SECTION 3
FIELD PRODUCTION

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Production of Native Bricaceous Plants with Pine Bark Soil Amendments

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Nature of Work: Many species of native ericaceous plants which grow in the mountains of north Georgia are in demand for use in the landscape. *Kalmia latifolia* (Mountain laurel) and *Rhododendron calendulaceum* (Flame azalea) are prized for their colorful flowers whereas *Leucothoe fontanesiana* (Doghobble) and *Rhododendron maximum* (Rosebay rhododendron) are grown for their flowers and attractive foliage. Mountain laurel and flame azalea are generally found on average to dry sites whereas doghobble and rosebay rhododendron are understory plants usually found on moist sites.

Bir and Ranney (1) noted that organic soil amendments increased the survival and growth of transplanted container-grown mountain laurel seedlings when produced in heavy mountain soils. Further research indicated that a 3 in. application of pine bark increased the survival of ‘Ostbo Red’ mountain laurel, ‘Gomer Waterer’ rhododendron, and ‘Gibraltar’ deciduous azalea when deep incorporated. The purpose of this study was to evaluate the effect of pine bark amendments on the survival and growth of four native ericaceous species.

Uniform one year old seedlings of *Kalmia latifolia, Rhododendron calendulaceum, Leucothoe fontanesiana,* and *Rhododendron maximum* were transplanted from containers to the field in June, 1990 at the Georgia Mountain Branch Experiment Station in Blairsville, GA. Amended plots (5 ft. x 25 ft.) were randomly arranged within 5 ft. x 100 ft. beds. Plants were spaced 2.5 ft. apart within rows with two rows per plot beginning 1 ft. from the edge of the bed. Five sample plants of each species were randomly placed within each plot.

Pine bark amendments were placed over the top of the beds and incorporated to a depth of 6 in. using a rototiller. Soil amendment treatments consisted of 1) control - no amendment, 2) uncomposted pine bark - 2 in. deep (UPB), 3) composted pine bark humus - 3 in. deep (PBH), and 4) uncomposted pine bark (2 in.) and composted pine bark humus (3 in.)(UPB+PBH). Composted pine bark humus had a smaller particle size compared to the nursery grade uncomposted pine bark used in this study.

Prior to planting, dolomitic lime, ammonium nitrate, ammonium phosphate, and magnesium sulfate were added according to University of Georgia Soil Testing Lab recommendations. Plants were fertilized in March and June of 1991 and 1992 with Osmocote 18-6-12 (Grace/ Sierra) at the rate of 55 lb. N/A. In July 1990, Devrinol 50W was applied as a preemergence herbicide at the rate of 3 lb. ai/A. Gallery 75DF was applied at the rate of 1 lb. ai/A in March and October of 1991 and again in March of 1992. Plants were irrigated as needed using drip emitters. The study was terminated in October of 1992. Data taken at this time were a growth index [(height + width north-south + width east-west)/3] and shoot dry weight. Percent survival was recorded in

October 1991 and again at the termination of the study. Data were analyzed using SAS with mean separations by Waller-Duncan.

Results and Discussion: *Kalmia latifolia* - Soil amendment had no effect on the survival of mountain laurel in 1991. In 1992, survival decreased to 83% for the UPB+CPB treatment compared to > 95% survival for the other treatments. Uncomposted pine bark and the untreated control plants had greater growth indices and shoot dry weights compared to the CPB or UPB+CPB treatments.

Rhododendron calendulaceum - The UPB+CPB treatment resulted in lower survival (79%) compared to 92% for the other treatments in 1991. In 1992, survival was >54% for all treatments except UPB+CPB (29%). Soil amendment had no effect on growth indices or shoot dry weights. In general, flame azalea exhibited very slow growth.

Leucothoe fontanesiana - Survival was greater than 95% for all treatments in 1991. In 1992, 83% survival was recorded for the UPB+ CPB treatment compared to >90% for the other treatments. Treatment had no effect on growth indices or shoot dry weights.

Rhododendron maximum - Soil amendment treatment had no effect on survival in 1991 and 1992. Percent survival of all treatments exceeded 88% in 1992. Similar to flame azalea, rosebay rhododendron grew very little during the study. Soil amendments had no effect on growth indices or shoot dry weights after two years in the field.

Significance to Industry: Shoot growth of flame azalea and rosebay rhododendron was poor under our conditions. For example, mean shoot dry weight of doghobble was approximately 5 times greater than either flame azalea or rosebay rhododendron. Production of flame azalea and rosebay rhododendron in full sun at an elevation of 1800 ft. is not recommended based on this study.

The combination of uncomposted pine bark and composted pine bark humus was detrimental to the survival of mountain laurel, flame azalea, and doghobble in 1992. For all four species, amending the soil with pine bark offered no benefit in terms of survival compared to the untreated control. Growth indices and shoot dry weights of mountain laurel decreased when the soil was amended with CPB or UPB+CPB compared with no amendment. Under the conditions of this study where plants were produced in a sandy loam soil, certain pine bark soil amendments offered no benefit or were detrimental to the growth of some species.

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Soil Nitrate Movement in an Overhead 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 little known. In fact, trees, shrubs and sod have been suggested as filters and a sink for nutrient runoff from agricultural lands (Lowrance 1984, Magdoff 1992). This was recently confirmed for a drip irrigated tree nursery (Bir 1993). The following research was undertaken to determine whether a field tree nursery utilizing overhead irrigation and dry granular fertilization was contributing to increased levels of nitrates in the soil and/or surface runoff.

The experimental site was located on a Delanco loam soil (fine-loamy, mixed, mesic aquic Hapludults). 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. 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 mis of 1 N KCI 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 six replicates.

Samples were collected April 4, 1990, in July during the 1991 growing season as well as one week after mid summer 1992 fertilizer application and again in December 1992. Fertilizer was banded 6 to 10 inches from trees. 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 summer 1992; and 1.0 oz. N/tree as 17-17-17 in late 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 overhead impact sprinklers as the nurseryman determined necessary. Irrigation water was drawn from a nearby river. Nearly all runoff from the nursery flows into a meadow adjacent to the river. Nitrate levels were monitored as water left the production area throughout the experiment.

Results and Discussion: Nitrate levels exceeded 10 ppm below fifty inches soil depth (Fig. 1) when trees were planted. By the summer of 1991, with trees in the field, nitrate levels above 50 inches depth measured 6, 18 or 36 inches from the base of the tree were less than 10 ppm but remained near 10 ppm at a depth of 60 in. (Fig. 2) measured 36 inches from the base of the trees.

Corings done during the 1992 growing season, one week following fertilizer application, indicate nitrate levels of a greater magnitude. Average nitrate levels at a distance of six inches from the base of trees were over 60 ppm near the soil surface (Fig. 3), declined in the next few inches of depth then increased to over 60 ppm between 20 and 30 inches. The average nitrate level in samples did not decrease to 10 ppm until the 50-60 in. depth sample. Samples taken at a distance of 18 or 36 in. from the base of the tree were never in excess of 10 ppm nitrate, on this sampling date.

Data taken in December 1992 indicate that nitrate levels in samples taken 6 inches from the base of trees had declined since July above a depth of 30 inches. However, nitrate concentrations increased gradually to over 60 ppm at a depth of 50-60 in.

These results reflect the following: 1. Nitrate concentrations are highest in the vicinity of applied fertilizer (6 in. from the trees). Nitrates do not appear to have much lateral movement under our conditions since samples taken 12 and 24 inches further from the trees were below 10 ppm. 2. The high concentrations of nitrates measured one week after fertilizer was applied in summer 1992 had declined near the surface by that winter. This fertilizer was probably used by the crop and other plants in the field or had leached to greater depths. 3. Trees are not using all the nitrates being applied since nitrate concentrations are increasing, particularly at a depth greater 30 inches at a distance of 6 in. from the trees. 4. Sod appears to be effectively maintaining nitrates at low soil levels since the 36 in. samples were never high in the root zone of sod and declined beneath the sod during the period monitored. 5. Nitrate levels in surface runoff never exceeded 1 ppm.

Significance to Industry: 1. Nitrate concentrations in field nursery soils were shown to increase during the first three 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 as runoff did not result in increased nitrate concentrations. Therefore, grass seems to be effectively preventing the movement of nitrates across the nursery.

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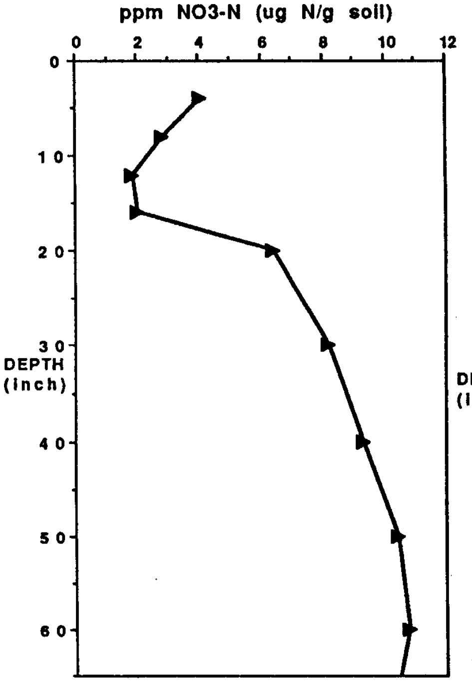

FIGURE 1. SOIL NITRATE CONCENTRATION AT INITIATION OF EXPERIMENT APRIL 1990.

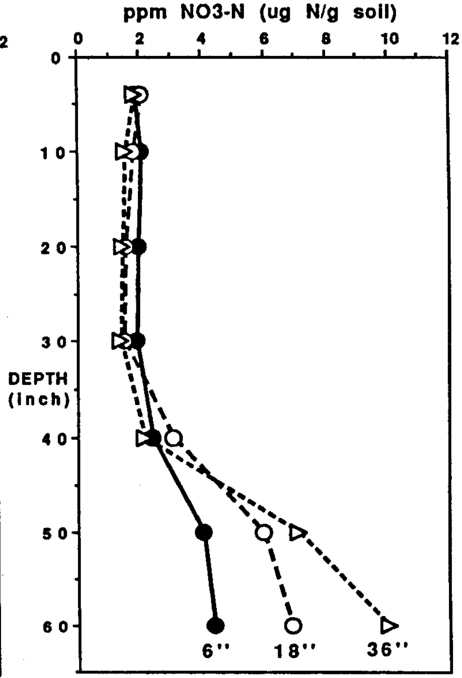

FIGURE 2. SOIL NITRATE CONCENTRATION JULY 1991.

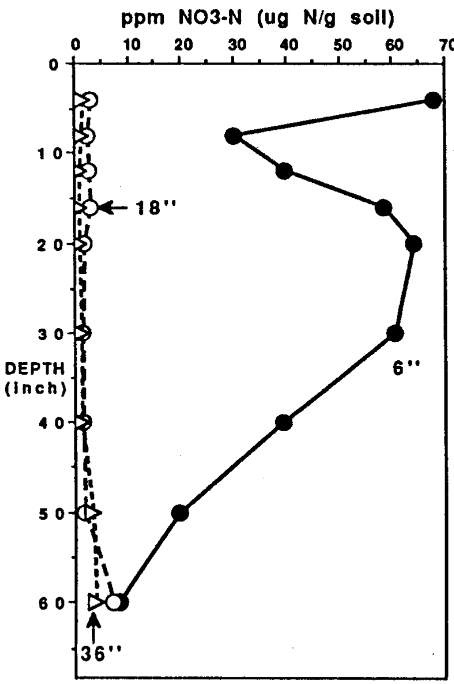

FIGURE 3. SOIL NITRATE CONCENTRATION JULY 1992.

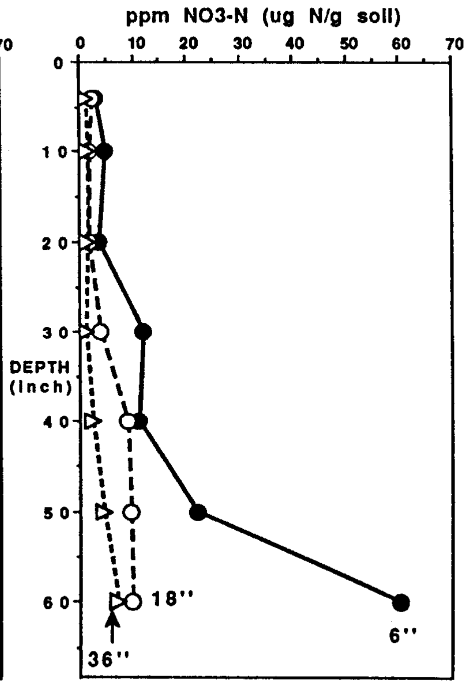

FIGURE 4. SOIL NITRATE CONCENTRATION DECEMBER 1992.

Effects of Antitranspirant Sprays and Hydrophilic Polymer Root Dips on the Growth of Bare-Root Northern Red Oak Seedlings Transplanted to the Field or Containers

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Nature of the Work: Desiccation of bare-root planting stock during handling or while in cold storage can reduce subsequent growth following transplanting (1). Various methods for preventing desiccation during handling, storage, or after planting have been developed. Antitranspirants or antidesiccants provide a physical barrier to moisture lose from plant tissues.

Hydrophilic polymers (starch acrylate copolymers, polyvinylalcohol copolymers and polyacrylamide copolymers) are chemical compounds that absorb hundreds to thousands of times their weight in water and are used to increase the water holding capacity of media or soils (2). Resulting plant growth in hydrophilic polymer amended media has been mixed (4). The efficacy of film-forming antitranspirants has likewise been inconsistent (3). Several brands of antitranspirants and hydrophilic polymers are readily available and advertised for use on nursery stock, but information is lacking on the effects of combined use of the compounds during cold storage on subsequent plant performance during container and field production. The objectives of this study were to determine the effects of antitranspirant sprays to various plant tissues and root dips in a hydrophilic polymer (alone or in combination) on stem xylem water potential during storage and first year growth and survival during container and field production.

In November, 1991, 550 northern red oak (<u>Quercus rubra</u> L.) 12" to 18" liners were field (Warren County Nursery, McMinnville, TN) dug with a U-blade, placed immediately into sealed black plastic bags and transported to Cookeville, TN. Fifteen seedlings were selected for determination of xylem water potentials ( ) of terminal shoots (Pressure chamber model 610, PMS Instrument Co., Corvallis, OR), fresh and dry weights. Seedlings were divided into four groups of 135 plants. Moisturin (Burke's Protective Coatings, Washougal, WA) antitranspirant concentrate was sprayed on either the roots, shoots, or whole plant, at a rate of 3 water: 1 Moisturin (vol.:vol.) or not treated. Each antitranspirant treatment was separated into three subgroups of 45 plants. Roots of one subgroup of each antitranspirant treatment were dipped for five seconds in a suspension of 2 oz. (56.7 9) of SuperSorb F (acrylamide acrylate copolymer, Aquatrols, Cherry Hill, NJ.) per 5 gallons (18.9 liters) of water. The rest of the seedlings were dipped in water only. All seedlings were then placed in corrugated cardboard boxes lined with polyethylene sheets, roots were packed in moist sphagnum peat moss, the sheets loosely pulled over the seedlings, and the boxes closed and placed in 4 C (40° F) storage.

On April 15, 1992, all seedlings were removed from storage. Forty five seedlings from each antitranspirant treatment were dipped in the hydrophilic polymer suspension as previously described. The remaining seedlings were dipped in water only. Five seedlings of each of the twelve treatment combinations were used for and weight determinations. Thirty seedlings of each treatment combination were planted in a clean cultivated non-irrigated silt loam field plot (3 blocks, 10 plants/block). Ten plants of each treatment combination were planted in a standard nursery mix (3 pine bark: 1 sand media plus fertilizer amendments) in 1# (2.3 liter) black plastic nursery containers. Standard container and field nursery practices were used throughout the growing season. Growth characteristics were measured in early November, 1992.

Results and Discussion: Dipping seedlings in the hydrophilic polymer prior to storage maintained stem at similar tensions as those recorded prior to storage (Table 1). The only other treatment in which did not become more negative (more water stressed) was when the whole plant was treated with antitranspirant and roots dipped in the hydrophilic polymer after storage (Table 1). Despite these reductions in water stress during storage, no significant ($\underline{P}$ 0.05) main effects of or interactions between hydrophilic polymer and antitranspirant applications were found for root or shoot fresh or dry weight, twig extension, leaf area, defoliation, dieback, or survival (data not presented). Reasons for a lack of response are unknown. While a lack of significant water stress during early establishment might induce such responses, nearly a 10 bar (1.0 MPa) difference in stem existed among treatments after storage (Table 1) and field-grown seedlings were irrigated only at transplanting. Wilson (5) found a negative effect on survival of three of four container-grown tree species with hydrophilic polymer amended media following transplanting to semi-arid field sites.

Significance to Industry: Applications of antitranspirants and hydrophilic polymers to nursery stock add to the cost of production through increased material and labor costs. In this study applications of an antitranspirant and/or a hydrophilic polymer (alone or in combination), prior to or after cold storage, failed to significantly affect first year growth of bare-root northern red oak seedlings during subsequent container or field production. This suggests that nurserymen should determine the cost versus benefits of utilizing these materials with the species and conditions present at their nursery prior to incorporating them as a standard production practice.

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Table 1. Effects of root dips in a hydrophilic polymer (2 oz. SuperSorb F/ 5 gallons of water) and spray applications of an antitranspirant (3 water: 1 Moisturin) to roots, shoots, or whole plant tissues on stem xylem water potentials ( ) of one-year-old bare-root Quercus rubra seedlings prior to and followinq cold storaqe (4 C).[Y]

Antitranspirant application to:	Roots dipped in hydroPhilic polymer:	Stem (MPa)
None	None	-1.50[Z] a
Whole plant	None	-1.30 ab
Shoots	After storage	- 1.24 abc
Shoots	None	-1.22 abc
None	After storage	- 1.19 abc
Roots	None	-1.18 abc
Roots	After storage	-1.17 abc
Whole plant	Afterstorage	-1.03 bce
Shoots	Before storage	- 0.91 bode
None	Before storage	- 0.85 bode
Roots	Before storage	- 0.82 cde
Whole plant	Before storage	- 0.49 d
Mean water Potential prior to storaqe		- 0.67 de

[Y] Tabular values are means of five observations per treatment, except the mean prior to storage which represents fifteen observations.

[Z] Means followed by the same letter are not significantly different at P = 0.05.

Evaluation of ROOTS™ on Root Regeneration of Live Oak

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Nature of Work: Live oak *(Quercus virginiana* Mill.) is found throughout Florida and is native to the coastal plains from southern Virginia to Texas (Duncan & Duncan, 1988). In 1990, tree farms producing trees in inground fabric containers were having severe problems with post-digging survival of live oaks. As part of an extensive research effort to improve post-digging survival of field-grown live oaks, root ball drenches with ROOTS'M (Roots, Inc., New Haven, CT) were evaluated.

Eight live oak trees (1 to 1.25 inches caliper) grown in a pine flatwoods sand (Myakka fine sand) at the CFREC-Sanford station were balled and burlapped (B&B) according to MN standards every 3 weeks beginning 20 Feb. 1991. Three sets of 8 trees were dug and treated as follows. After B&B, trees were placed in elevated cypress sawdust bins and irrigated with low volume emitters (Black, Roberts Irrigation Products, San Marcos, CA) 3 times daily for 6 weeks (9 gal/day). Each tree was then lifted from the sawdust, all root growth outside the ball collected, and the tree replanted into the bin. Dry weights of the collected roots were recorded. After trees were returned to the bins, they were again irrigated as before for 6 additional weeks. The day after the root harvest and again one week later, root balls of four randomly selected trees within a set were drenched with a quart of 2% (v/v water) ROOTS™ as suggested by the manufacturer. After the second six week root regeneration period, root regrowth was again collected in a second harvest and dry weight measured. To account for differences in tree size, root dry weights were divided by trunk caliper at 6 inches above ground level. The second root regeneration periods were initiated April 3, April 25, and May 14, 1991; for the first, second and third sets, respectively.

Results and Discussion: For the first two sets of trees (Fig. 1A), root regeneration measured prior to treatment with ROOTS™ (first harvest) was similar between trees later drenched with ROOTS™ and control trees. For the third set, trees later drenched with ROOTS'™ regenerated significantly more roots than the control trees prior to treatment. After treatments were applied (second harvest), no significant differences in regenerated root dry weights were found between ROOTS™-drenched trees and control trees for any set (Fig. 1B).

Prior to this test, it was determined that >95% of the root mass regenerated in the sawdust bins was on the exterior of the burlap. This agreed with previous studies which found nearly all root regeneration from severed roots occurs within 2 inches of the cut end (Gilman, 1990). Since trees used to evaluate ROOTS™ were forced to regenerate a second set of roots, any root-promoting activity should have been more pronounced than if ROOTS™ had been applied prior to the first root harvest. After the first root regeneration period, any differences in carbohydrate levels among trees should have been diminished. This equalizing of carbohydrates levels may explain why ROOTS™-treated trees of the third set had more root regeneration prior to treatment (first harvest) than control trees, but not after treatment (second harvest).

Significance to Industry: No benefit, in terms of root regeneration of B&B live oaks, was measured by drenching root balls with the ROOTS™ compound at manufacturer suggested rates. Similar results would be anticipated from treatment of harvested rootballs of fabric container-grown trees.

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Acknowledgement

Appreciation is extended to Roots, Inc., for supplying the ROOTS™ compound. Florida Agricultural Experiment Stations Journal Series No. T-00249.

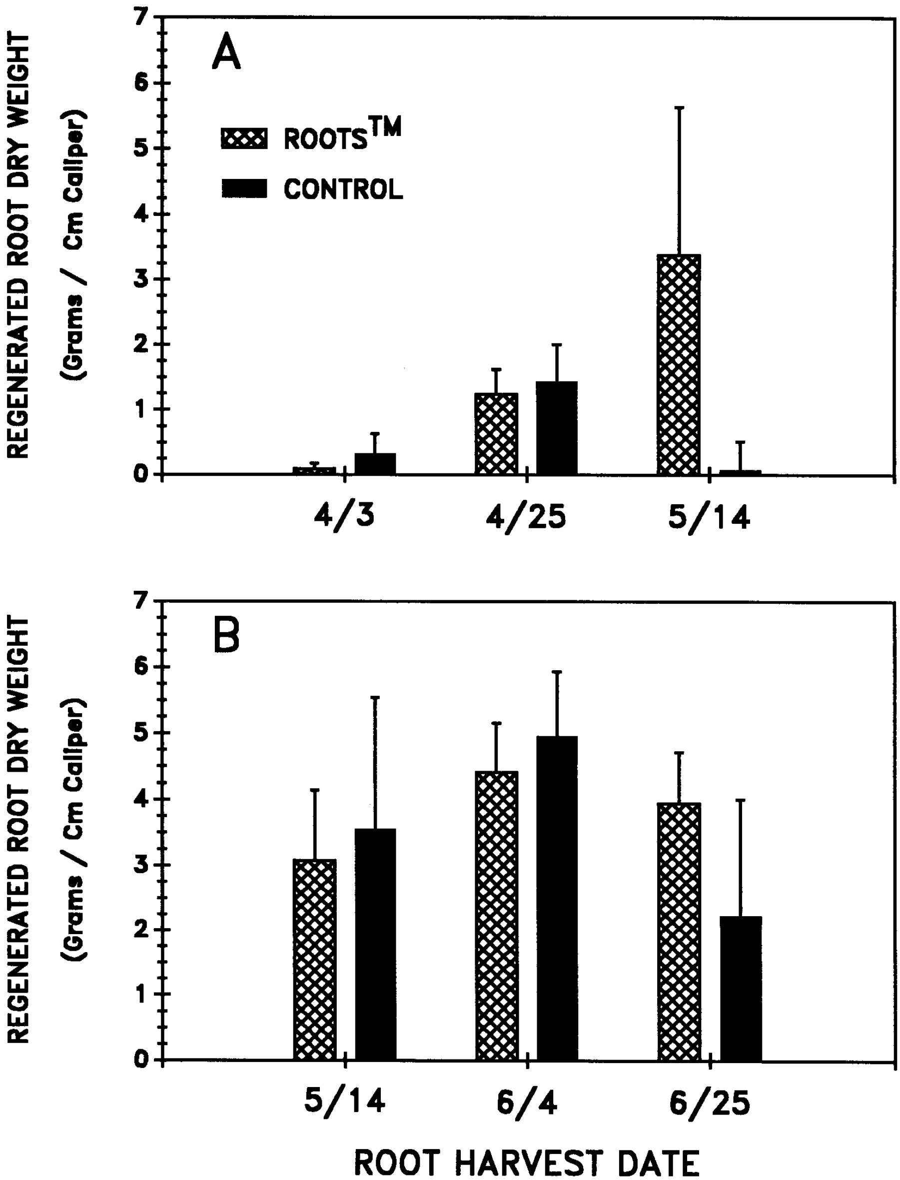

Figure 1. Regenerated root dry weights per caliber inch of trees drenched or not drenched (control) with ROOTS™. Regenerated root dry weights were measured prior to treatment (A) and after treatment (B). Vertical bars indicate the standard error of the means of 4 trees.

Growth and Survival of 'Whitespire' Birch Grafted on Five Species of Birch Rootstocks

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Nature of Work: Among the genus *Betula* are arborescent species native to a broad range of latitudes, climates and habitats with variations in site hydrology ranging from upland and alpine sites to wet bottomlands. These differences in species origin and their adaptability to varied environments may provide a opportunity for enhancing growth and resistance to environmental stresses by selecting rootstocks that are better adapted to a given environment.

'Whitespire' birch was originally selected for its chalky white bark and narrow, pyramidal form, and is purportedly resistant to bronze birch borer, *Agilus anxius* (Gory), a major pest of white-barked birches. 'Whitespire' birch has also been found to be relatively tolerant to heat and drought (2, 4), though intolerant of poorly drained soils (1). Research with container grown trees has shown that grafting 'Whitespire' birch on river birch and, to a lesser extent, on European birch rootstocks can enhance flood tolerance over trees on 'Whitespire' rootstock (3). The objectives of this study were to evaluate survival, growth, rootstock suckering and short-term graft compatibility of 'Whitespire' birch scions on five species of rootstocks under field conditions.

Ten trees of 'Whitespire' birch on each of the 5 rootstocks were planted at a spacing of 4 5 m by 6.1 m in a randomized complete block design, with trees assigned to blocks according to tree size in Spring 1991.

Results and Discussion: The field soil was classified as a sandy clay loam (49% sand, 26% silt, and 25% clay), with a mean percolation rate of 2.3 cm•hr^{-1}, and an initial pH of 6.6.

No signs of graft union incompatibility (e.g. mechanically weak unions) were observed. However, occasional death oftrees on some rootstocks occurred throughout the study (Table 1). Trees grafted onto river, European, paper and 'Whitespire' rootstocks had similar (not significantly different) survival rates of 100, 80, 80, and 60%, respectively. Trees on Szechuan rootstocks had a low survival rate of only 30%, significantly lower than all other rootstocks except Whitespire' birch.

Trees on European birch had one of the greatest trunk diameters and tree heights at the end of the 1993 growing seasons (Table 1). Trees on river birch had trunk diameters and heights similar to trees on European birch. Trees on paper, 'Whitespire', and Szechuan birch had three of the smallest trunk diameters and heights. Tree width was similar for all trees with the exception of trees on European birch rootstocks that were significantly wider than trees on all rootstocks but Szechuan birch.

Frost cracks occurred in March 1993 on the lower trunk of the 'Whitespire' scion on some rootstocks. Trees on river birch had the greatest incidence of cracking, while trees on European and Szechuan birch rootstock had no cracking (Table 2). The greater incidence of frost cracks on scions grafted on river birch rootstock suggests that the rootstock may be influencing cold hardiness of the scion. However, frost cracks did not contribute to tree mortality, for trees on river birch had one of the highest survival rates (Table 1).

Rootstock suckers are a potential problem with all grafted plant species. Unless suckers are removed or suppressed they can become secondary tree trunks with distinctly different and often undesirable characteristics. 'Whitespire' birch rootstocks had a mean of 11.1 cumulative rootstock suckers, significantly greater than all other rootstocks. The remaining rootstocks had a similar number of mean cumulative rootstock suckers of 3 .5, 1.4, 1.1 , and 0.2 for European, river, Szechuan, and paper birch, respectively.

Trees on river birch rootstock showed interveinal foliar chlorosis on young leaves, typical of iron deficiency, during the first two growing seasons. Soil applied $FeSO_4$ and foliar spray of chelated iron effectively relieved this problem. Foliage appeared normal the third growing season and the above materials were not applied. River birch grown on its own roots can develop leaf chlorosis in soils with pH > 6.5. Results from our study indicate that this is a characteristic retained by the river birch rootstock. Thus, use of river birch rootstock is probably best reserved for acidic soils, i.e. pH < 6.0 - 6.5.

Significance to Industry: At the end of the experiment, trees of 'Whitespire' scion grafted onto European and river birch rootstocks had two of the greatest survival rates, trunk diameters, and tree heights of all graft combinations and significantly greater trunk diameter than trees on 'Whitespire' rootstock. These results are specific to the rootstock genotypes included in this experiment and the potential exists for considerable variation within these species. However, this study demonstrated that growth of certain birches, e.g. 'Whitespire', can be enhanced by grafting this cultivar on rootstocks of other birch species including European and river birch.

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Table 1. Mean tree survival, trunk diameter, height, and width of B. *platyphylla* var. *japonica* "Whitespire' grafted on five rootstocks.

Rootstock	Survival (%)	Trunk Diameter (cm)	Height (m)	Width (m)	Frost cracks (no.)	Cumulative rootstock suckers (no.)
river	100 a	6.2 ab	3.27 ab	1.29 b	1.0 a[z]	1.4 b
European	80a	7.6a	3.50a	1.93 a	0.0 bc	3.5b
paper	80a	4.8 bc	3.32 ab	1.37 b	0.3 b	0.2 b
'Whitespire'	60 ab	4.4 c	2.90 b	1.46 b	0.6 b	11.1 a
Szechuan	30 b	5.8 abc	2.92 b	1.55 ab	0.0 bc	1.1 b

[z]Means followed by the same letter within a column are not significantly different, $t0_{.05.}$

Effects of Nursery Aisle Cover Crops

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Nature of Work : The extreme amount of tillage between nursery rows often results in high amounts of erosion and runoff into nearby streams. The use of a groundcover in the aisleway would reduce runoff, the amount of herbicide used, and labor.

Universal Soil Loss Equations (USLE) type plots were established on a Mountview silt loam (fine, silty,siliceous, thermic, Typic Paleudults) at Tennessee Technological University nursery research farm in Putnam County, Tennessee. The plots were set up to evaluate tree growth and surface runoff as affected by aisle covers. This study will focus on tree growth evaluation. Four treatments and three replications in a random complete block plots design was used. The treatments included: 'Appalow' *(Lespedeza cuneata (Dumont)* G. Don), crimson clover(*Trifolium incarnatum* L.), perennial ryegrass (*Lolium perenne* L.), and clean till. Each plot was 50 feet long and 10 feet wide with approximately 5% slope and were established parallel to slope. Red maple (*Acer rubrum* L.) liners were planted 2 5-3 feet apart in the spring of 1992 in the center of each plot.

Three growth parameters were used in this study, leaf area, leaf weight, and tree caliper. The leaves were collected in the fall of 1993 shortly before leaf drop. The leaves from 25 trees were measured in square centimeters using a Li-Cor portable area meter model LI-3000. The entire collection of leaves were then oven dried and weighed. Caliper readings were taken with a Manostat caliper meter approximately 1 inch above the bud scar shortly before the trees began to set bud in early February, 1994.

Results and Discussion: The leaf weight data collected was averaged and a mean for each treatment was reached. The same was done for caliper. Using this data, both the leaf weight and caliper readings were analyzed according to their variance between the replications and treatments. This analysis is shown in Table 1. The a level demonstrates the percent variance between the treatments and the replications. The closer the factor is to 1.0, then the smaller the chance of a significant statistical difference due to the effect tested. The .18 a level for the effect of replication on leaf weight had the greatest probability of significant statistical difference of all the effects tested. Growth on the south replication was restricted possibly due to a burn pile which served as a host for japanese beetles. This variability was still, however, insignificant. A more detailed analysis of the aisle cover treatment effects are shown in Table 2. This table demonstrates that none of the treatments significantly effected growth. The largest difference between mean leaf weights was 0.416 oz (11.8 g); when the crimson clover treatment was compared to the ryegrass treatment. For there to be a statistical significant difference there would have to be a difference greater than 1.05 oz (29.9 g). Treatments also did not significantly effect caliper growth. The greatest treatment difference in caliper was .063 in (1.6 mm).

Growth was not affected by the use of various groundcovers due to competition for water. This is not surprising since the crimson clover and ryegrass grow primarily in the spring and then senesce in the early summer. Since there is an overabundance of water in the spring, there would be no competition for water, and growth would not be affected. The ‘Appalow’, however, grows actively from spring to early frost. Then, one would assume competition would occur between the trees and the groundcover for water in the drier summer months. However, no significant reduction in growth occured. As indicated by the data above, trees can be produced in the presence of the right groundcovers.

Initially, leaf area was intended to be used as a growth parameter. However, measuring this parameter by using a Li-Cor leaf area meter which became very tedious. After 25 trees were measured in this manner it was decided to correlate this data to leaf weight. The results are shown in Figure 2. Using the formula Y= -50 + 413X, where Y = leaf area and X = leaf weight. The r2 value was .86, which indicates that the model is explaining 868 of the variability in the correlation.

Significance to Industry: It appears that trees can be produced in the presence of groundcovers studied as opposed to clean till. The groundcovers mentioned in this study have been effective at the Tennessee Technological University nursery research farm with no reduction in crop growth. When used, these groundcovers could prevent soil deterioration, improve trafficability, and reduce labor. However, further research is need to determine the effect of these ground covers on other important nursery tree species.

Table 1. COMBINED ANALYSIS OF VARIANCE IN LEAF WEIGHT AND CALIPER.

	LEAF WT	CAL
	- - - - - - - - - - a level	- - - - - - - - -
REP	.18	.70
TRT	.79	.90
%CV	25.8	14.9

Table 2. EFFECT OF AISLE COVER TREATMENT ON LEAF WEIGHT AND CALIPER OF *ACER RUBRUM.*

TRT	LEAF WT(ounces)	CAL(in)
APPALOW	1.95a	0.72a
CRIMSON CLOVER	2.28a	0.77a
CLEAN TILL	2.01a	0.78a
RYE	1.86a	0.72a
LSD 0.05	1.04	0.22

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

Figure 1.