.

Results and Discussion: Mayhaw varieties flowering on two-year-old wood in 1993 were ‘Hoppie’, ‘Festive’, ‘Betsy’, ‘Annette’, ‘Cotton Candy’, ‘Golden Farris’, ‘Suzette’, ‘Heavy’, ‘Red Harvest’, ‘Super Spur’, ‘Francis Creek’, ‘Big V’, ‘Canary’, ‘Texas Super Berry’, ‘Cecilia’, ‘Big Red’, ‘Deville’, ‘Firebird’, ‘Tucknage 57’, ‘Catahoula’, and ‘Duggieville’ (Table 1). The earliest flowering varieties included ‘Texas Super Berry’, ‘Golden Farris’, and ‘Super Spur’. Twenty-nine mayhaw varieties did not flower in 1993 but should flower on three-year-old wood in 1994.

Dates of full leaf varied from March 10th for ‘Texas Super Berry’ to April 10th for ‘Warrior’ and ‘Big Saline’ (Table 1). In addition to ‘Texas Super Berry’, mayhaws having early dates of full leaf included ‘Golden Farris’ (March 14th), ‘Super Spur’ (March 17th), ‘Flame’ (March 25th), and ‘Ruby Red’ (March 25th).

Significance to Industry: Research findings on mayhaw flowering and other characteristics will provide information to the nursery industry that can subsequently be used to make proper mayhaw varietal recommendations.

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Table 1. Dates of flowering and full leaf (1993) for mayhaw varieties/ selections

Variety/Selection	Flowering Period	Date of Full Leaf
Hoppie	March 28-31	April 4
Festive	March 25 - April 7	March 30
Betsy	March 21 - April 7	March 30
Annette	March 14 - April 7	March 31
Cotton Candy	March 15-30	March 30
Golden Farris	March 3-5	March 14
Charlie	no flowers	April 7
US Grant	no flowers	March 30
Suzette	April 1-7	April 5
Flame	no flowers	March 25
Reliable	no flowers	April 7
Heavy	March 14 - April 7	April 3
Red Harvest	March 28-31	April 5
Super Spur	March 10-31	March 17
Warpaint	no flowers	April 2
Francis Creek	March 15 - April 1	April 7
Big V	March 14-31	April 5
Cotton Island	no flowers	April 3
Darlene	no flowers	April 3
Shannon	no flowers	April 5
Red Chief	no flowers	April 5
Canary	March 15 - April 1	April 7
Guynell	no flowers	April 5
Texas Super Berry	February 10 - March 10	March 10
Cecelia	March 27-30	April 7
Big Red	March 26-31	April 5
Debbie	no flowers	April 3
Deville	March 24- April 1	April 1
Ann's Delight	no flowers	April 5
Ruby Red	no flowers	March 25
Toledo Giant	no flowers	April 7

Firebird	April 2-5	April 5
Marline	no flowers	April 5
Monarch	no flowers	March 31
Springtime	no flowers	April 8
Indian Maid	no flowers	April 7
Silver Dollar	no flowers	April 7
Turnage	March 21-31	April 5
Catahoula	April 1-3	April 7
Mary's Prolific	no flowers	April 7
Cameron	no flowers	March 27
Flagon	no flowers	March 31
Louisiana Giant	no flowers	April 7
Southern Pride	no flowers	April 4
Golman	no flowers	April 7
Redskin	no flowers	April 3
Duggieville	March 20-31	April 3
Warrior	no flowers	April 10
Saline #3	no flowers	April 7
Big Saline	no flowers	April 10

Field Performance of Two Species as Influenced by Container Production System

John M. Ruter
Georgia

Nature of Work: Production of trees and shrubs in containers offers a number of production, marketing and establishment advantages compared to field-grown plant material. The pot-in-pot (PIP) production system was developed to address some of the problems associated with the production of container-grown plants such as exposure of root systems to extreme temperatures and windthrow (1). In a previous study, 'Natchez' crape myrtle grown in a PIP system responded with increased root dry weight and higher root ratings than plants grown above-ground in a conventional production system whereas production system had little or no effect on the root and shoot growth of 'Savannah' holly (2). Improved root development was related to lower container medium temperatures during the growing season. It is not currently known if plants grown in a PIP system will show better development after transplanting compared to plants grown in a conventional above-ground system. The purpose of this study was to compare the growth and establishment of two landscape plants grown in a PIP system compared to a conventional above- ground container production system.

Plants were grown outdoors under full sun at the University of Georgia Coastal Plain Experiment Station in Tifton, Georgia. Uniform liners in #l containers of *Ilex x attenuata* Ashe 'Savannah' and *Lagerstroemia indica x fauriei '* Natchez' were potted into #7 containers (#070, Lerio) March 18, 1991. Potting medium consisted of milled pine bark and sand (4:1 by vol) amended with micronutrients (Micromax) at 1.5 lb/yd3 and dolomitic limestone at 6.0 lb/yd . Plants were top-dressed with High-N 24-4-7 at the rate of 1.5 lb N/yd^3 on March 25 and June 3, 1991. Holder pots (Lerio #070) were placed in the ground with 1 in at the top of the container remaining above grade. Plants were irrigated daily with 160° low volume spot spitters at the rate of 1.0 gal per container.

On February 12, 1992, four replications of both treatments from the container phase for both species were planted in the field as a randomized complete block. The container-grown plants were planted in augered holes measuring 24 in across and 12 in deep in a Tifton loamy sand (fine-loamy, siliceous, thermic Plinthic Paleudult). Plants were fertilized on February 12, April 1, and June 1 at the rate of 50 lb N/A over a 24 in circular area with Sta-Green 12-6-6. Plants were watered at the rate of 1.0 in using drip irrigation when less than 1.0 in of rainfall occurred during the previous week. In October, 1992, final growth index and shoot dry weight measurements were made on *Ilex* and *Lagerstroemia.* The root system of each plant was manually excavated to the diameter of the original planting hole. All roots extending past the original rootball were removed and were weighed separately to get a root regeneration into the surrounding soil dry weight as well as a rootball dry weight. Data analysis for all growth parameters were evaluated by analysis of variance using SAS. Mean separation where appropriate was conducted using a Waller-Duncan K-Ratio T-Test.

Results and Discussion: After several months in the field, the only measurable difference in growth for *Ilex* was in root regeneration beyond the original rootball. Plants grown in the conventional production system had 57% more root dry weight beyond the original rootball compared to plants grown in the PIP system. Production system had no effect on the root and shoot growth of *Lagerstroemia* after being placed in the field. Although not measured, root regeneration from plants grown in the conventional production system was less uniform around the circumference of the rootball compared to plants grown in the PIP system (personal observation). Lack of root regeneration in certain areas of the rootball was hypothesized to be due to high temperature damage to the rootball during the container-phase of the study. While production system influenced root system development of *Lagerstroemia* (2), the initial advantages were not evident after one season in the field.

Significance to Industry: For *Lagerstroemia,* the benefits of being grown in the PIP system were not evident after one season in the field. With a slower growing plant such as *Ilex x attenuata* 'Savannah', production system had little or no effect on plant growth and establishment in the field. The added expense of producing plants in a PIP system needs to be weighed in relation to the limited benefits seen for field establishment of the two species used in this study.

Literature Cited:

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