# Suppression of Citrus Young Tree Decline with Humus

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**ABSTRACT**

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Citrus young tree decline, which has caused an average estimated 10% tree loss in Florida for the past several years, has been suppressed by addition of a special humus as a soil amendment to 12-yr-old Valencia orange trees. A 6-yr study showed an 82% recovery of affected trees in soil top-dressed once with 100 lb (45 kg) of humus. In a 5-yr study of yields, fruit was increased about 20% in a treated block of 400 trees. Yields declined approximately 28% in an adjoining untreated block of 900 trees. Use of the humus as a one-time topdressing to the soil under the leaf canopy of affected orange trees appeared to partially correct an unfavorable soil condition frequently associated with citrus growing on the sandy flatwoods and ridge soils of Florida.

Citrus young tree decline (YTD), which is also called blight, sand hill decline, or lemon root decline, is probably the most destructive disease of citrus in Florida. Typical symptoms resemble those of drought or malnutrition. The disease has been present in Florida since 1874 (3). A 4-yr survey (4) of 21 affected groves representing 223 10- to 40-yr-old trees showed mean annual tree losses of 5–12%. If the value of an average 15-yr-old tree was $59.37 (1) in 1979, then the loss to a grove owner would have been $285–772 per acre per year and to the Florida citrus industry more than $451,000,000 per year. Tree value has increased since 1979. Although many man years of research have been directed toward a satisfactory solution to YTD, no causal agent has been positively identified, no transmission to healthy trees has been successful, and no successful control measures have been described except possibly the use of montmorillonite clay (3).

The purpose of this paper is to describe 6 yr of research on field control of YTD by using a high-nitrogen humus made from cotton gin waste.

## MATERIALS AND METHODS

At the Tropical River grove, Alva, FL, during April of 1975, the manager chose two rows, each of 55 Valencia orange trees, many of which were showing symptoms of YTD. The rootstock was uncertain but was thought to be rough lemon. From among this group of trees, the manager selected 28 trees with YTD to receive 100 lb (45 kg) of the humus topdressing. The YTD-affected trees were rated 3 and 4 on a scale of 0 = no disease, 1 = slight symptoms, 2 = moderate symptoms, 3 = severe symptoms, 4 = not expected to survive another season, and 5 = obviously dead or nearly dead trees. The grove was in a well-drained area, was well cared for, and was in sod and on a flatwoods soil. Each tree receiving the humus was photographed in color to record its condition at the time of treatment.

The humus was made by moistening raw waste from a south Georgia cotton gin with water and aerating it to encourage thermophilic aerobic fermentation. When the temperature of the waste returned to near ambient, the original plant material was no longer identifiable.

The humus approximated 400 mg/L N, 130 mg/L P, and 400 mg/L K, or the equivalent of a fertilizer having an analysis of 0.040, 0.013, and 0.040. Approximately 20% of the N could be leached. The pH was 6.8, conductivity 4.3 millimhos, and 16:1 C/N ratio.

After the soil was top-dressed with 100 lb (45 kg) of the humus per tree (5 tons per acre at 100 trees per acre or 3.5 tons of air-dried material per acre), the land was lightly disked. Thereafter the grove received normal treatment in accordance with the recommendations of the Florida Agricultural Extension Service.

At Gutwein groves near LaBelle, FL, the manager selected a continuous block of 13 acres (5.3 ha) of Valencia orange trees on rough lemon root stock. When the soil was top-dressed in early spring of 1977, the trees were 12 yr old; many showed various stages of decline and each was photographed in color. A continuous block of 400 trees (4 acres, 1.6 ha) was soil top-dressed with 100 lb (45 kg) of humus per tree, and the soil was lightly disked. On both sides of this block were 9 acres (3.6 ha) of untreated trees that served as controls. This grove was also in well-drained sod and on a flatwoods soil. After humus was applied, the grove received normal care. Trees in the Tropical River and Gutwein groves were permanently marked for identification.

Both yield and tree survival records were obtained at the Gutwein grove. Only tree survival records were possible at the Tropical River grove. The yield records were obtained from commercial harvesting crews of 15–25 fruit pickers directed by a foreman. The treated block of 400 trees was picked first. The untreated blocks of two rows each of 100 trees on both sides of the treated block were picked next. An employee of the Gutwein groves recorded the boxes of fruit from each block. The yield records were taken for 5 consecutive years.

## RESULTS

Comparison of the color photographs made at the time of humus topdressing in the spring of 1975 and 9 mo later indicated some improved growth of trees at the Tropical River grove. By the end of the second year after treatment, improved growth was obvious. During the third and fourth years after humus topdressing, 23 of the 28 treated trees had returned to normal appearance and fruitfulness. By the end of the fifth year, 82% of the trees treated in 1975 had not regressed but appeared normal.

Cambial samples taken from treated and untreated trees by Stanley Nemec, USDA Horticultural Research Laboratory, Orlando, FL, confirmed that the humus-treated trees were apparently free of YTD. The untreated trees gave a positive test for YTD and had typical symptoms.

At the Gutwein grove, comparison of the photographs taken at the time of treatment and at the end of the first year also showed improved growth of trees.

**Table 1.** Yield of Valencia oranges from 12- to 16-yr-old trees soil top-dressed with 100 lb (45 kg) of cotton gin waste humus per tree in 1977 at Gutwein groves, LaBelle, FL

| Year | Boxes of fruit per acre[a] | |
|---|---|---|
| | Humus-treated trees | Untreated trees |
| 1977 | 195 | 210 |
| 1978 | 195 | 170 |
| 1979 | 224 | 160 |
| 1980 | 239 | ...[b] |
| 1981[c] | 182 | 152 |

[a] One box = 90 lb (40.8 kg).
[b] Yield data not available.
[c] A severe cold period during the 1980–1981 winter reduced yields in the area.

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Records for 1977 through 1981 (Table 1) show that during the first year after treatment yield neither increased nor decreased. In the third and fourth years after treatment, yields increased. In the untreated control block, yields declined steadily, which is typical of YTD-affected trees. Some YTD-affected trees in the control block declined quickly, some slowly. Loss to YTD over the 4 yr amounted to 35% in the untreated control block. YTD caused no loss of trees in the treated block.

## DISCUSSION

In the Florida flatwood and ridge soils where much of the citrus is grown, the humus content is only about 0.5% in original virgin soil and is substantially less after cultivation unless amendments are made. Addition of 100 lb (45 kg) of the special humus per tree is roughly equivalent to 0.5%, the amount present in the virgin soil. According to Buckman and Brady (2), humus is the most important constituent of productive soils. Apparently at least 0.5% is necessary for orange trees. However, there are as many kinds of humus as there are parent materials from which it is derived.

Cotton gin waste humus differs from Florida flatwoods humus by having high nitrogen, which favors plant growth as well as the soil microflora. There is yet no evidence that YTD is caused by parasitic microorganisms or by nutrient deficiency. YTD is associated with soils poor in organic matter or clay, both of which provide high cation exchange capacity. Humus has 8–30 times more cation exchange capacity than does montmorillonite clay (2), which suppresses YTD symptoms (3). The microbial content of the cotton humus should be carefully explored in view of recent reports of plant growth-promoting rhizobacteria (5).

The evidence presented indicates that YTD may be caused by a soil management problem that is correctable by the addition of a high N form of humus to the soil.


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