SECTION 3
FIELD PRODUCTION

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A Survey of the Pot-In-Pot Growers in Middle Tennessee

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Nature of Work: Nursery production in Tennessee has typically been field production. Since the introduction of the Pot-in-Pot (PNP) system in 1990 (Parkerson, 1990) several producers of field grown nursery stock have adopted the PNP production system. These growers were motivated to try PNP for several reasons: 1) to stimulate summer cash flow, 2) to avoid costly summer digging, 3) to be able to ship plants anytime, (Tilt & others, 1994) even when it is too wet to dig, 4) to speed-up harvest (labor is scarce), and 5) to capture the large container market of shade and ornamental trees. This research reports the progress of the PNP Production System in Middle Tennessee.

Results and Discussion: Of the 500^{+} nurseries in Coffee, DeKalb, Franklin, Grundy, Van Buren & Warren counties, 11 nurseries have begun a PNP operation. Seven of the 11 nurseries growing PNP are growing nursery stock in containers for their first time. Three of these nurseries started in 1991 with approximately 32,000 7- and 10-gallon containers of PNP. Eight of the 11 nurseries have expanded their PNP Production System. In the spring of 1995, there was a total of about 150,000 PNP containers, which was an increase of 50,000 in one year. Several growers have additional expansion planned, and other growers are expressing an interest in the PNP Production System. In 1995, the most common sizes are 7-gallon and 15-gallon with 78,000 and 33,000 produced, respectively. Several of these nurseries produce 2-3 sizes which may include 5, 7, 10, 15, 20, and 25 gallon containers.

Most of the plants grown in PNP are traditional shade and ornamental trees. Currently, about 20 selections of trees are grown, but only a couple of shrub varieties. Generally, the growers consider harvesting the PNP easy (compared to field production)(Tilt & others, 1994), except for the species that ‘root out’ excessively, such as birch and willow (Ruter, 1994). The only producer that reported harvest to be difficult was a Pot-N-Ground (PNG) grower that had to hand spade about two-thirds of the crop. This problem is typical with the PNG since it involves the use of only one container.

Cultural practices are similar to that of traditional container production. All but three of the growers are using 100% milled pine bark as the container substrate. Sand is being added by two and peat moss added by one nursery with a traditional container operation. All of the growers are using controlled-release fertilizers. Five of the eleven are incorporating (four already had a traditional container operation with a blender) and the other six nurseries are topdressing. Ten of the eleven are using cyclic irrigation with spray stake emitters.

The PNP growers are potting large field-grown liners, and marketing a finished product after one growing season. Many of the traditional field growers were told by their customers they wanted more inventory in containers. The PNP system has allowed the field producers to get into container production without the investment of overwintering structures that would be needed in Tennessee. (Parkerson, 1990)

The PNP system mimics traditional field production more than traditional container production. Because PNP is done in the field, our growers can relate to it better. For instance, 6 x 4 is a common spacing with PNP. It is more in line with field production spacing than container production.

Another similarity is the management of the floor, in regard to vegetation. Generally in field production, the aisles are mowed and herbicides are banded down the row. Many of the PNP nurseries have adopted a similar practice.

In field production, inclement weather can force field labor home without pay. One grower stated that the PNP system has allowed him to shift his labor to potting and maintaining plants in the PNP during inclement weather.

The most frequently mentioned problem with PNP is drainage of the field soil. During periods of excessive moisture, almost half of the growers have experienced some standing water in some of the socket pots. Another challenge/problem has been the time required to walk the irrigation lines checking for leaks and clogged emitters. One grower stated “it requires a daily commitment” that field growers are not accustomed to.

Significance to Industry: PNP production has stimulated late summer sales which was previously nonexistent to the Middle Tennessee Nursery Industry. Five of the eleven growers indicated that PNP has increased their gross annual sales. This has occurred with very little additional marketing efforts.

One grower reported that his customers like the advantage of buying container trees as needed, without maintaining a large inventory of B&B trees after the digging season has ended. The PNP system can be a viable complement to traditional field production.

PNP requires much less irrigation water, than traditional container production, with no runoff. PNP does not require structures for overwintering. (Tilt & others).

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The Use of Trifluralin for Root Control in the PNP System

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Nature of work: The Pot-In-Pot (PNP) production system is increasing in popularity among nurseries in Tennessee. One problem associated with producing plants in the PNP system is rooting out of the growing container through the holes in the socket container and into the surrounding soil (Ruter, 1994). Another problem associated with growing ornamentals is root circling in the growing container. Several reports have indicated Spinout™, a copper containing material, has been effective in modifying root growth in containers (Beeson, 1992; Struve, 1990). Dinitroanline herbicides such as trifluralin, have been shown to inhibit root growth in container-grown plants (McDonald, 1984). The objective of this preliminary study was to evaluate the effectiveness of trifluralin used in conjunction with Spinout™, to control the root system of *Acer burgeranum*, Trident Maple grown in the PNP system.

In April 1994, uniform bareroot whips (24 in) of Trident Maple were potted in #7 containers. Potting substrate was a pine bark:sand (6:1, v:v) amended with Osmocote 17-7-12 (12 lb/yd^3), Micromax (1.5 lb/yd^3), and dolomitic limestone (5 lb/yd^3). Prior to potting, half of the containers were treated with Spinout™, by spraying the product on the inside of the container. Socket containers were placed in the ground leaving about 1-2 in above ground level. Five trifluralin treatments were placed in the bottom of the socket container. Three treatments of Biobarrier, a permeable geotextile fabric with trifluralin impregnated nodules bonded in the fabric, were used with 16, 32 or 64 nodules. Treflan 5G and Trilin 10G were hand shaked into the socket container at 8 lb ai/A. The potted maples were then placed in the socket container. Irrigation was applied daily using a low volume spray stake at the rate of 0.75 gal per container. In November, height and caliper, and root growth out of the container were measured. One replication was harvested for root and shoot dry weights (data not shown). The experiment was a randomized block design with three replications of two plants in each experimental unit.

Results and discussion: The PNP had no effect on the height or caliper of *Acer buergeranum* (Table 1). Ruter (1993) observed similar results with *Ilex*, *Lagerstroemia*, and *Magnolia*. Generally, there were less roots that grew out of the container when Spinout™ was used, 27.6, verses 48.5 roots in containers without Spinout™. When the three longest roots outside of the container were measured, the Spinout™ treatments had less growth, 9.8 cm, compared to 13.5 cm in containers without Spinout™.

The Biobarrier treatments, 16, 32, and 64 nodules, had fewer roots to grow out of the containers, with a greater reduction in number when Spinout™ was used. There was a slight decrease in root length with Biobarrier treatments in conjunction with Spinout™ than without Spinout™, regardless of the number of nodules. Treflan 5G and Trilin 10G suppressed root development out of the container with respects to root number and root length. The authors concluded the difference between the plant response to the Biobarrier treatments compared to the two granular formulations was the rate used. Biobarrier has 18.9% trifluralin impregnated into the nodules, therefore a higher level of volatility could exist between the socket container and the growing container.

Significance to the industry: This study demonstrates that root systems of plants grown in the PNP system can be reduced using trifluralin bonded to geotextile materials or applied as a granular in conjunction with Spinout™ compared to no root treatment. The cost effectiveness of granular trifluralin will be the preface of evaluating higher rates of granular trifluralin with species that have a noted vigorous root system.

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Table 1. Effects of trifluralin treated socket pots on growth of *Acer buergeranum*.

Treatments	Rate	Height (cm)	Caliper (cm)	No. of roots[Z]	Root, ln (cm)[Y]
Without Spinout™					
Biobarrier	16 nodules/pot	115.8	11.2	17.8	2.6
Biobarrier	32 nodules/pot	112.8	11.0	15.5	1.6
Biobarrier	64 nodules/pot	131.8	12.8	32.2	4.3
Treflan 5G	8.0 lbs ai/A	127.2	13.6	65.7	17.5
Trilin 10G	8.0 lbs ai/A	114.8	11.2	59.5	13.3
Control		115.2	12.4	100.0	42.1
With Spinout™					
Biobarrier	16 nodules/pot	100.5	9.3	3.5	0.7
Biobarrier	32 nodules/pot	117.3	14.3	14.5	4.3
Biobarrier	64 nodules/pot	123.0	12.1	0.8	0.2
Treflan 5G	8.0 lbs ai/A	118.8	12.3	39.7	9.8
Trilin 10G	8.0 lbs ai/A	116.2	11.0	39.0	15.7
Control		109.5	9.3	68.0	28.1
LSD		18.6	3.3	25.8	7.6
Spinout * trifluralin treatments		NS	NS	**	**

[Z] Number of roots outside of the growing container.
[Y] Mean of the three longest roots outside of the growing container.

The Effect of Pine Bark Soil Amendments on Bed-Grown Hybrid Ericaceous Shrubs

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Nature of Work: While organic soil amendments used when planting individual trees and shrubs have proven to be of little value in enhancing plant survival and subsequent growth (Corley 1984, Pellett, Schulte, Whitcomb), some research has shown the benefit from amending larger areas such as planting beds (Banko, Bir 1991, 1993). When benefit has existed, plants propagated from stem cuttings or seed were the crop. This research was undertaken to determine whether tissue culture propagated hybrid ericaceous plants grown in field bed culture would benefit from the application of pine bark mulch as a soil amendment. This research was conducted in a commercial field nursery located at approximately 3000 ft. in elevation in the Blue Ridge mountains of NC. Plants were grown in full sun.

Beds six feet wide were established in clay loam soil. Limestone and superphosphate were applied and tilled in according to soil test recommendations. Beds were covered with either 0, 2 in. or 4 in. deep pine bark mulch then tilled to a depth of 8 inches. The pine bark used was the least expensive bagged product sold as mulch. Fertilizer was applied according to North Carolina Cooperative Extension Service recommendations. The first year plants were in the bed, weeds were controlled via directed sprays of Roundup on an as needed basis. During the winter prior to the second and third growing season Casoron 4G was applied at the rate of 150 pounds per acre. Treatments were randomized within three replicates.

Test plants were *Rhododendrons* 'PJM' and 'Scintillation' as well as *Kalmia latifolia* 'Pink Globe'. Plants were received as container grown liners in fall 1992. They were potted into quart containers in pine bark medium and overwintered in a white poly covered winter protection structure. In mid April 1993, plants were set in beds at the same depth as they were growing in pots. There were fifteen plants of each cultivar planted in acentric rows. Plants were two feet apart within rows.

A drought immediately ensued following planting. Transplants went three weeks without receiving measurable rainfall. No irrigation was available until July 1993.

Survival data was recorded annually on all plants. Height and width growth data was recorded at the beginning of the experiment then annually following the growing season. Growth data was collected only from the middle five plants in each treatment bed in an attempt to minimize edge effects. A growth index was determined by adding the height plus width then dividing by two. The growth index at the end of each growing season was subtracted from the initial growth index to yield an annual growth index.

Results and Discussion: Each test plant responded to a different degree with 'PJM' hybrid rhododendron surviving in the highest percentages and 'Pink Globe' mountain laurel surviving in the lowest numbers (Table 1). Either rate of pine bark soil amendment application increased survival over using no soil amendment. Four inches of pine bark soil amendment increased plant survival over application of two inches of pine bark soil amendment.

Table 1. Percentage of plants alive in April 1995 as affected by pine bark soil amendments.

	Cultivar		
Treatment	PJM	Scintillation	Pink Globe
Control	27	13	0
2 in. pine bark	76	42	35
4 in. pine bark	89	84	55

A similar response existed in plant growth (Table 2). For all test plants, the greatest growth occurred where four inches of pine bark mulch had been incorporated. However, each plant grew at its own rate with Rhododendron 'PJM' producing the most growth followed by 'Pink Globe' mountain laurel and Rhododendron 'Scintillation'.

Table 2. Growth Index after two years as affected by pine bark soil amendments.

	Cultivar		
Treatment	PJM	Scintillation	Pink Globe
Control	14.25	4.77	0.00
2 in. pine bark	13.80	9.45	13.36
4 in. pine bark	16.00	11.80	15.94

*all plants dead

Significance to the Industry: The research demonstrated the importance the use of pine bark soil amendments can have on plant survival in field bed culture of hybrid rhododendrons and mountain laurel. The positive effect of pine bark mulch as a soil amendment should be equally important when establishing landscape beds. Four inches of pine bark mulch incorporated into clay loam soil resulted in greater plant survival than two inches of incorporated pine bark mulch which was superior to no pine bark mulch being added to the soil. Four inches of pine bark mulch incorporation into clay loam soil also increased growth in each of the test plants.

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Long-Term Fertilization Study with Field-Grown Nursery Crops

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Nature of Work: Nursery managers desire to maximize growth of plants under production systems with efficient fertilization practices. Fall fertilization has proven to be effective, but producers have questions regarding nutrient leaching, plant uptake, nutrient distribution in the plant, and predisposition of crop plants to winter injury (1,2,3,4,5). Research was initiated in three Kentucky commercial nurseries with six genera of nursery plants to determine the effects of three fertilizer sources and rates on plant growth and development. Plots were established with *Acer rubrum* 'Red Sunset' and *Euonymus alata* 'Compacta' at Snow Hill Nursery and Picea abies and Pseudotsuga menziesii at Nieman's Nursery in the spring of 1994. Treatments were applied to *Ilex x meserveae* 'China Girl' and *Picea abies* 'Nidiformis' at Ammon's Wholesale Nursery in the fall of 1994. Treatments included Woodace 29-3-8 (VIgoro Industries product with XC-IBDU), 33-3-6 (Scotts Company product with Poly S coating) and 18-3-3 (uncoated urea as the nitrogen source) applied at 100, 250 and 400 pounds of N per acre per year split into spring and fall applications. Treatments were replicated a minimum of five times in randomized complete block designs for each genus Growth index measurements are recorded at least twice annually for multi stemmed genera. Height and caliper are measured for other genera. The timing a magnitude of grou~h flushes are being observed. Leaf samples are taken from deciduous plants in July of each year and from evergreens in November for nutrient analysis.

Results and Discussion: As would be expected in a field study with woody plants at least three years old, the first year's data revealed no differences in growth rate or spring budbreak. In the Red Sunset maples, flower budbreak on March 14, 1995 ranged from 0 to 80%. Treatments did not influence the timing of budbrealc this spring, but there were modest differences between replicate blocks. The plot is highly uniform. The difference in budbreak is likely due to relatively small differences in microclimate between replications. This is an interesting observation that will be followed.

Significance to the Industry: Fleld-production dominates the production systems for trees and shrubs in Kentucky and neighboring states. There is a significant range in the rate and timing of fertilizer applications among nurseries. Research is required to determine the efficiencies in utilizing controlled-release fertilizers in field production systems in this "transitional climate zone" of the Southeast/Midwest. Results in the first year of a three-year study reveal no differences in the timing of spring budbreak or winter injury between treatments.

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