

Utilization of Organic Wastes in Florida Agriculture¹

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Florida's rapidly increasing population is generating large quantities of wastes that must be disposed of in a manner that will not adversely impact the environment. Many traditional disposal methods are no longer adequate to handle increasing waste generation. In addition, alternative means of handling wastes need to focus on utilization rather than disposal. Possible areas for waste utilization include citrus, pastures and sugar cane, which are commodities occupying extensive acreage in the state.

Types of Organic Wastes Available

A variety of non-hazardous wastes are generated in Florida for which land application appears to be a viable option. These include municipal effluent and biosolids, animal wastes, food processing wastes, and municipal solid wastes. Land application often provides an economically sound and environmentally acceptable option for utilization of these so-called "waste materials."

Environmental Concerns

Unmanaged or mismanaged land application efforts have resulted in a variety of aesthetic and

environmental problems. Many of these problems developed due to lack of a clear understanding of the soil-plant system's capability to safely assimilate waste materials. In addition to the more common concerns about adverse effects on soil and plants, the effects of waste disposal on groundwater quality is an especially urgent problem in Florida.

Due to the sandy nature of most Florida soils, amendments must be carefully evaluated for their potential to pollute both the soil and water (ground and/or surface water). Excessive waste application rates may result in nitrogen and phosphorus contamination. It is imperative that the composition of the amendment be well known prior to application to land. Wastes may also contain toxic metals that can adversely affect soil biological processes, leach into groundwater, or be assimilated by plants. The EPA has established ceilings for metals contained in waste materials applied to land.

In determining the appropriate application rate of organic wastes to cropland, it is critical to know the annual decomposition (mineralization) rate of the material. Knowledge of these rates is especially important for nitrogen, since much of the nitrogen in wastes is in organic form.

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Rate of Mineralization or Decomposition

Nitrogen mineralization rates from organic wastes applied to land vary depending on soil and environmental conditions as evidenced by a variety of studies reported in the literature. Mineralization values ranging from 41 to 50% of the organic N from aerobically-digested sewage sludge and 23 to 41% of the organic N from anaerobically-digested sludge have been reported during the initial crop season. Mineralization rates of approximately 40%, 15%, and 8% have also been calculated for waste-activated sludge, anaerobically-digested sludge, and composted sludge, respectively. Results obtained from an ongoing study with application of granular biosolids to bahiagrass pastures in Florida indicated that more than 60% of the N contained in the biosolids applied at rates lower than 2 tons/acre was released and taken up by the plant during the first year.

Research data that describe the mineralization of N with time following organic waste application, and associated plant response, would provide information that the citrus, sugar cane and cattle industries could use to integrate both organically and inorganically derived N into an efficient fertilization program. However, mineralization rates need to be measured under field conditions before we would have confidence in them.

Decomposition of organic materials occurs in two phases. The first phase is usually rapid, which can account for a significant release of inorganic N (in addition to that already present in the organic waste) within a few weeks of soil application. The second phase involves a slower decomposition rate over longer time periods. Not all of the material will decompose during a given year, and some decomposition will continue during subsequent years. Knowledge of N mineralization over a period of several years when organic wastes are added can be used to determine the annual rate needed each year to meet crop demands. Mineralization rates will vary depending on waste characteristics, soil characteristics, and environmental conditions.

Examples of Organic Wastes Used in Florida

Biosolids (sewage sludge) and poultry manure are readily available in Florida, and are commonly applied to citrus groves. These materials are increasingly being applied to pastures, which are normally under-fertilized and require N applications for adequate biomass production and forage quality. For example, the South Dade Soil and Water Conservation District produces about 45,000 tons/year of a cake-type biosolids (25% solids) derived from wastewater residuals. This product contains about 5% N and 2.5% P_2O_5 on a dry-weight basis, and nearly all of it is applied to citrus groves at 2 to 6 wet tons/acre. Use of these biosolids is economical because the cost of processing and delivery is subsidized by the waste producer. In a typical case, the material is delivered to a citrus grove at no cost, and is spread by a custom applicator for \$6/ton.

In 1992, animal manure (primarily poultry-derived) was applied to 14,000 acres of Florida citrus groves. Southwest Florida growers have applied poultry manure to "weaker" areas of their groves in an attempt to improve physical and chemical soil characteristics. Poultry manure is more expensive to apply than biosolids; it costs about \$40/ton to apply to a citrus grove, including material, transportation, and spreading costs. The N concentration varies between about 1 and 3% on a dry-weight basis. Assuming N, P_2O_5 , and K_2O concentrations of 2, 3, and 1.5%, respectively, 1 acre of grove can receive 40, 60, and 30 lbs of N, P_2O_5 , and K_2O from poultry manure for \$40. It costs approximately the same to apply similar N, P_2O_5 , and K_2O rates using conventional, water-soluble fertilizers.

Benefits of Organic Wastes Application in Florida

Florida soils are generally sandy and low in organic matter concentration. They have a low nutrient and water retention capacity and low natural fertility. Addition of organic matter tends to enhance their overall ability to retain both nutrients and water. These are positive factors, both with regard to

enhancing soil fertility and protecting groundwater resources from potential contaminants that might leach through the soil.

Florida farmers realize the value of maintaining at least 1 to 2% soil organic matter in sandy soils. While some growers only apply organic wastes (biosolids or manure) to zones in their fields where organic matter is very low (localized areas called “sand ponds”), other growers apply these materials uniformly across a field regardless of soil characteristics. In the former case, the wastes are viewed as materials that can improve inherent soil fertility, while in the latter case they are viewed as a nutrient source as well as a soil fertility enhancement.

Since water-insoluble organic N is not readily leached from the root zone, the use of organic waste materials as N sources for citrus production could be an important component of an overall BMP program to minimize N losses. Citrus and pastures are particularly suited for applications of slowly-available N because they are perennial, long-term crops. The fact that some growers who use these materials do not count the N released as part of the “fertilizer” N that they apply annually indicates a lack of knowledge within the industry with respect to mineralization, or “N-release” rates. By not accounting for N from biosolids or manure sources, growers who combine them with their regular fertilizer program may be over-fertilizing. Better knowledge of the N-release characteristics of organic wastes would prompt a decrease in water-soluble N use, and would possibly increase the demand for waste sources in Florida.