

# Field Production

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## A Comparison of B&B Stock Holding Methods

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**Index Words:** *Acer platanoides*, Landscape Establishment, Root Ball Holding, Rooting Out

**Nature of work:** Many nurseryman and landscape contractors are aware of problems associated with holding field grown B&B stock for more than a few weeks, or holding spring-dug stock for summer sales. Nurseryman have been experimenting with ways to keep roots from drying out, leaves from scorching or dropping, root balls from hardening or flattening, and weeds from growing on the root balls. These holding challenges may increase tree stress thereby decreasing tree quality and landscape establishment.

While mulch has been widely used in the past, additional methods currently being used to hold B&B stock include surrounding the root ball with stretch wrap, and using untreated or copper-impregnated geotextile bags (1). Research conducted using copper-treated burlap showed that treated burlap prevented rooting-out of B&B stock during storage thereby reducing reballing and/or root removal prior to planting (3). Other research has shown that treated or synthetic burlap should be removed at planting time since both decay slowly and inhibit root growth (2).

The objectives of this research were to compare B&B stock holding methods for spring-dug/summer-planted trees, and to determine the economic advantages and disadvantages of these holding methods. On March 10 and 11, 1997 nine root ball holding treatments were applied to recently harvested 28 in (71 cm) root balls of 2 in (5 cm) caliper Summershade Norway maple (*Acer platanoides* L. 'Summershade') balled with standard coarse, untreated burlap (NYP Corporation, Elizabeth, NJ). Treatments were as follows:

- UTB - untreated burlap/ no drip irrigation (control)
- DI – untreated burlap/drip irrigation
- TB - treated burlap (NYP Corporation)/drip irrigation
- M – untreated burlap mulched with shredded hardwood/no drip irrigation
- BSW – untreated burlap covered by black stretch wrap/ drip irrigation (Braun Horticulture, Inc., Ontario, Canada)
- CSW – untreated burlap covered by clear stretch wrap/drip irrigtio (BrownCor International, Milwaukee, WI)

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- TPB – untreated burlap covered with a polypropylene bag (The Tapered Bag, Root Control Inc., Oklahoma City, OK)/drip irrigation
- CU – untreated burlap covered with a copper-impregnated polypropylene bag (Tex-R Agroliner, Texel, Quebec, Canada)/ drip irrigation – this treatment was placed into a 28" hole in the ground
- CONT – untreated burlap potted into 65 gal. black plastic container/drip irrigation

Treatments were replicated five times and trees were set out in a completely randomized block design on a mulch-covered holding bed with drip irrigation applied via 2 gal/hr drip emitters, two per root ball tucked under the holding treatment and applied on an as need basis.

Root ball temperatures were recorded hourly from 9 am to 8 pm on two dates (May 12, June 18) using a thermometer probe (Omega, Stamford, CT) inserted 4" deep and 2" inches back from the edge of each root ball. On July 14, 1997 visual ratings of leaf scorch (amount of necrotic tissue) were made. In addition, the holding treatments were removed and the rootballs rated for the amount of root penetration through the burlap. On July 15 all trees were transplanted to a landscape site. The trees were redug on October 27, 1998 with a 60" tree spade. The roots were allowed to air dry until January 1999 when an Air Spade (Concept Engineering Group, Inc., Verona, PA) was used to remove the top 6" of root ball soil to permit a rating of new root growth out from the original root ball.

**Results and Discussion:** The control treatment's limited caliper and root growth supports applying some form of holding treatment to root balls if they must be held above ground for more than a few days after spring digging and prior to summer planting (Table 1). Growth of trees with lower root ball temperatures using the mulch (M) treatment was not as good as for the black stretch wrap (BSW) treatment trees that incurred higher root ball temperatures (Figure 1). This suggests that high root ball temperatures as recorded here are not necessarily a major limiting factor in plant growth. Though both the clear (CSW) and the black (BSW) stretch wrap treatments resulted in high root ball temperatures, competition for moisture from weeds that grew under the clear stretch wrap (CSW) probably accounted for the poorer growth of that treatment. The importance of drip irrigation combined with a root ball covering is being tested in an ongoing study, the results of which will be reported in the future.

Whether or not it is desirable to have root growth occur outside of the root ball during holding is debatable, and probably depends on the ability of whoever is moving the trees to deal with extra roots. The mulch (M)

and containerized (CONT) treatments had large volumes of roots growing out of the root balls, but rated poorly in caliper growth once planted in the field (Table 1). Trees from the untreated above ground bag (TPB) which did not contain copper had little rooting out during holding due to air-root pruning, but field growth was limited (Table 1). By contrast both the copper-treated bag (CU) and the burlap treated with cupric ammonium carbonate (TB) had similar limited rooting out during holding but performed well in the field possibly due to copper's effect as a growth regulator, stimulating a denser root system (2).

Overall treatment costs, representing material costs plus the cost of labor for applying the materials, varied greatly (Table 2). Treatment costs ranged from a low of \$2.25 for the drip irrigation only (DI) treatment to a high of \$14.70 for the containerized (CONT) treatment. If a nursery or landscape company is only holding a few trees the cost of the holding treatment may be insignificant, but could be important if a large quantity of trees is being held.

**Significance To Industry:** The overall performance of two treatments, the treated burlap (TB) and the black stretch wrap (BSW), both of which were relatively inexpensive holding methods, should be considered by the industry. Holding cost should not, however, be the sole determining factor in selecting a holding method. Cost should be considered along with the ability to supply supplemental irrigation during holding, plant response to the holding method, and the ability to move additional roots if a treatment that promotes considerable rooting out is selected.

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Table 1. Overall root ball ratings.

	Temps <sup>1</sup>	Leaf <sup>2</sup>	Root <sup>3</sup>	Caliper <sup>4</sup>	Root <sup>5</sup>	Cost <sup>6</sup>
UTB – untreated burlap/no drip (control)	7	8	1	9	8	1
DI – UTB/drip	4	6	2	8	4	2
TB – treated burlap/DI	5	3	2	2	3	3
M – UTB with mulch/no drip	1	7	6	4	7	4
BSW – UTB with black stretch wrap/DI	6	2	4	3	2	5
CSW – UTB with clear stretch wrap/DI	8	4	5	5	6	5
TPB – UTB with fabric bag/DI	3	2	1	7	5	6
CU – UTB with copper fabric bag/DI	2	5	3	1	4	7
CONT – UTB containerized/DI	5	1	7	6	1	8

<sup>1</sup> Rootball temperatures for 6/18/99: 1 (coolest) - 9 (warmest)

<sup>2</sup> Leaf scorch: 1 (least) - 8 (most)

<sup>3</sup> Root growth out during holding: 1 (least) - 7 (most)

<sup>4</sup> Caliper increase after 1 \_ years: 1 (most) - 9 (least)

<sup>5</sup> Field root growth after 1 \_ years: 1 (most) - 8 (least)

<sup>6</sup> Labor + Materials: 1 (least) - 8 (most)

Table 2. Root ball holding treatment costs.

	Labor Cost <sup>1</sup>	Materials	Total Cost
UTB – untreated burlap/no drip (control)	\$ 0	\$ 0	\$ 0
DI – UTB/drip <sup>2</sup>	\$1.50	\$.75	\$2.25
TB – treated burlap/DI	\$1.50	\$.90	\$2.40
M – UTB with mulch <sup>3</sup> /no drip	\$3.00	\$.75	\$3.75
BSW – UTB with black stretch wrap <sup>4</sup> /DI	\$4.50	\$.80	\$5.30
CSW – UTB with clear stretch wrap <sup>4</sup> /DI	\$4.50	\$.80	\$5.30
TPB – UTB with fabric bag <sup>5</sup> /DI	\$4.50	\$1.65	\$6.15
CU – UTB with copper fabric bag <sup>6</sup> /DI	\$11.50	\$1.92	\$13.42
CONT – UTB containerized <sup>7</sup> /DI	\$11.50	\$3.20	\$14.70

<sup>1</sup> Labor Cost = Hours times \$10.00 wage

<sup>2</sup> DI - 5 year minimum reuse @ \$.75 each

<sup>3</sup> \$0 - \$1.50: range of free material used or purchased

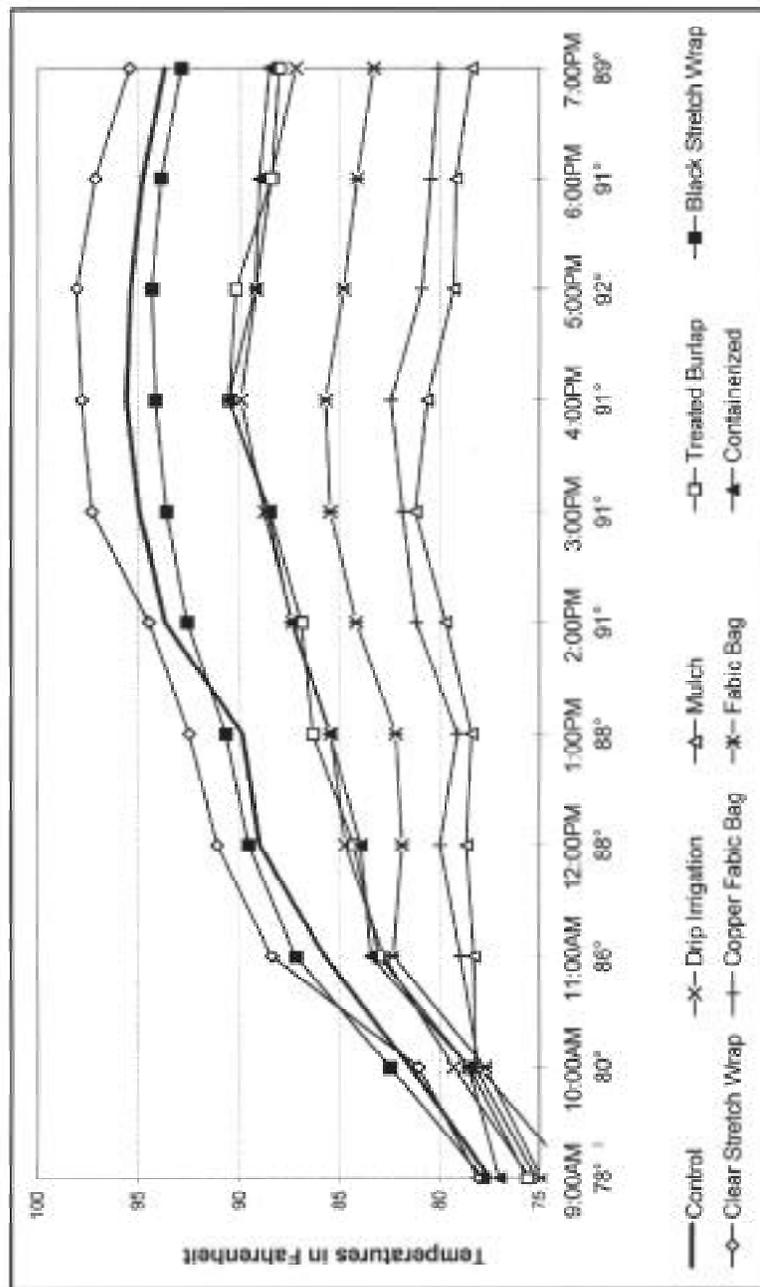
<sup>4</sup> 40 ft per ball, double wrapped @ \$.05 each

<sup>5</sup> Tapered Bag - \$4.50 each – 5 cycle minimum reuse

<sup>6</sup> Tex-R Agroliner - \$3.50 each – 3 cycle minimum reuse

<sup>7</sup> Container # 65: \$22 each: 5-10 year reuse

Figure 1. Hourly root ball temperatures on June 18 1997



**Are You Ready,  
WPS Inspectors Are Coming to Your Nursery**

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**Index words:** Worker Protection Standard, WPS, Pesticide, Regulations, Nursery Inspection

**Nature of Work:** The Worker Protection Standard (WPS) is a regulation issued in 1992 by the U.S. Environmental Protection Agency. It covers pesticides that are used in the production of agricultural plants on farms, forests, nurseries, and greenhouses. The WPS requires you, the grower, to take steps to reduce the risk of pesticide-related illness and injury if you use such pesticides or employ workers or pesticide handlers who are exposed to such pesticides.

If you are an agricultural pesticide user and/or an employer of agricultural workers or pesticide handlers, the WPS requires you to provide to your employees and, in some cases, to yourself and to others: 1) information about exposure to pesticides; 2) protections against exposures to pesticides; and, 3) ways to mitigate exposures to pesticides. To ensure that employees will be informed about exposure to pesticides, the WPS requires: 1) pesticide safety training for workers and handlers; 2) pesticide safety poster to be displayed for workers and handlers; 3) access to labeling information for pesticide handlers and early-entry workers; and, 4) access to specific information in a Application List of Pesticide Treatments which should be centrally located on the establishment.

**Results and Discussion:** Worker Protection Standards (WPS) were implemented four years ago, and are being enforced. The 1998 report by the Florida Department of Agriculture and Consumer Services (FDACS) has shown that WPS violations are higher in nursery and greenhouse businesses than other agricultural businesses. Compliance with WPS accomplishes three objectives: 1) protects you and your employees; 2) keeps productivity steady, and, 3) guards against financial liabilities.

A total of 2,280 farm, nursery, greenhouse and forest establishments were inspected by FDACS inspectors. WPS violations were found at 554 locations, for an overall violation rate of 24 per cent; however, the rate at nurseries and greenhouses was 32 per cent.

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Growers need to remember that compliance requirements should now be a part of daily routine business operations. If you are not in compliance, you are in violation of a Federal law, since it is illegal to use pesticides in a manner inconsistent with the label. The label is the law. Farm worker organizations are monitoring compliance and have lodged complaints about violations in nurseries in several parts of the state. A warning letter is usually given for a first violation, with fines for subsequent violations.

### Most Frequently Cited Violations

#### A. Information at a Central Location

Worker and Handler employers must make sure that certain information is displayed at a central location for pesticides about to be applied or recently applied on the agricultural establishment. The information must include:

1. Application information:

- Location and description of the area to be treated
- The product name, EPA registration number and active ingredient(s) of the pesticide
- Time and date the pesticide is scheduled to be applied
- The restricted-entry interval for the pesticide

This information must be available for 30 days after the restricted entry interval for the pesticide has expired.

2. Emergency information:

- Name, telephone number and address of nearest medical facility

3. Pesticide Safety Poster

- The poster may be either the WPS safety poster developed by EPA or an equivalent poster that contains the safety concepts required by WPS.

#### B. Pesticide Safety Training

Agricultural employers must make sure that pesticide Handler employees are trained about general pesticide safety and correct ways to handle pesticides before they are assigned a Handler task. The employer must make sure that agricultural workers have been trained about general pesticide safety. Workers must be trained by the 6th day of employment at the agricultural establishment. They must receive basic safety information if they perform Worker tasks before receiving the required pesticide safety training.

#### C. Decontamination Sites

Employers must make certain that a decontamination site is provided to Handlers for the duration of the Handler task. This includes water for routine washing (enough for washing the entire body) and emergency eye flushing, soap and single use towels and a clean change of clothes (i.e. a one-size-fits-all coverall). For Workers, employers must provide water for routine washing and emergency eye flushing and soap and

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single-use towels. The decontamination area for Workers must be provided for 30 days after the end of any restricted entry interval for that area.

**Significance to Industry:** The penalty for not complying with the Federal Worker Protection Standard is the same as the penalty for using a pesticide in a manner inconsistent with its labeling. In general, the fines can be up to \$1,000 per offense for private applicators (owners/operators of agricultural establishments) and other persons; and up to \$5,000 per offense for commercial applicators (owners/operators of commercial pesticide handling establishments) and other persons. If the WPS is knowingly violated, the criminal penalty can be up to \$1,000 and 30 days in jail for private applicators and up to \$25,000 and 1 year in jail for commercial applicators. Most States and Tribes enforce under their own laws and regulations and have their own penalties that may differ from Federal penalties. In addition, some local governments may impose their own pesticiderelated ordinances and may impose their own penalties. Other benefits of WPS compliance include: healthier, more productive employees; less sick days, which results in constant production rate; and, fewer workman's compensation claims.

For information on WPS, contact John Roberts, FDACS District Manager, at (904) 462-2202. You can request a copy of the "Quick Reference on How to Comply with the Worker Protection Standards" issued by FDACS, which is intended to replace obsolete "How to Comply" handbooks. The Florida Nurserymen & Growers Association (FNGA) state office also has copies of this publication; call (800) 375-FNGA (3642).

Growers can also obtain a booklet to help simplify pesticide record keeping from the Florida Farm Bureau Federation. Contact Kevin Morgan at (352)374-1537 for more information.

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## The Use of Crumb Rubber as a Zinc Source in an Established Pecan Orchard

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Index words: Crumb Rubber, Zinc, Pecan

**Nature of Work:** The objective was to determine if there was significant zinc uptake by pecan trees from crumb rubber placed in the soil profile as vertical mulch. Also, it was the intent of this study to determine if placing crumb rubber in vertical holes within the drip line of pecan trees would influence foliar mineral content. Several reports reflect the high concentrations of zinc in crumb rubber and its damaging affects to plant growth. Therefore, it was decided to use the pecan as the test plant, because of its high use and high zinc requirements. Zinc availability to plants is related to its mobility within the soil. Jones reported that 95% of the zinc in the soil moves by diffusion. Factors which limit the rate of diffusion of zinc are known to reduce zinc availability. According to Mills and Jones, Jr.(5) , this is probably the reason zinc deficiency is often found on compacted soils or where root growth is restricted.

**Material & Methods:** Nine treatments, using two sizes of crumb rubber were applied to 6 year old pecan, *Carya illinoensis* 'Cheyenne' on July 9, 1996. Vertical holes were made using a 2 inch gas operated auger. Each hole was drilled sixteen inches deep, four feet from the base of the tree. Holes were spaced three feet apart and were made to the drip line of the tree. Thus the number of holes drilled around each tree was dependent on the spread of the canopy. A completely randomized design was used with two replications of each treatment, including the control (no rubber applied). Nylon tubes were used for the treatments (fine grade and course grade crumb rubber) designated in table 1. In this fashion, the crumb rubber could be removed from the hole and a determination made on the degradation of the rubber. Each nylon tube of crumb rubber (fine) was weighed to obtain an average weight per tube. The one quarter inch crumb rubber had an average weight of 380 grams per tube while the number ten mesh crumb rubber (course) had an average weight of 180 grams per tube. Bulk treatments of one quarter or ten mesh crumb rubber was made by placing 500 ml. of crumb rubber in the hole. Trees in this study were sprayed, fertilized and maintained utilizing normal orchard practices. The orchard was under drip irrigation, therefore moisture stress was not a factor in this study. Plant tissue samples were taken immediately before treatments were applied in 1996 and during the growing season of 1997 and analyzed for percent nitro-

gen, phosphorus, potassium, calcium, magnesium, and ppm concentration of iron, manganese, zinc and copper. Samples were taken every two weeks to detect any trends in nutrient change within the plant.

**Results and Discussion:** As stated by Esteban Herrera (3), zinc is the primary micronutrient which must be applied annually to pecan trees in the irrigated southwest. Zinc deficiency is known to cause small and chlorotic leaves and a reduction in growth resulting in a non pathological disease called "little leaf". Zinc requirements of the pecan dictates that the nutrient be applied annually beginning at bud break and continuing at two to three week intervals until terminal growth ceases during the growing season. The normal range for zinc in pecan leaves is 50 to 100 ppm. Concentrations of nutrients varies with variety, sampling time, position of the leaf in the shoot and position of the leaflet in the leaf. The recommended sampling procedure for pecans consists of sampling the middle position of the current season's shoot, taking 30-60 leaflets for each sample. It is known that concentration of nutrients within the leaflet changes as the season progresses or as the leaflet grows. There is a normal increase just before "leaf drop" to the reservoirs within the stem of the plant. There was an increase zinc uptake from all treatments, including the control. The increase noted within the control is assumed to be from normal cultural practices by the grower, Table 2. Annual applications of zinc are made by the grower to maximize yields. The results of this study indicate that crumb rubber applied as a vertical mulch increased the foliar zinc levels in all treatments. It is well documented that zinc concentrations may adversely affect nitrogen, manganese and iron while the use of calcium will slow or stop the uptake of zinc. Some crops are able to digest and even require high amounts of zinc. Pecan is one such plant. The mechanism of zinc tolerance is not yet fully understood. Limited uptake by the roots does not seem to play a role in tolerance according to Foy et al. (2), and Baker (1) explains that a key factor important in zinc tolerant plants is the prevention of zinc translocation from the root to the shoot. Internal tolerance can exist as binding of zinc to the cell wall, accumulation in the vacuole or detoxified (Peterson, Turner, and Mathys. Further study is warranted to track the amount of zinc in potting media, and in soils were crumb rubber from waste tires is used as a mulch. Tissue standards for pecan, *Carya illinoensis* are well established. Mills and Jones, Jr., publishes the normal range of major and minor elements for optimum growth and production of the crop. Foliar sufficiency levels for zinc in pecan should range between 40 - 100 ppm according to Mills and Jones. Zinc levels in the tissue samples taken in 1996 increased from near 70 ppm to over 100 ppm in November, 1996, Table 2. This increase occurred for the control as well as the two crumb rubber treatments. Levels of zinc dropped during the early sampling period in 1997, but reached over 100

ppm by the July 15 sampling date (Table 2). Near the end of the sampling period, zinc levels for all treatments (including control) were near 100 ppm and above. The quantities found in the foliar samples were not excessive. The crumb rubber treatments recorded a higher concentration of zinc than the check, however, the amount was less than 20 ppm (table 2). Crumb rubber treatments did not have any adverse effect on the uptake of zinc.

**Significance to the Industry:** Crumb rubber has been tested on sports turf as mulches to improve soil aeration with great success. Vertical mulching (aeration) with crumb rubber could offer an excellent method of reducing soil compaction in heavy soils or high traffic areas if the trees could utilize the high zinc content. Table 2 shows the release of zinc, though not statistically different, from crumb rubber applied as a vertical mulch. If crumb rubber could be used to aerate compacted soil in the landscape, it could offer a means of recycling a by product while providing soil aeration. However, high concentrations of zinc in crumb rubber may limit its use to plants tolerant to excessive zinc concentrations.

Table 1. Treatments made using two sizes of crumb rubber as vertical mulch in pecans. Young Pecan Orchard, Starkville, MS, 1996 and 1997.

Treatment number	Type of Treatment	# of holes drilled around tree
1	Bulk-10 mesh	9
2	Tube - 1/4 inch	9
3	Tube - 10 mesh	6
4	check	0
5	Bulk - 1/4 inch	9
6	Tube - 1/4 inch	9
7	Tube - 10 mesh	6
8	Bulk - 10 mesh	6
9	Bulk - 1/4 inch	6

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Table 2. Foliar zinc levels in pecans as influenced by vertical mulch of crumb rubber. Young Pecan Orchard, Starkville, MS, 1996 and 1997.

	Control	Fine Grade	Course Grade
	Zn(ppm)		
July 3, 1996	72	74	64
Sept. 11, 1996	86	96	81
Nov. 5, 1996	110	116	100
May 29, 1997	85	98	75
June 19, 1997	54	95	78
July 1, 1997	70	82	94
July 15, 1997	102	112	94
July 30, 1997	83	104	90
Aug. 18, 1997	78	114	102
Aug. 29, 1997	85	116	101
Sept. 19, 1997	98	119	104

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