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MULCHES AND SLOW-RELEASE FERTILIZERS IN A CITRUS YOUNG TREE CARE PROGRAM[1]

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Abstract. **Use of mulches and slow-release fertilizers to reduce young tree care costs was investigated from October, 1981 to December, 1983 on newly-planted 'Orlando' tangelo** (Citrus paradisi **Macf. x** C. reticulata **Blanco) trees on** Poncirus trifoliata **(L.) Raf. rootstock on the Gainesville campus of the University of Florida. Black plastic and fiberglass pads were evaluated for their effect on soil temperature, soil moisture content, leaching of nutrients, and weed and tree growth. Weed growth was greatly suppressed but little effect was noted for the other parameters except where fiberglass reduced soil temperatures slightly and black plastic increased temperatures. Slow-release fertilizers utilizing sulfur-coated products have the potential for reducing application frequency to one-half as often as currently recommended using conventional fertilizer sources without decreasing tree growth.**

Young citrus trees require considerable attention from planting until establishment. Depending upon the density per acre, maintenance costs for the trees the first 2 yr in the grove range from $8.15-$13.40 per tree (5). The low figure represents average costs for trees in a solid planting and the high figure represents a grove situation having 1-2 scattered resets per acre. A substantial portion of young tree care costs is taken by fertilizing and watering them. Average watering costs (where young trees are irrigated by water wagon) for the first 2 yr range from $2.50 to $6.75 per tree. Similarly, fertilizer material and application costs range from $1.45 in solid new plantings up to $2.05 per tree in the case of scattered resets. These figures, although small on a per tree basis, become quite substantial considering that over 6,000,000 young trees have been planted each of the last 2 yr, and many more will be set following the 1983 freeze.

Slow-release fertilizers produced more growth of very young citrus trees than more soluble sources in Texas (2) and Florida (4), probably due to a continuous rather than a fluctuating supply of nutrients. Slow-release nitrogen sources were also effective in reducing the amount of nitrogen lost through leaching (4).

Organic and synthetic mulches are routinely used in vegetable production because they control weeds, limit water losses and reduce soil treatment (1). Organic mulches for citrus trees have not been recommended due to problems with foot rot (3). Plastic mulches and fiberglass mats represent materials that might be considered since they should not present conditions favorable for the development of foot rot. These mulches may serve to reduce water losses from the soil surface, prevent weed growth, reduce leaching, modify soil temperatures and eliminate water ring reconstruction.

Very little information is available on the use of mulches or slow release fertilizers on young citrus trees in the field. Our objectives were: 1) to determine the effect of mulches on soil temperature, moisture content and growth of newly-planted citrus trees; and 2) to compare growth, leaf nutritional status, and nutrient leaching using standard and slow-release fertilizers.

Materials and Methods

Sixty container-grown 'Orlando' tangelo trees on *Poncirus trifoliata* rootstock, were planted in two 30-tree blocks in October, 1981. One block was used to evaluate fertilizer treatments and the other to evaluate mulches. Trees were planted at a 15 x 20 ft spacing on the campus of the University of Florida in Gainesville in an Arredondo fine sandy loam.

The mulch experiment consisted of a standard water ring constructed from soil, a similar ring covered with a 10 x 10 ft black 6-mil polyethylene sheet held in place by soil placed at the edges, and a commercially made 50-mil plastic water ring with a 1 inch-thick fiberglass pad cut to fit inside the ring (Adams ring and pad). Treatments were placed on each of 10 trees in a completely randomized design, resulting in 10 single-tree replications per treatment. Neutron probe access tubes were installed on 5 of the 10 trees in each treatment to allow soil moisture measurements at the 2 ft level on a weekly basis from April, 1982 until November, 1983. Trunk diameters were measured as an indication of growth on April 12, 1982, April 5, 1983 and December 12, 1983. Soil temperatures were recorded weekly using copper-constantan thermocouples attached to a multipoint recorder. Measurements were taken at the soil surface at 1- and 12-inch depths on a weekly basis.

The fertilizer experiment was applied to the block in 3 treatments of 10 trees each in a completely randomized design. The treatments consisted of the standard 8-2-8-3 mix applied at 2 lb/tree in 1982 and 4 lb/tree in 1983. Four applications were made in both seasons following standard recommendations for young citrus trees (6). A slow-release formulation of the same analysis was made using sulfur-coated urea and sulfur-coated potash as the nitrogen and potassium sources. This material was applied as a single application or as 2 split applications. All treatments received equal amounts of fertilizer materials each year. Trunk diameter measurements were made on April 12, 1982, April 5, 1983 and December 12, 1983. Leaf samples were collected each year from nonfruiting spring flush growth during August and analyzed for essential minerals.

Soil leachate tubes, which consisted of 1½ inch diameter PVC pipe attached to ceramic cups, were placed at a 2 ft depth for 3 trees/treatment. Tubes were capped and placed under 0.5 bars of suction for 24 hr, after which the leachate was collected and analyzed for soluble nutrients and pH. Samples were collected 4 times/year prior to each standard fertilization. In addition, standard soil samples were taken for each tree at a 6-inch depth.

Results and Discussion

Mulches. Temperatures measured 1 inch under the soil surface within the water rings varied considerably with treatment (Fig. 1). Differences were greatest during the warm summer months, so data are shown for May, June and July. Temperatures under the black plastic mulch were higher than under fiberglass pads and the untreated checks. Temperatures under the black plastic approached 100°F in July and were 6-8°F warmer than temperatures in the other treatments. Temperature differences were not as great in other months (about 2-5°F) probably because of less heating

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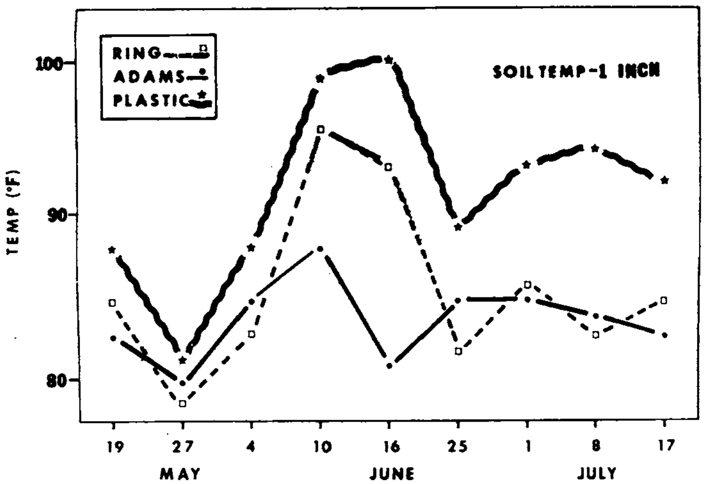

Fig. 1. Soil temperatures under water rings at one-inch depth. Ring = *standard* water ring constructed of soil; Adams = plastic ring plus fiberglass pad; Plastic = soil ring covered with black plastic.

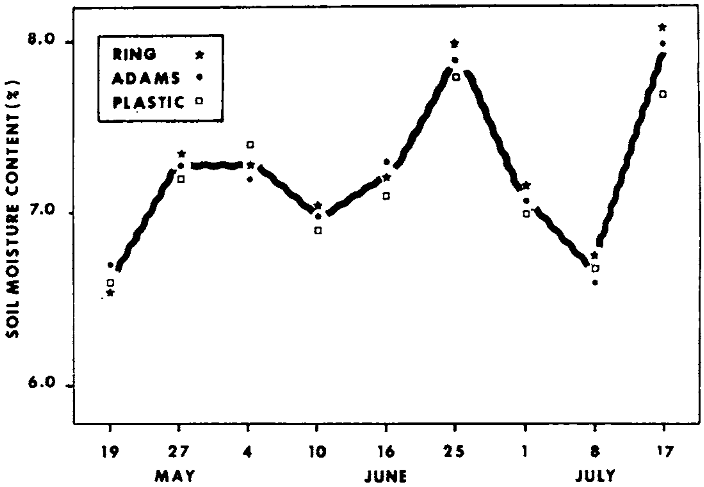

Fig. 3. Soil moisture content under water ring at the 2-ft depth (only one line is shown since data are similar for all treatments). See Fig. 1 for key.

due to reduction in solar radiation because of sun angle. Fiberglass pads usually were associated with lower soil temperatures at the 1-inch level. This was not unexpected since the material is used extensively as insulation. Temperatures under the fiberglass were always lower than under the black plastic mulch and about the same or slightly cooler than the untreated checks (Fig. 1). Temperatures at the 12-inch level under the mulches were not greatly different, however, the black plastic mulch consistently produced temperatures slightly warmer than untreated checks or trees with fiberglass pads (Fig. 2).

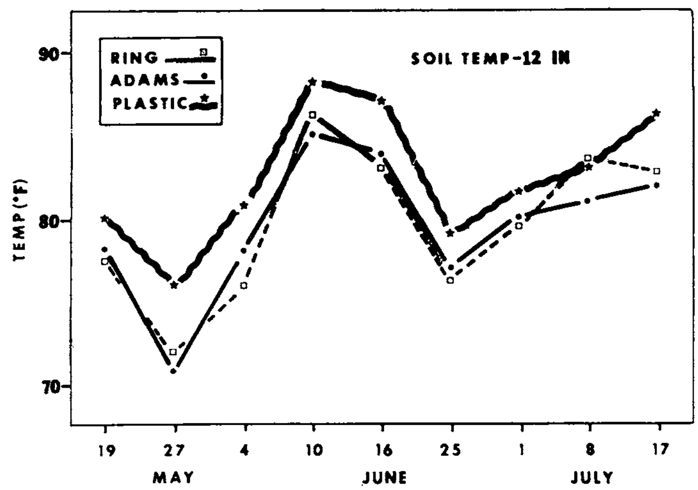

Fig. 2. Soil temperatures under water rings at 12-inch depth. See Fig. 1 for key.

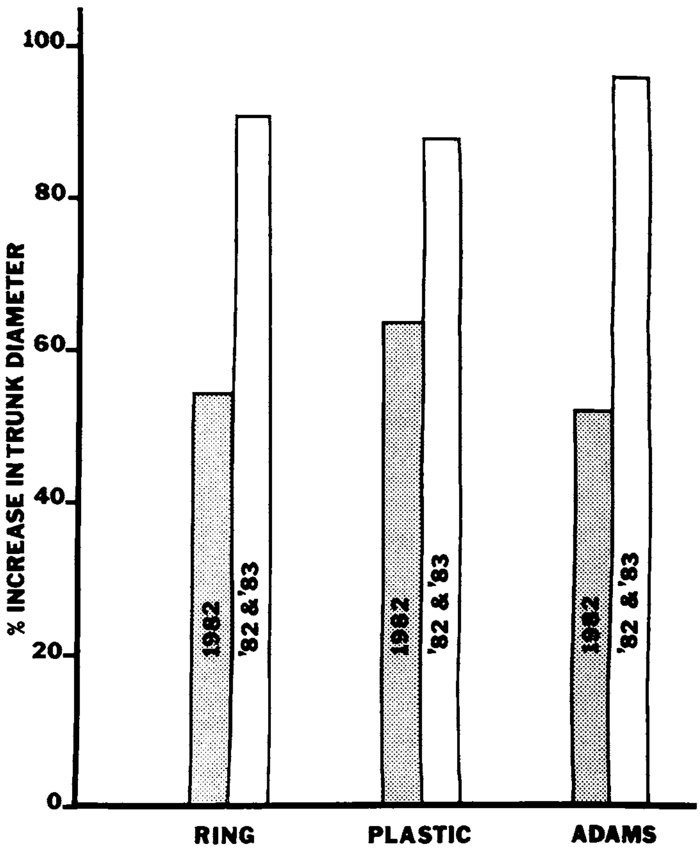

Fig. 4. Percent increase in trunk diameter due to water ring treatments. See Fig. 1 for key to Ring, Plastic, and Adams.

Soil moisture content at the 2-ft depth varied seasonally but there was no apparent difference between the black plastic mulch, fiberglass pad and untreated check (Fig. 3). Citrus roots probably extended beyond the area of the mulch by the second growing season and most of the water loss probably occurred from the tree canopy rather than the soil surface.

There were no statistically significant differences in trunk diameter among any of the treatments in either year (Fig. 4).

Weed growth was decidedly suppressed with both mulches tested and the use of these mulches eliminated the necessity for water ring rebuilding, a frequent job where no mulches are employed. These desirable features may be sufficient justification to consider the use of mulches, though the mulches tested could not be recommended on the basis of water conservation, temperature modification or increased tree growth.

Fertilizers. Soil leachate samples collected during the course of the experiment showed a disappointing scattering of data, probably due to varying fertilizer dissolution rates and fluctuations in rainfall/irrigation patterns. One consistently occurring trend, however was the depression of the pH of the leachate solution over time in the plots receiving slow release materials no doubt due to the effect of sulfur used to coat the slow-release particles (Fig. 5). In contrast, soil samples taken at a 6-inch depth showed no change in pH due to treatment. Moreover, standard leaf analyses showed all treatments produced mineral levels within acceptable ranges. However, use of sulfur coated materials over long periods should be carefully monitored.

Tree growth, expressed as increase in trunk diameter, varied with treatment (Fig. 6). Trees fertilized only once each year were only 60% as large as trees fertilized 2 times each year with slow-release or 4 times each year with standard fertilizers. Since equal amounts of materials were applied each year, this reduction in growth must be due to depletion of minerals critical to growth in the latter part of the growing season. Slow-release, sulfur-coated fertilizer materials may be useful in reducing application frequency by 50% since trees treated in this manner were as large as trees fertilized twice as often with more soluble chemical sources.

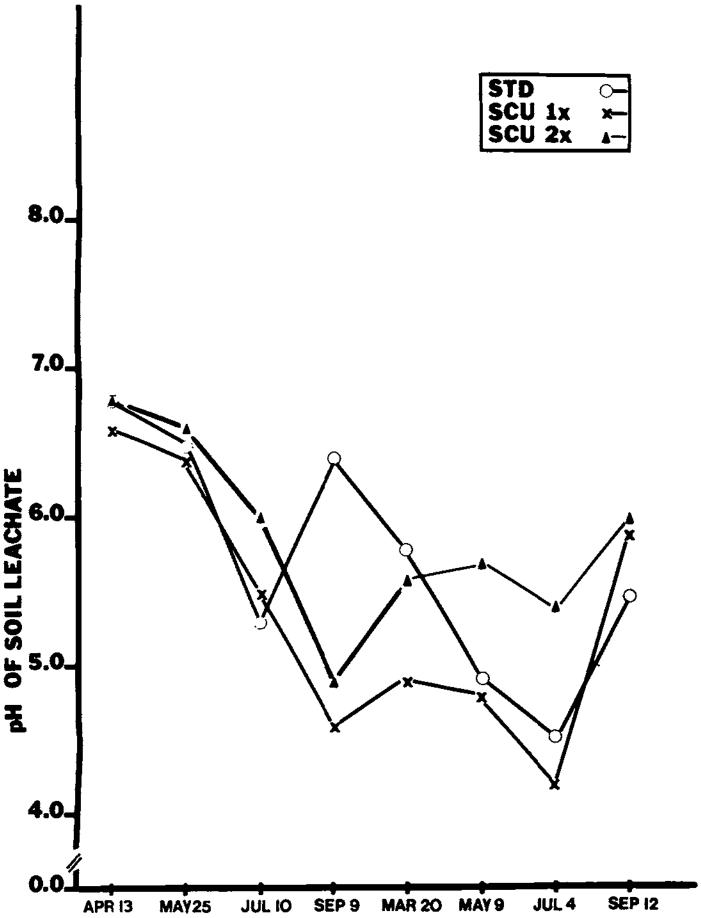

Fig. 5. Soil leachate pH levels utilizing different fertilizer materials and frequencies (STD = chemical 8-2-8 applied 4 X/yr; SCU 1X = Sulfur-coated N&K 8-2-8 mix applied 1X/yr; SCU 2X = Sulfur-coated N&K 8-2-8 mix applied twice/yr; total nutrients applied per year equal for all treatments).

Conclusions

A 2-yr study on the effect of mulches and slow-release fertilizers on the growth of young trees produced no significant growth or soil moisture differences due to mulches used, although some soil temperature differences were noted. Mulches suppressed weed growth and eliminated the need for frequent water ring reconstruction. These benefits may be adequate justification for the use of either mulch, particularly for resets that may receive less than optimal care.

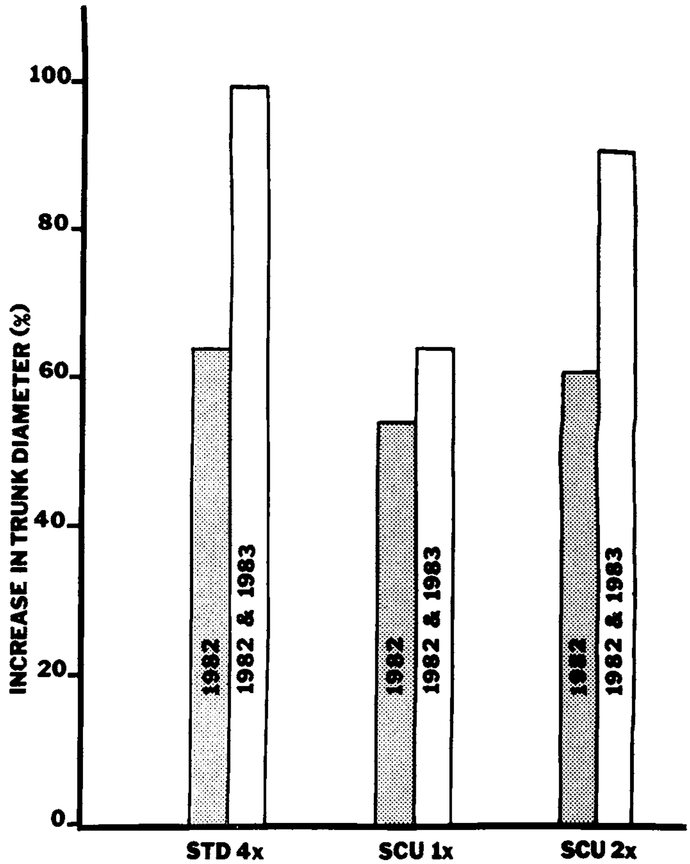

Fig. 6. Percent increase in trunk diameter due to fertilizer treatments. See Fig. 5 for key.

Sulfur-coated, slow-release fertilizer mixes offer growers the opportunity to reduce fertilizer application frequency by 50% with no adverse effects on tree growth or leaf or soil analyses. A trend of increasing soil acidity over time where sulfur-coated materials were used was noted. These conditions should be monitored and may bear correction by application of liming materials or incorporating liming materials in the fertilizer mix.

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