Results and Discussion

We have moved seventeen *Magnolia gradiflora* trees ranging from 7" to 16" caliper in 8' or 9' boxes, one 15" caliper *Pinus elliottii* in a 9' box, two 12" caliper *Liquidambar straciflua* in 9' boxes, two 20-23" caliper *Prosopis* 'Reese Hybrid' in 12' and 14' boxes, one 16" caliper *Cinnamomum camphora* in a 9' box, one 14" caliper *Schinus* spp., one multple weeping stem *Ilex vomitoria* and one multiple stem *Ilex opaca* 'East Palatka' all in 9' boxes during the past year.

With the exception of the two Mesquites (*Prosopes* 'Reese Hybrid' which lost 60-80% of their foliage during the first two or three days of boxing, (they have since recovered), we have been able to maintain all of the trees in full leaf regardless of the season they were moved with no apparent transplanting shock.

Boxing and misting foliage after transplanting have proven to be our most effective way to move large specimen trees without transplanting shock. This is of particular advantage in landscaped sites where subsequent construction would make it impossible to replace large trees that did not survive transplanting. Specimen trees may also be removed from a construction site and held for a number of years in healthy condition before being moved into a new landscape site with excellent chances for survival.

Literature Cited

1. American Association of Nurserymen. 1990. American Standard for Nursery Stock. American Association of Nurserymen, Washington, D. C. 33 pp.

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FERTILIZER TYPE AND NITROGEN RATE AFFECTS FIELD-GROWN LAUREL OAK AND JAPANESE LIGUSTRUM

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Abstract. **Laurel oak (*Quercus hemisphaerica*) and Japanese ligustrum (*Ligustrum japonicum*) grown in fine sand in the field received 3 or 6 lbs. N/1000 ft²/yr as controlled release (Nutricote 40, 180 and 360, Plantco Inc., Bramalea, Ontario Canada) or water soluble granular carriers (ammonium and calcium nitrate). Seventeen months after planting there were no differences in oak height or trunk caliper among fertilizer carriers. Increasing the N rate from 3 to 6 lb N/1000ft²/yr resulted in a slight increase in height but not caliper. *Ligustrum* receiving soluble granular fertilizer were larger than unfertilized checks. There were no growth differences due to fertilizer types. *Ligustrum* receiving 6 lb N/1000ft²/yr were larger than those receiving the 3 lb rate.**

Recent work indicates that the carrier of nitrogen may not be as important to landscape plant response as the method of application (8) and presence of competing turf (6). In support of this, hibiscus shrubs grew similarly in a fine sand when fertilized with a variety of slow-release and water-soluble nitrogen carriers (3). The best response resulted from surface broadcast application (5).

Moderate growth and acceptable leaf color of hibiscus were maintained by applying 5 lbs. N/1000 ft²/yr divided into 5 equal applications (4). Wright and Hale (9) stated that 3.5 lbs. N/1000 ft²/yr was adequate for shade tree growth with no growth increase at the 7 lb rate. Ponder et al. (7) reported N from 0-8 lbs N/1000 ft²/yr had no effect on tree growth. Citrus does not respond to applications of N in excess of 4-5 lbs N/1000 ft²/yr (2). The objective of this study was to compare growth of field-grown oaks and *Ligustrum* fertilized with controlled release fertilizer with that from soluble granular fertilizer at two N rates.

Materials and Methods

Laurel oaks (*Quercus hemisphaerica*) were planted on 5 ft centers in rows spaced 12 ft apart as bare root liners in Feb. 1985. *Ligustrum japonicum* were planted on 5 ft centers in rows spaced 12 ft apart from 1 gallon containers in Jan., 1987. Both species were planted in a fine sand (sandy, siliceous, hyperthermic, Hapladault). Overhead irrigation was applied several times only during the first several months following planting. Oaks were occasionally pruned to promote development of a central leader and dominant lateral branches. The *Ligustrum* were not pruned. Glyphosate was periodically applied for weed control. Millet was grown as a cover-crop between plant rows. A 3" thick layer of cypress wood chips was applied to a 9 ft² square centered around each plant in August 1987.

Oaks were fertilized once with a soluble granular fertilizer (16N-4.4P-8.3K) in 1986 about 1 year before initiation of treatments. Oaks (beginning on 19 Aug. 1987) and *Ligustrum* (beginning on 8 Sept. 1987) received 16N-4.4P-8.3K Nutricote 180 twice each year, Nutricote 180 + Nutricote 40 (5:1 ratio) twice each year, Nutricote 360 once each year or soluble granular fertilizer twice or five times per year for a total of 5 treatments (Table 1). The granular fertilizer was formulated with ammonium nitrate, calcium nitrate, triple superphosphate and potassium chloride as a 16-10-10. Each fertilizer was surface applied to the mulch (9 ft²) at a rate of 3 or 6 lb N/1000ft² of applied area per year. Ten treatments and a non-fertilized check were arranged in a randomized complete block design, with 20 blocks (replications) totaling 220 plants for each species.

Initial height and caliper of the oaks, and height and crown spread of the *Ligustrum* were recorded in August 1987. Caliper and height was measured by averaging the greatest spread and the perpendicular spread. *Ligustrum*

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Table 1. Application dates to oaks and *Ligustrum* for Nutricote[z] and granular[y] fertilizers.

Fertilizer	Application dates						
	Aug. 1987	Nov. 1987	Mar. 1988	June 1988	July 1988	Sept. 1988	Dec. 1988
Nutricote 180 + Nutricote 40	X		X			X	
Nutricote 180	X		X			X	
Nutricote 360	X					X	
Granular (2 appl./yr)	X		X			X	
Granular (5 appl./yr)	X	X	X	X	X	X	X

[z]16N-4.4P-8.3K analysis.
[y]Granular fertilizer formulated as a 16-10-10 from ammonium nitrate, calcium nitrate, triple superphosphate and potassium chloride.

Table 2. Laurel oak height and caliper increase from Aug. 1987 through Dec. 1988 for Nutricote and soluble granular N carriers at two application rates.

Fertilizer	Caliper increase (inches)	Height increase (inches)
Nutricote 180 + Nutricote 40 (5:1 ratio) (2 appl./yr)[y]	0.98[z]	81.9
Nutricote 180 (2 appl./yr)[y]	0.94	73.2
Nutricote 360 (1 appl./yr)[x]	0.94	77.2
Soluble granular (2 appl./yr)[y]	0.98	81.5
Solube granular (5 appl./yr)[w]	0.94	80.7
3 lbs N/1000 ft²/yr	0.94[v]	76.4
6 lbs N/1000 ft²/yr	0.98	81.5[u]
Non-fertilized check	0.91[t]	72.8[t]

[z]Mean of 40 trees.
[y,x,w]Yearly amount divided into 2, 1 and 5 applications, respectively.
[v]Mean of 100 trees.
[u]Height increase greater at the 6 lb rate than at the 3 lb rate.
[t]Non-fertilized checks were similar to trees in all fertilizer treatments.

height and crown spread were used to calculate a growth index = plant height + average crown spread/2). Plants were remeasured in Dec., 1987 and at the conclusion of the study in Dec., 1988.

Results and Discussion

Type of fertilizer did not affect increase in height or caliper (Table 2). Non-fertilized trees grew as well as trees in any fertilizer treatment. Increasing the N rate from 3 to 6 lb N/1000ft² resulted in a slight increase in height but not caliper.

Type of fertilizer did not affect growth index of *Ligustrum* either (Table 3). However, only plants receiving soluble granular fertilizer were larger than non-fertilized checks. There was a general unthriftiness in the *Ligustrum* field which was due to sting, ring and stunt nematode infestation. The effects of this on plant response to fertilizer treatments can not be determined.

The lack of differences among treatments in the current study may reflect a delayed response which only longer-term studies can evaluate. Red maple planted in a fine sandy loam in Alabama did not respond to N application during a 2-yr study (7). At the end of a 2-yr study in Virginia, neither height nor trunk caliper of pin oak, dogwood and red maple trees receiving 7 lb N/1000ft²/yr were greater than trees fertilized at the 3.5 lb rate (9). In the current study, one application per year of controlled-release Nutricote 360 or two applications of Nutricote 180 were as effective in promoting growth as two or five applications of a water-soluble granular fertilizer. This could represent a savings in the labor required to fertilize landscape sites in Florida's sandy soils. The use of controlled-release fertilizers may also reduce nitrogen leaching, although this has not been proven.

Literature Cited

1. Anonymous. 1986. American standard for nursery stock. Amer. Assoc. of Nurserymen, Wash. D.C.
2. Dasberg, S. 1987. Nitrogen fertilization in citrus orchards. Plant and Soil 100:1-9.

Table 3. *Ligustrum* growth index[z] increase from Aug. 1987 through Dec. 1988 for Nutricote and soluble granular N carriers at two application rates.

Fertilizer	Increase in growth index		
	3 lbs N/100ft²/yr	6 lbs N/1000ft²/yr	Combined
Nutricote 180 + Nutricote 40 (5:1 ratio) (2 appl./yr)[y]	11.9[v]	11.0[v]	11.4[u]
Nutricote 180 (2 appl./yr)[y]	12.3	14.8	13.5
Nutricote 360 (1 appl./yr)[x]	8.9	12.9	10.9
Soluble granular (2 appl./yr)[y]	18.0*	18.7*	18.3
Soluble granular (5 appl./yr)[w]	9.8	17.8*	13.8
3 lbs N/1000 ft²/yr			12.2[t]
6 lbs N/1000 ft²/yr			15.0**
Non-fertilized check		3.9[v]	

[z]Growth index = (plant height + average crown spread)/2.
[y,x,w]Yearly amount divided into 2, 1 and 5 applications, respectively.
[v,u,t]Mean of 20, 40 and 100 trees, respectively.
*Significantly greater than the non-fertilized check by Dunnett's t-test at P = 0.05.
**Change in growth index greater at the 6 lb. rate than at the 3 lb. rate.

3. Gilman, E. F. 1987. Response of hibiscus to soil applied nitrogen. Proc. of the Fla. State Hort. Soc. 100:356-357.
4. Gilman, E. F. 1988. Field-grown hibiscus response to nitrogen rate. Proc. Fla. State Hort. Soc. 101:99-101.
5. Gilman, E. F. 1989. Effects of injected and surface fertility on hibiscus growth. Proc. of the Fla. State Hort. Soc. 102:144-145.
6. Neely, D. 1984. Grass competition for nitrogen around landscape trees. J. Environ. Hort. 2:86-88.
7. Ponder, H. G., C. H. Gilliam, E. Wilkenson, J. Eason and C. E. Evans. 1984. Influence of trickle irrigation and nitrogen rates on *Acer rubrum* L. J. Environ. Hort. 2:40-43.
8. van de Werken, H. 1984. Fertilization practices as they influence the growth rate of young shade trees. J. Environ. Hort. 2:64-69.
9. Wright, R. D. and E. B. Hale. 1983. Growth of three shade tree genera as influenced by irrigation and nitrogen rates. J. Environ. Hort. 1:5-6.

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EVALUATION OF LANDSCAPE MULCHES

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Abstract. **Fifteen organic materials including commercially available mulches were evaluated during the 6 month period of June to November 1990 to determine their potential value as landscape mulch. The materials evaluated included cypress mulch, pine bark, pine straw, grass clippings, hardwood chips, ground yard trash,, cypress mulch on oak leaves, hardwood chips on oak leaves, ground yard trash on oak leaves, cypress mulch on ground yard trash, hardwood chips on ground yard trash, oak leaves, chipped branches, Pinellas mulch, and Tampa mulch.**

Particle size of the mulches were determined. During the evaluation period, soil pH, soil moisture, soil temperature, and rate of subsidence were measured. Color differences were determined. Weeds were collected monthly, and dry weights were recorded. Trials to determine water infiltration rate and effect of flooding and wind were conducted. Significant differences were detected in soil moisture, soil temperature, weed control, and subsidence. Subjective evaluations were ascertained by written survey. Cypress mulch and wood chips ranked highest and grass clippings and Pinellas mulch ranked lowest.

Mulch can be defined as any organic or inorganic material placed on the soil surface "to modify the soil environment and enhance plant growth" (4). Landscape contractors and home gardeners utilize mulch for functional and aesthetic purposes. Mulch has been reported to conserve soil moisture, moderate soil temperature, and reduce weed numbers (1,2,5,7).

As soil moisture moves to the surface by capillary action, the effects of sun, wind, or low-relative humidity promote evaporation (3). A mulch cover may reduce soil moisture evaporation by lengthening water flowage between soil capillaries and air (1). Mulch may keep soil temperature cooler in summer and warmer in winter. Ashworth and Harrison (1) noted diurnal soil temperatures recorded under two organic mulches (bark and straw) fluctuated less when compared to 6 other synthetic mulches. The use of various mulches to suppress weed populations was documented by Powell *et al.* (5). All mulches reduced weed numbers but differed in their effect on specific weed species.

Organic material such as branches, leaves, or grass clippings obtained from landscape maintenance practices may be considered yard trash. After 1991, according to Florida's Solid Waste Management Act of 1988 (Florida Statute, Chapter 88-130), yard trash may no longer be disposed of in municipal landfills. Utilization of yard trash as a landscape mulch may be one of several alternative uses for this material.

The objective of the current investigation was to determine the suitability of 15 organic materials, including municipal yard trash and commercially available mulches, for use as a landscape mulch. The results presented and discussed in this paper report findings obtained from the 6 month period June to November 1990.

Materials and Methods

Research plots were installed in a field which was rototilled to a depth of 6 inches and leveled. Plots were delineated using 8" x 4" landscape timbers as borders. Timbers were placed such that 3 randomized complete blocks, each consisting of sixteen 8' x 3'4" plots, comprised the study area.

Any weeds remaining in the plots were removed by hand. Then each plot was filled to a 3" depth with one of the 15 mulch materials. The plots were 1) bare soil, 2) cypress mulch, 3) pine bark, 4) pine straw, 5) grass clippings, 6) hardwood chips, 7) ground yard trash, 8) cypress mulch on oak leaves, 9) hardwood chips on oak leaves, 10) ground yard trash on oak leaves, 11) cypress mulch on

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