Field Production

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Drill and Fill and Other Field Nursery Fertilizer Application Techniques

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Index Words: *Ilex* X 'Nellie R. Stevens' Holly, *Ulmus parvifolia* 'Allee' elm

Nature of Work: Field grown nursery stock has traditionally been fertilized with soluble field grade granular fertilizers which are customarily applied in spilt applications as a top dress to established crops before bud break and in early summer. Nutrient availability in field grade fertilizers is subject to rainfall. Heavy rain may wash soluble nutrients away before they can be adsorbed by roots. A summer drought may delay release of nutrients until late summer or fall, potentially causing a late flush and damage by early frosts or reduced acclimation and death due to winter freezing temperatures. Controlled release fertilizers (CRF's) can also be applied as a one time per year top dress. However, growers consider CRF's to be expensive and there is a lack of information regarding any improved efficiency or greater plant growth of field grown nursery stock.

In recent years, many field grown nursery crops have been irrigated with drip irrigation. With irrigation in place, nursery stock can be “fertigated” by injecting soluble fertilizers into the irrigation line. The annual rate of fertilizer application can be divided into several applications during the growing season. Liquid fertilizer can also be used to supplement granular field applications, particularly if rainfall has washed granular fertilizer away from plant roots.

The Drill & Fill fertilizer application technique is new in concept to field production of nursery stock. The Drill & Fill technique is very similar to the soil auger technique used for landscape shade trees by tree service companies for decades. The Drill & Fill method uses a drill or punch bar to create holes adjacent to field grown plants. CRF's can then be placed below the soil surface, therefore less prone to wash away from plant roots or be moved by mowing equipment and other cultural activities. However, only a few grower observations provide any evidence of the benefit of this labor intensive fertilizer technique.

The objectives of this study were to measure plant growth responses of test crops to Drill & Fill CRF application compared to Top Dress application of CRF; Liquid Fertilizer application distributed by the irrigation system during the growing season; dry granular fertilizer split applications and combinations of liquid fertigation, dry fertilizer surface application, Drill & Fill CRF and Top Dress CRF fertilizer application techniques.

One year in field, established plants of *Ilex* X 'Nellie R. Stevens' Holly and *Ulmus parvifolia* 'Allee' elm were selected as test crops. The study was conducted at Shiloh Nursery, Harmony, NC in cooperation with John Allen and Danny

Allen owners of Shiloh Nursery. Other cooperators in the study were Donald Breedlove, Iredell County Horticulture Agent, Mary Kelly and Rick Helpingstine of Harrell's Fertilizer Company and Ted Bilderback, Carroll Williamson and Mary Lorscheider of N.C. State University.

All plants in the study were drip irrigated. To conduct this study, 5 rows of nursery stock for each crop were selected. There were 360 'Nellie R. Stevens' hollies and 360 'Allee' elms included in the study for a total of 720 plants. On November 8, 2001, the initial growth measurements were taken for each plant in the study. On Feb 7, 2003, each plant was measured again. 'Allee' elms were measured for height and caliper. 'Nellie R. Stevens' was measured for height, maximum width and minimum width. A growth index (GI) was calculated by averaging maximum and minimum width, adding height and dividing the sum by 2. Differences between initial measurements and data collected 15 months later were used to calculate an increase in growth for both test crops. Drill & Fill and Top Dressed Controlled Release Fertilizers samples were also collected Feb 7, 2003, sent to Pursell Industries, Sylacauga, Al and analyzed for percent of total nitrogen released.

Shiloh standard fertilizer practices included application of dry granular 17-17-17 before bud break in spring and application of NH_4-NO_3 (34-0-0) in June. Liquid fertilizer applied via irrigation lines was used as a supplemental practice. Liquid fertilizer was applied in 5 applications during the growing season.

Controlled Release Fertilizer treatments were applied November 8, 2001 and January 29, 2002. A gas powered drill and 2 inch auger were used to create 2 holes six to ten inches deep on each side in line with the drip irrigation tubes. Eight ounces of 18-6-12 (8-9 month release) Harrell's/Polyon fertilizer was deposited just beyond the root zone. The controlled release fertilizer was then covered with field soil. The same fertilizer product was also top dressed on each side of the plant at the same rate as Drill & Fill.

Results and Discussion: Analysis of release of the 18-6-12 Harrell's/Polyon Controlled Release Fertilizer indicated that approximately 47% of the Drill & Fill and 36% of the Top Dressed CRF had released from November 8, 2001 to February 7, 2003 (Table 1). Considering that no more than one-half of the nitrogen in the controlled release fertilizers released, it would be expected that the CRF's could influence growth during the 2003 growing season. A third follow-up measurement of growth responses in Fall 2003 would seem to be appropriate.

The amount of nitrogen fertilizer applied or released (available for plant adsorption) produced variable plant growth responses in both test crops. The combination Drill & Fill + Liquid + Dry Granular fertilizer treatment had the highest amount of fertilizer applied (6.9 oz N) and available (5.4 oz N), however 'Allee' elm had similar caliper in treatments with 1/3 rd the applied / available N. In contrast, for 'Nellie R. Stevens holly, the highest rate was not among the best treatments. Additionally, there did not appear to be any preference for the fertilizer application technique. For example, the Liquid + Dry Fertilizer treatment produced the greatest increases in growth index for 'Nellie R. Stevens' but had one of the lowest increases in caliper for 'Allee' elm. No application technique used alone and/or in combination with other techniques produced the greatest growth responses in either crop. The most consistent fertilizer treatments were Dry Fertilizer, Top Dress CRF + Dry Fertilizer, and the Drill & Fill + Top Dress CRF which produced the greatest increase in growth in both species.

Significance to the Industry: The Harrell's/Polyon 18-6-12 (8-9 month) controlled release fertilizer had 47% of the N released from Drill and Fill method and 36% of the N released as a Top Dress application. Fertilizer application rate and the application technique did not provide conclusive results regarding effects on plant growth characteristics measured for either test crop. Residual growth response during the 2003 growing season is expected for the controlled release fertilizer treatments.

Table 1. Summary of Treatments, Rates Applied and Available Nitrogen Per Plant

Fertilizer Treatment	N Applied Plant/yr (oz)	N Released Plant/yr (oz)	'Allee Elm' Increased Caliper (mm)	'Nellie R Stevens' Increased in GI
Dry Fertilizer	2.0	2.0	23.7a	10.0ab
Liquid Fertilizer 34-0-0	2.0	2.0	21.9b	9.7ab
Drill & Fill CRF 18-6-12	2.9	1.4	23.4a	6.9bc
Top Dress CRF 18-6-12	2.9	1.0	23.5a	6.8bc
Liquid + Dry Fertilizer	4.0	4.0	22.2b	10.2a
Drill & Fill + Dry Fertilizer	4.9	3.4	22.2b	7.7ab
Top Dress CRF + Dry Fertilizer	4.9	3.0	22.9a	8.8ab
Top Dress CRF + Liquid	4.9	3.0	22.8a	6.7bc
Drill & Fill CRF+ Liquid	4.9	3.4	23.0a	6.9c
Drill & Fill CRF + Top Dress CRF	5.8	2.4	25.1a	9.1ab
Drill & Fill CRF + Liquid + Dry Fertiizer	6.9	5.4	23.8a	7.1bc

Evaluation of Two Devices Utilized to Straighten Trees

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Index Words: Trunk-Aid®, Tree Trainer™

Nature of Work: Trees that have bent or crooked trunks are virtually worthless in the nursery industry. A product that would straighten tree trunks while being cost effective and easy to utilize could increase profit margins. The Trunk-Aid® is a plastic hook device that is placed over a stake and holds the tree vertical, maintaining the trunk straight during the hardening process. According to the manufacturer it is best utilized with trees that are bent, do not stand up to flexing and are 3 years old, if grown from a whip. The Tree Trainer™ does not require a stake and acts like a bow utilizing the pull of tension the device exerts upon the trunk in order to straighten crooked trees. It is made of aluminum and comes in two sizes. The small unit fits trees ½ “ to 1 ½ “ in diameter. The large unit fits trees 1 ¼” to 2 ¾” in diameter.

The objective of this study was to evaluate two devices ability to straighten bent and crooked tree trunks. Twenty-five *Castanea dentata* (American Chestnut) trees with varying degrees of crooks or bends were selected. All trees ranged from 3 to 4 feet in height. This research took place at the Tennessee State University CARP Farm in Nashville, TN. On April 10, 2002 a total of thirteen Trunk-Aid® and twelve small unit Tree Trainer™ devices were placed on the trees according to the manufacturers' specifications. A 1 to 5 scale was used to evaluate the trees with the following definitions: 1= very severe bend or crook, 2 = severe bend or crook, 3 = moderate bend or crook, 4 = slight bend or crook, 5 = no bend or crook. Trees were evaluated before the devices were attached and upon removal. Two individuals evaluated all trees. Trees tested with the Tree Trainer™ had the device removed on June 25, 2002. Trees tested with the Trunk-Aid® had the device removed October 18, 2002. The duration of time each product remained on the trees was according to their recommendation. Both products were monitored on a monthly basis and adjustments were made accordingly.

Treatments were analyzed via Paired-Sample T-Test with SPSS (1). Differences were considered significant at P = 0.05.

Results and Discussion: Three trees that received the Trunk-Aid® and two that received Tree Trainer™ devices expired during the course of this study. The deaths appeared to be unrelated to the devices. Results indicated that the Trunk-Aid® product significantly straightened bent trees while the Tree Trainer™ did not significantly improve crooked trees (Table 1). The Trunk-Aid® device was easy to attach. However, a small number of the conduit stakes that the Trunk-Aid® devices were attached to needed further tamping into the soil on a monthly basis. The main drawback of the Tree Trainer™ was the difficulty in knowing when enough tension had been applied in order to straighten the tree. A number of the trees developed cracks on the trunk due to the applied tension. The

Tree Trainer™ also girdled several trees over the course of the season leaving permanent trunk damage. In addition, the apparatus was more difficult to attach compared to the Trunk-Aid®.

Small Tree Trainer™ units retailed for $22.00 individually. The Trunk-Aid® product retailed for $1.69 per device and became less expensive if bought in larger quantities. EMT conduit was utilized as stakes for the Trunk-Aid® devices costing 43 cents per foot equaling $1.29 per stake. The total cost of utilizing one Trunk-Aid® device was $2.98 per tree. Both devices could be reutilized.

Significance to the Nursery Industry: Results show that the Trunk-Aid® device can be used to straighten bent trees. In addition, it is labor efficient and cost effective. The Tree Trainer™, although ingenious, requires frequent attention to insure damage is not caused to the tree. It is not as cost effective as the Trunk-Aid®. The Tree Trainer™ may best be utilized by homeowners in the landscape. Utilizing a product, such as the Trunk-Aid®, that consistently straightens bent trunks may increase the marketability of trees that otherwise would not be suitable for sale.

Table 1. Pre and post test means of tree straightening devices

Treatment	Pre-Mean	Post-Mean	SD	Significance
Trunk-Aid®	3.12	4.20	0.95	*
Tree Trainer™	3.35	3.65	0.86	NS

NS, * Nonsignificant or significant at P = 0.05, respectively.

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1. SPSS 10.0. Chicago, IL 60606.

Effect of Weed Control and Nitrogen on the Growth of Field-grown Shade Trees in Central Arkansas

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Index Words: herbicides, fertilizer, red maple, callery pear, willow oak

Nature of Work: While the literature encourages the use of a vegetation-free area around the base of shade trees in a field nursery (Bullock, 1996; Mathers, 1999), there is little data to quantify the impact on shade tree growth (Whitcomb, 1973). Data have been published on the effect of vegetation-free zones in fruit crops (Smith, 1959; Smith, 2002).

Previous research suggests a benefit from fertilizing field-grown plants with nitrogen (Rose, 1999; Smith 1990). Specific results are dependent on the nitrogen rate, time of application, and species involved. This research is designed to evaluate the effect of nitrogen rate on the growth of shade trees during the first year of field production.

Research was conducted at a commercial nursery in central Arkansas. Plants included in this study were *Acer rubrum*, *Pyrus calleryana* 'Cleveland Select', and *Quercus phellos*. Trees were planted from containers (1-gal *Acer rubrum* (seedlings), 5-gal *Pyrus calleryana* 'Cleveland Select', and 5-gal *Quercus phellos*) on April 22,2002 by the nursery. Plants were watered as needed by drip irrigation. The standard practice in the nursery is to mow the aisle between rows of trees but not to use any mechanical or chemical weed control within a row of trees. Tree spacing is 8' O.C. The pattern of tree row spacing is 3 rows of trees separated by a 10' tall fescue/bermudagrass aisle, an 18' grassy aisle, and then another set of 3 tree rows each separated by a 10' grassy aisle.

Four fertilizer treatments were evaluated: granular urea broadcast at 9, 19, and 29 grams N/tree and an unfertilized check.

Weed control consisted of two treatments: vegetation-free 1' on either side of the tree row (16 ft^2 rectangle) versus a vegetative ground cover within the tree-row. Weed control was accomplished during 2002 using 1 application of pendimethalin (3 lb a.i./A) pre-emergent herbicide at planting and two spot applications during the growing season with glyphosate. We estimate the product cost (labor not included) for pendimethalin at $60/A/application and for glyphosate at $10/A/application.

Fertilizer and herbicide treatments were imposed on trees growing in a commercial nursery. Treatments were assigned in a completely randomized design. Treatments consisted of a single plant replicate, however, the number varied depending on the species. For red maple and willow oak, there were 12 single plants replicates, and for callery pear 6 single plant replicates.

Final growth was measured on October 18, 2002. Trunk caliper was measured for all three tree species, however, shoot height was only measured for red maple.

Results and discussion:

Nitrogen Rate:

Regardless of the tree species or fertilizer rate, nitrogen at any rate did not have a significant effect on the change in trunk caliper during the first growing season (data not shown). A change in tree height was only measured for red maple. Fertilizer rate had no effect on tree height for this species during the first year (data not shown). A similar study was conducted in 2002 at a different field nursery in Eastern Arkansas. Results (not shown) from that nursery also indicated no effect of nitrogen rate on tree growth during the first growing season. Tree species in that study included swamp white oak, red maple, and crabapple.

Weed Control:

The use of weed control within the tree row had a significant effect on tree growth during the first growing season. Use of weed control within the tree row resulted in a significant increase in trunk caliper by the end of the first growing season for callery pear and willow oak but not red maple seedlings (Table 1). Weed control within the row resulted in a significant increase in shoot height for red maple at the end of the first growing season (Table 2). Tree height was not measured for callery pear or willow oak.

Significance to industry: Weed control is a common recommendation for overall best management practices in field shade tree production. While the recommendation makes good common sense, little data exists to quantify the impact of this cultural practice. Overall results indicate that the use implementation of vegetation control within the tree row has a significant effect on first year growth of shade trees. There was no effect of nitrogen rate on shade tree growth in the first year.

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Table 1. Effect of vegetative ground cover within the tree row on the change in trunk caliper (cm) during 2002 for 3 tree species.

Vegetative ground cover around trees	Red Maple	Callery Pear	Willow Oak
no	0.4 a	0.7 a	0.3 a
yes	0.3 a	0.3 b	0.2 b

Numbers within a column followed by the same letter are not significant at the 5% level.

Table 2. Effect of weed control within the tree row on the change in shoot height during 2002 for Red Maple.

Vegetative ground cover around trees	Change in Shoot Height (cm)
no	8 a
yes	-1 b

Numbers within a column followed by the same letter are not significant at the 5% level.