Using compost in citrus

By Monica Ozores-Hampton, Robert Adair and Phil Stansly

Composting is a biological decomposition process whereby microorganisms convert raw organic materials into a relatively stable, humus-like product. Florida generates a variety of non-hazardous organic wastes such as yard trimmings, municipal solid wastes, biosolids, animal wastes, food wastes and agricultural byproducts — all of which can be composted for land application to improve soil quality. Proper composting can be expected to eliminate pathogens by heat and competition with other microorganisms. Therefore, no waiting period is required between application and harvest where the soil amendment does not contact the harvested product, according to the U.S. Food and Drug Administration's Food Safety Modernization Act.

Figure 1. Overview of windrow composting of yard-trimming waste and biosolids at the Lee County Composting Facility in Felda. *Photo credit: Monica Ozores-Hampton*

Figure 2. Field spreading of compost prior to planting citrus. *Photo credit: Phil Stansly*

Proper composting requires selection of organic materials to obtain a favorable ratio of carbon to nitrogen of 25-30:1, adequate moisture (45 percent to 50 percent) and constant aeration. The organic matter is chopped and sieved at about five-eighths inch and set out in long piles or windrows to cure (Figure 1). The piles must be turned periodically to aerate and assure homogeneity, preferably when core temperature reaches 160°F as indicated by a compost thermometer. In favorable conditions, the compost can be finished in three to six months.

BENEFITS OF COMPOST

Soils suitable for citrus in Florida are generally sandy and low in soil organic matter (SOM) and, therefore, of low tilth and fertility. Many citrus groves include areas that only reach 25 percent to 50 percent of their potential production due to poor soil fertility associated with low SOM content and cation exchange capacity (CEC), regardless of the amount or frequency of fertilizer applications. Addition of compost to these "sand soaks" or "ball bearing sand" areas tends to enhance the soil's ability to retain both nutrients and water, improving fertilizer-use efficiency while maintaining high yields.

While the use of concentrated, inexpensive and readily available synthetic fertilizers in Florida citrus has generally resulted in satisfactory yields, losses attributed to the poor soil zones are often not addressed. Furthermore, citrus greening or huanglongbing (HLB) has weakened citrus trees in Florida so that they are less able to handle the stress of poor and depleted soils. Trees would benefit from the advantages that compost can impart to remain profitable. Research has indicated that non-hazardous organic waste materials suitable for composting can benefit citrus growers. Compost can be applied to improve a soil's physical properties (water-holding capacity, soil structure and bulk density), chemical properties (CEC and plant nutrient availability) and biological properties (microbial activity).

Yield losses from HLB-affected trees experienced by commercial citrus growers have been correlated with low fibrous root densities, which reduce root system capacity for water and nutrient uptake. Evidence from research on other crops indicates that compost enhances root growth and its ability to take up important nutrients including phosphorus, potassium, calcium and magnesium as well as micronutrients, especially manganese and iron. Compost has been shown to improve yields in vegetables while reducing nitrogen, potassium, calcium, magnesium and micronutrient (copper, iron, manganese, zinc, etc.) rates and protecting water quality by reducing leaching and improving nutrient uptake by the crop. Some citrus growers already use compost, but limited scientific data is available on long-term benefits that justify the expense. Nevertheless, the use of compost as soil amendments for citrus production could be an important component of an overall best management practices program to minimize nitrogen and phosphorus losses. The compost production system can complement a foliar micronutrient program by

Above: Figure 3. Ray Ruby grapefruit trees at the University of Florida/Institute of Food and Agricultural Sciences Southwest Florida Research and Education Center in Immokalee in October 2014, one year and five months after planting. Compost plots are shown on the right and middle, with no compost on the left. *Photo credit: Phil Stansly*

Left: Figure 4. Appearance of Ray Ruby grapefruit trees at the Florida Research Center for Agricultural Sustainability in Vero Beach after a second application of yard-trimming waste mulch (right) in June 2015 when trees were 1 year and 3 months old. Trees on the left were planted into metalized plastic mulch. *Photo credit: Bob Adair*

enhancing the root environment and tree heath, and by providing a slow-release carbon source for active soil microorganisms.

CRDF RESEARCH PROJECTS

Compost is best applied banded and incorporated prior to planting. This way, the young trees derive maximum benefit from the amended soil. A research project was funded by the Citrus Research and Development Foundation (CRDF) in which 12 tons per acre of composted yard-trimming waste were broadcast spread and incorporated prior to planting (Figure 2, page 8). Also, Ray Ruby grapefruit on Smooth Flat Seville rootstock was then planted (under polyethylene mulch) in a replicated long-term field trial at the Southwest Florida Research and Education Center in Immokalee (Figure 3). Two years and two months later, tree caliper and canopy area were 39 percent and 45 percent greater, respectively, for trees in composted plots compared to no compost.

There is still value to applying organic material such as yard-trimming waste on the surface as a mulch cover after planting, as seen in another CRDF-funded trial using Ray Ruby grapefruit on Sour Orange rootstock planted in March 2014 at the Florida Research Center for Agricultural Sustainability in Vero Beach (Figure 4). One and a half years and two applications of yard-trimming waste later, and in spite of undoubtedly losing nitrogen during breakdown of this woody material, there was a 30.2 percent increase in trunk caliper and a 27.8 percent increase in canopy volume compared to trees grown on bare ground without compost.

APPLICATION ADVICE

Although compost can also be applied once trees are established, the greatest benefit will be derived if it can be incorporated at shallow depth to avoid root damage. This can be done with a "tree hoe," a rotary cultivator mounted on a three-point hitch and provided with adjustable skids to control the depth of cultivation (Figure 5). A variant of this machine can also move in and out between trees. Another variant, patented by Hoyle Pounds of Winter Garden in 1959, spreads fertilizer while it is hoeing.

Unfortunately, these machines are no longer built, and old ones are being rescued from junk yards by citrus growers wanting to incorporate compost and fertilizer as well as find a weed-management alternative to reduce herbicide pressure on their trees. Thus, the use of compost in citrus production will be expected to expand in the future, given its many economic and environmental benefits.

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Figure 5. Side operating tree hoe: side view (top photo) and cultivator tines seen from below (bottom photo). *Photo credit: Phil Stansly*