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FERTIGATION AND GROWTH OF YOUNG 'SUNBURST' TANGERINE TREES

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Abstract. **Young 'Sunburst' tangerine [*Citrus reticulata* Blanco X *C. paradisi* Macf.] trees on sour orange [*C. aurantium* L.] rootstock in a commercial grove received 0.66 or 1.32 lbs N/tree/year in a 12.0N - 0.0P - 4.9K - 1.0% Mg - 0.04% Mn - 0.01% Cu - 0.03% Zn or 9.0N - 0.0P - 7.4K - 1.0% Mg - 0.04% Mn - 0.01% Cu - 0.03% Zn liquid formulation, applied 44 times/year during years 1 and 2. During year 3, 0.52 and 1.05 lbs N/tree/year, in the same fertilizer analysis was applied 18 times/year. After 3 years there were no significant differences in trunk caliper and tree height in 24 paired trees per treatment. Leaf analysis showed low to deficient nutrient levels for some elements. Trees had no crop in year 1, sustained some cold damage in year 2 (blossom loss) and year 3 (partial defoliation) when a crop was set.**

Current fertilizer recommendations call for approximately 0.45, 0.73, 1.00 and 1.14 lbs. N/tree/year applied 3-6 times/year for trees 1-4 years old, respectively (3). Growers commonly apply higher rates, especially, via fertigation, in an attempt to maximize early growth. However, accumulating evidence suggests that reduced fertilizer application rates compare favorably with traditionally higher rates in stimulating growth of young nonbearing citrus trees (1, 3, 5).

Recent research has emphasized the use of granular controlled-release fertilizers rather than increasingly common fertigation systems (4). The objective of this study was therefore to compare the effects of fertigation rates on growth of young 'Sunburst'/sour orange trees, using a 1/2 and full nitrogen rate, according to the participating grower's fertilization program. Freezes in 1988 and 1989 fortuitously provided the opportunity also to study the effect of reduced fertigation rates on nonbearing young trees with mild cold damage.

Materials and Methods

'Sunburst' tangerine/sour orange trees were interplanted with 'Orlando' tangelos in May, 1987 in Hillsborough county and were therefore 2-years old when the experiment began in 1988. During years 1 and 2 of the experiment, trees were fertigated 44x/year with 0.66 (1/2N) and 1.32 (N) lbs N/tree, respectively in a 12.0N - 0P - 4.9K - 1.0% Mg - 0.04% Mn - 0.01% Cu - 0.03% Zn liquid formulation. During year 3, when fertigation frequency was decreased during the winter months, 0.52 (1/2N) and 1.05 (N) lbs N/tree/year, respectively, in the same fertilizer analysis was applied 18 times/year. Nitrogen levels were selected according to the grower's current fertilization practices and were slightly higher than recommended rates in years 1 and 2 but lower in year 3 (Table 1). Trees had no crop in year 1 of the experiment, sustained some cold damage in year 2 (blossom loss) and year 3 (partial defoliation and some limb damage) when a crop was set.

Twelve trees receiving the 1/2N treatment were paired with an equal number of trees receiving the full N treatment in each of two replicates. *Stem* caliper and plant height were measured twice a year in the spring and fall for 3 years and crop load estimated in year 3. Treatment means and standard deviation were determined for both treatments for each of three years and means were compared using a t test.

Results and Discussion

There were no growth differences in trunk caliper and tree height for trees receiving 1/2 and full nitrogen treatments throughout the 3-year experiment (Tables 2, 3). Crop estimates were also similar. The 1/2 nitrogen treatment fell within the lower range of recommended application rates for all 3 years whereas the full N treatment exceeded recommended rates for 2 out of 3 years (Table 1). Growth increases between November and March were also comparable. These data support previous reports that fer-

Table 1. Fertilization of young 'Sunburst' tangerine trees[z].

	Lbs. N applied/tree/year		
	1988	1989	1990
1/2 N	0.66	0.66	0.52
N	1.32	1.32	1.05
Recommended rate[y]	0.56 - 0.90	0.72 - 1.28	0.84 - 1.44
Fertigations/year	44.0	44.0	18.0

[z]Planted in 1987.
[y]Recommended range of lbs N/tree/year in an 8N - 3.5P - 6.6K fertilizer for years 2, 3 and 4.

Table 2. Trunk caliper of young 'Sunburst' tangerine trees as affected by nitrogen rate[z]

	Trunk Caliper[y] (inch)	
	1/2 N	N
Feb., 1988	0.79 ± 0.07	0.08 ± 0.06
Oct., 1988	1.69 ± 0.09	1.68 ± 0.07
March, 1989	1.93 ± 0.15	2.00 ± 0.12
Oct., 1989	2.76 ± 0.19	2.75 ± 0.23
April, 1990	2.94 ± 0.17	3.10 ± 0.21
Oct., 1990	3.28 ± 0.13	3.25 ± 0.27

[z]One half (1/2N) and full N rate in 1988 and 1989 was 0.66 and 1.32 lbs N/tree/year, respectively.
One half (1/2N) and full N rate in 1990 was 0.52 and 1.05 lbs N/tree/year
[y]Mean of 24 paired samples per treatment/date ± standard deviation. No significant differences according to t test at 5% level.

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Table 3. Plant height of young 'Sunburst' tangerine trees as affected by nitrogen rate[z]

	Plant Height[y] (ft.)	
	1/2 N	N
Feb., 1988	3.50 ± 0.25	3.29 ± 0.26
Oct., 1988	5.67 ± 0.38	5.61 ± 0.32
March, 1989	6.28 ± 0.33	6.24 ± 0.39
Oct., 1989	7.62 ± 0.50	7.51 ± 0.57
April, 1990	7.82 ± 0.76	7.74 ± 0.61
Oct., 1990	8.25 ± 0.51	8.37 ± 0.73

[z]One half (1/2N) and full N rate in 1988 and 1989 was 0.66 and 1.32 lbs N/tree/year, respectively.
One half (1/2N) and full N rate in 1990 was 0.52 and 1.05 lbs N/tree/year
[y]Mean of 24 paired samples per treatment ± standard deviation.
No significant differences according to t test at 5% level.

tilizer rates lower than many growers currently use produce adequate growth of young trees.

Young 'Sunburst'/sour orange trees have produced medium to heavy crops, with one report of 88 fruit/tree produced after 2 1/2 years (2). Trees in this experiment did not bear until they were 4-years old because of cold damage. Reduced fertigation rates reported in this paper may be adequate to stimulate growth of nonbearing young 'Sunburst' trees for years 2-4, especially when cold damage has been sustained, but may be inadequate if a crop is set. Leaf analysis (Table 4) also indicated that N, P, Mn and Zn levels in years 2 and 3 of the experiment were in the low to deficient range, with nitrogen being deficient for both 1/2 and full N treatments in year 3 when a crop was produced.

The impact of citrus fertilization practices on the quality of ground and surface waters and the development of more economical production practices to minimize energy and capital inputs are becoming increasingly important.

Table 4. Mineral composition of young 'Starburst' tangerine leaves as affected by nitrogen rate[zy]

	1/2N		N	
Element	1989	1990	1989	1990
N (%)	2.50	1.90[x]	3.05	1.90[x]
P (%)	0.12	0.14	0.13	0.12
K (%)	1.48	0.90[x]	1.46	1.02[x]
Ca (%)	3.61	5.03	3.17	4.67
Mg (%)	0.34	0.41	0.30	0.38
Mn (ppm)	18.50[x]	22.00[x]	20.00[x]	24.00[x]
Zn (ppm)	13.00[x]	2.40[x]	12.00[x]	3.00[x]
Cu (ppm)	9.50	17.00	9.00	29.00
Fe (ppm)	58.50	89.00	49.00	93.50
B (ppm)	30.00	37.50	34.00	41.00

[z]One half (1/2N) and full N rate in 1988 and 1989 was 0.66 and 1.32 N/tree/year, respectively.
One half (1/2N) and full N rate in 1990 was 0.52 and 1.05 N/tree/year.
[y]Mean of 2 samples consisting of 100 4- to 6-month old spring flush leaves taken from 24 tree/treatment
[x]Low to deficient.

Reduced fertigation rates for young citrus trees can significantly reduce such inputs.

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FERTILIZATION OF FREEZE-DAMAGED 'HAMLIN' ORANGE TREES

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Abstract. **Six-year-old 'Hamlin' orange trees (*Citrus sinensis* [L.] Osbeck) were fertilized at 0, 2.5, 5.0 or 7.5 pounds of granular material (10N-4.3P-8.3K plus minors) in three applications/year following the freeze of 23 Feb. 1989. Free damage reduced the canopy size about 50%. By October 1989, leaf N, Zn and Mn were at deficient levels for all treatments. Levels of all other elements were within low to acceptable ranges. However, no differences in tree growth and appearance were observed among treatments. The experiment was repeated following the freeze of 25-26 Dec. 1989. Freeze damage reduced canopy size from 50 to as much as 90%. Trees were fertilized three times in 1990 using an 8N-0.86P-6.6K-0.4Mg formulation at the same rates as in 1989. Tree appearance and growth again were similar for all treatments, and leaf N levels were deficient only for 0 and 2.5 lb rates. Therefore, mature nonbearing citrus trees have the capacity to store and mobilize nutrients from the trunk, limbs and roots and require low levels or no fertilization following a freeze where severe wood damage occurs. Alternatively, it may be necessary to apply N only along with a foliar application of minor elements.**

Severe freezes of 1983, 1985 and 1989 have killed or damaged over 200,000 acres of citrus trees in Florida. The December 1989 freeze alone caused the loss of over 85,000 acres of citrus trees (3). Moreover, many trees are damaged by freezes to varying degrees which may include partial or complete defoliation, twig dieback, or major limb damage. Several opinions exist as to how partially damaged citrus trees should be rehabilitated; in particular, how fertilizer programs should be adjusted to compensate for leaf or

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