

Soil temperatures in this full sun experiment ranged from a low of 5.6°C to a high of 39.4°C. The average temperature for the 12-month growing period was 25°C, considerably above the estimated release curve for 21°C fertilizer sources. However, the excessively high soil temperatures probably caused rapid release of both 21°C and 32°C sources and most nutrients may have been expended by fall when temperatures were lower. Data show that none of the sources supplied sufficient nutrients to allow re-growth in the spring.

Data from both species indicate there is potential for a single annual slow-release fertilizer application under shade, but not in full sun with the sources utilized when soil temperatures may be excessive. Because of the extremely high soil temperatures observed in full sun, it would appear that spacing full sun plants is not wise until they have sufficient canopy to shade at least part of the container surface.

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EFFECTS OF IRRIGATION REGIME, ANTITRANSPIRANTS, AND A WATER ABSORBING POLYMER ON THE SURVIVAL AND ESTABLISHMENT OF TRANSPLANTED LIVE OAKS

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Abstract. Sixty-four 4-inch caliper live oaks (*Quercus virginiana* Mill.) were transplanted in Aug. 1984 from 1 area of a tree nursery in Oak Hill, Fla. to an adjacent area using a 44-inch tree spade. Trees were either sprayed with water, Wilt-Pruf (1:10 dilution), or Cloud Cover (1:2 dilution) the day before transplanting, or 6 oz of Terra-Sorb (water-absorbing, starch polymer) was added to the sides of the planting hole. Thirty-two trees were irrigated with 18 gal of water daily and 32 trees were irrigated 7 days after a 1-inch rain or the last irrigation (weekly). There was no interaction of irrigation rate with other treatments on survival of the live oaks. Fifty-five % of trees watered weekly and 65% of trees watered daily survived. Visual ratings after 21 and 37 days were greater if trees were watered daily than those watered weekly. Sixty-seven, 80, 38, and 54% of trees survived when sprayed with water, Wilt-Pruf, or Cloud Cover or treated with

Terra-Sorb, respectively. Terra-Sorb resulted in greater mean branch elongation in the spring of trees irrigated daily.

When the quantity of water transpired exceeds the ability of a plant to take water from the soil, water stress occurs and plant growth and quality is reduced. When plants are dug from a field nursery, construction site, or an undisturbed native habitat, the loss of a substantial portion of the root system predisposes the plant to water stress. This is especially true during hot, dry periods. It is often essential to move trees in Florida during the summer months to meet demands for larger landscape materials not commonly grown in containers or to coincide with development and construction. Antitranspirants and soil additives have been suggested as possible means of reducing water loss during establishment of transplanted trees and shrubs.

Antitranspirants reduce water loss from leaf surfaces by either coating the leaf with an impermeable film or inducing stomatal closure through alteration of some metabolic process. Wilt-Pruf, Cloud Cover, and Vapor Gard are among the resin type antitranspirants that limit water loss by coating the leaf surface. Wilt-Pruf increased visual rating of semiballed *Camellia sasanqua* dug during the summer in Georgia, but did not alter the visual rating of *Osmanthus fortunei*, *Ilex crenata* and Kurume hybrid azaleas (4). It was concluded that careful digging and fre-

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quent watering during dry seasons are more important than shading at planting or applying Wilt-Pruf before digging. Davis and Kozlowski (3) concluded that the environment and species influence the efficiency and usefulness of antitranspirants. Wilt-Pruf decreased the water loss and net photosynthesis of *Fraxinus americana* and *Pinus resinosa* for 8 days but not thereafter. Cracking of the antitranspirant film over the stomata guard cells accounted for the decrease in effectiveness with time. Gilliam and Ponder (6) found that Vapor Gard reduced water loss for 1 week and increased survival of *Photinia x Fraseri* that were dug in summer afternoons in Alabama, whether plants were irrigated before digging or not. Transpiration in transplanted blueberries was reduced by 80% by a predig application of Vapor Gard (1).

Incorporation of 0.7 oz Terra-Sorb, a water absorbing polymer, to the planting backfill for transplanting container-grown *Liquidambar styraciflua* did not influence survival or growth but increased installation costs by 27 to 30% (7). David Hensley (personal communication, Kansas State University) found that Terra-Sorb applied as a slurry to roots of bare root sugar maples, transplanted in May in Kentucky reclaimed mine spoils, increased survival by 286%.

Terra-Sorb has also been used as an amendment to organic container growth media. Banko (2) reported fall garden mums were larger and had more flower buds under reduced irrigation when the pine bark:sand (4:1 by volume) medium had been amended with Terra-Sorb 200 at 2 lbs./yd³. Gibson and Whitcomb (5) evaluated Terra-Sorb 200 as a substitute for peat in a pine bark based medium and found that 2 lbs./yd³ resulted in good top and root growth of *Ulmus parvifolia* and *Juniperus procumbens*, but 4 lbs./yd³ reduced root growth of the juniper.

The cost and return of every operation in a nursery or landscaping firm is examined by the prudent manager. Use of antitranspirants and other commercially available products to aid in survival and establishment of transplanted trees is no exception. For this reason, an experiment was conducted at the tree nursery of Burbage Tree Movers in Oak Hill, Fla. Two antitranspirants and a water absorbing polymer were evaluated as aids to survival and establishment of live oaks across 2 irrigation regimes.

Materials and Methods

Sixty-four 4-inch caliper live oaks, *Quercus virginiana*, were selected from a block of 800 trees that had been field-grown near Oak Hill, Fla. for 4.5 years. Trees had been shaped by pruning approximately 3 months before selection. In the morning of 20 Aug. 1984, 16 trees each were sprayed with Wilt-Pruf (1 to 10 dilution), Cloud Cover (1 to 2 dilution) and water. All leaves were thoroughly covered using a back-pack, air-blast sprayer.

Trees were dug with a 44-inch tree spade on 21 and 22 Aug. and moved approximately 100 yds to another site in the nursery where holes were dug using the same tree spade. The air temperature was 88 to 90°F and the sky was partly cloudy. Before 16 previously non-treated trees were placed in the holes, 6 oz of Terra-Sorb were distributed on the sides of each hole. Terra-Sorb is a gelatinized starch-hydrolyzed polyacrylonitrile graft co-polymer manufactured and distributed by Industrial Services International, Inc., Bradenton, Fla. All trees were watered thoroughly after transplanting and a berm of soil was constructed around each tree to facilitate watering. Ten branch tips on each tree were marked with paint for determining the amount of shoot elongation in the spring of 1985.

Treatments were replicated 8 times in a split block design with irrigation regime constituting the sub-blocks. One irrigation regime consisted of daily irrigation with 18 gal of water per tree applied through 2 Robert's spot spitters per tree. Half the trees were watered 7 days after the last irrigation or rainfall of at least 1 inch with 18 gal per tree. Trees were spaced 8 ft on center and 12 ft were allowed between blocks. Leaf drop was rated 6, 15, and 21 days after transplanting using a scale of 1 to 6 with 1 denoting no leaf drop and 6 indicating severe leaf drop. Visual quality ratings were made on days 36, 57, and 250 using a scale of 1 to 3 with 3 denoting the highest quality. Percent survival and the length of new growth on the 10 marked branches was determined in May, 1985.

Results and Discussion

There was no interaction of irrigation regime and the other treatments on survival of the live oaks. Fifty-five % of trees irrigated weekly and 65% of trees irrigated daily

Table 1. Effects of irrigation regimes, antitranspirants, and a water absorbing polymer on the percent survival, mean quality rating, and mean leaf drop rating of transplanted *Quercus virginiana*.

Treatment	Percent survival	Quality rating ^z				Leaf drop rating ^y		
		Day 21	Day 37	Day 57	Day 250	Day 6	Day 15	Day 21
Irrigation regime								
Daily	65	2.5a ^x	2.5a	2.3a	1.8a	2.94a	2.84a	1.81a
Weekly	55	2.2b	2.2b	2.1a	2.1a	3.06a	3.28a	2.06a
Other treatments								
Control	67	2.3a ^x	2.4a	2.4a	2.1a	2.69ab	2.62a	1.16a
Wilt-pruf	80	2.3a	2.3a	2.1a	2.2a	3.69a	3.25a	1.19a
Cloud Cover	38	2.4a	2.4a	2.3a	1.6a	2.44b	3.00a	2.88a
Terra-Sorb	54	2.2a	2.1a	1.9a	1.9a	3.19ab	3.78a	2.00a

^zVisual quality ratings were made using a scale of 1 to 3 with 3 denoting the highest quality.

^yLeaf drop ratings were made using a scale of 1 to 6 with 1 denoting no leaf drop.

^xMean separation within column and treatment group by Duncan's multiple range test, 5% level.

survived (Table 1). This survival rate was lower than that normally obtained during the summer by Burbage Tree Movers, but they usually put the trees in a holding area with frequent overhead irrigation for 2 to 6 weeks before transplanting. Visual ratings after 21 and 37 days were greater if trees were irrigated daily than those irrigated weekly. Sixty-seven, 80, 38, and 54% of trees survived when sprayed with water, Wilt-Pruf, or Cloud Cover or treated with Terra-Sorb, respectively.

Cloud Cover resulted in less leaf drop on day 6 than Wilt-Pruf and the effects of the control and Terra-Sorb were intermediate (Table 1). There were no differences in leaf drop due to treatments on days 15 or 21. There was no significant correlation between initial leaf drop and survival of these trees.

Neither antitranspirants nor the Terra-Sorb caused significant differences in visual quality rating of trees on day 36, 57, and 250 (Table 1). However, the quality rating of trees that survived was increased by Cloud Cover (3.0) compared to Wilt-Pruf (2.5), Terra-Sorb (2.4), and the control (2.5) on days 36 and 57. Mean branch tip growth was increased by the daily irrigation regime (2.7 inches) compared to weekly irrigation (2.2 inches) only if Terra-Sorb had been added to the planting hole. Otherwise, branch growth was not affected by treatments.

Transplanting 4-inch caliper live oaks in August in central Florida is risky under conditions described in this paper. Cloud Cover applied in the manner described in

this paper was of no benefit to the trees in terms of survival, but improved slightly the visual appearance of surviving trees approximately 1 and 2 months after transplanting. Terra-Sorb increased spring growth when the trees were irrigated daily. Wilt-Pruf appeared to help in terms of survival. This study provided extreme conditions for tree survival and treatments might perform differently under different conditions.

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RESPONSE OF FOUR WOODY ORNAMENTAL SPECIES TO A SUPERPHOSPHATE-AMENDED CYPRESS SAWDUST, SAND, AND SEDGE PEAT MEDIUM.

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Abstract. Shoot dry weights for *Ilex cornuta* Lindl. & Paxt. 'Burfordii Nana', *Juniperus chinensis* L. 'Parsonii', and *Ligustrum japonicum* Thunb. 'Variegatum', and root dry weights of *I. cornuta*, *J. chinensis*, and *Magnolia grandiflora* L. were not different after 9 months when grown in a 4 cypress sawdust: 1 sand: 1 sedge peat (v/v/v) medium with or without superphosphate (20% P) at 148 g P/m³. The growing medium for all species was amended with sludge (5.2N-2.2P-OK) at 9 kg/m³ and received monthly surface applications of Shore 8N-3.4P-6.6K (13 g) and sludge (13 g). Growing medium P levels 36, 151, and 238 days after potting were not different for any of the species, except for *J. chinensis* at day 36 and *L. japonicum* at day 151. Growing medium P levels for *J. chinensis* and *L. japonicum* were higher without (10 and 46 ppm, respectively) than with superphosphate (5 and 32 ppm, respectively).

Most container-grown woody ornamentals are grown in media amended with superphosphate (9 or 20% P) and subsequently fertilized with slow-release fertilizers that contain P. Gouin and Link (2) and Yeager and Wright (6) have grown quality *Ilex crenata* 'Helleri' in 3 peat: 2 sand (v/v) and pine bark media, respectively, not amended with superphosphate but fertilized with surface applications of slow-release fertilizers that contain P. Therefore, the benefit of amending media with superphosphate is questionable if additional P is applied. The purpose of this research

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