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COMPOST QUALITY CONSIDERATIONS FOR CROP UTILIZATION

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Over the past several years compost production has increased dramatically in the agricultural, industrial, and municipal sectors. This expansion has been driven by increasing solid waste management costs, heightened public enthusiasm for organic matter recycling, and recognition that composting provides a way to manage manures and other organic solid wastes in an environmentally sound manner.

All this increased composting has generated large volumes and a great variety of compost products. Although these composts have by and large proven beneficial for agricultural and horticultural production, it is important to recognize that most composting operations are driven by a waste disposal incentive, and may not have the same emphasis on product quality as most other manufacturing operations. Thus it is important that potential users of compost understand compost quality considerations, and demand products which have the characteristics their applications require.

There are at least four broad areas of compost quality to consider: beneficial properties for crops, potential negative impacts on crops, other environmental risks, and materials handling. Each of these is discussed in more detail below.

Among the various agronomic benefits that have been claimed for compost, nutrients and soil quality effects would probably top the list. Nutrient levels will vary widely with the feedstocks that composed the initial compost mixture, and to a lesser extent the composting process. N-P-K ranges from 0.5-0.2-0.3 to 2.5-2-1.5 (dry weight basis) are typical of commercial compost products (Composting Council, 1995, p. 102), although some manure composts can have even higher nutrient concentrations. Although these values are low relative to commercial fertilizers, at application rates of 10 tons/acre they can contribute all or at least a significant part of crop nutrient needs. As with manure, not all these nutrients are available in the year of application. Reported nitrogen mineralization rates range from 5 to 30% per year (DeLuca and DeLuca, 1997). Although this wide range makes it difficult to transition from chemical fertilizers to exclusive use of compost for crop nutrient needs, repeated applications will eventually allow the system to achieve a steady state.

Some composts provide an additional crop benefit which is gaining a great deal of attention – the suppression of various soil born pests and disease. While these benefits have been well established for several horticultural and turf pathogens, the level of benefit varies widely among different composts (Hoitink and Fahy, 1986). Research in this area is proceeding at several universities around the country, and effects on various agricultural crops are being explored.

Although composts can and do generally have positive impact on crops, there are some circumstances when negative consequences can occur. Phytotoxicity is the general term for toxic effects on plants, and with composts are most commonly caused by high salt levels (>5 dS (mmhos/cm)) (Composting Council, 1995, p. 102) or anaerobic byproducts such as organic acids (Lynch, 1977). Phytotoxicity can be tested directly using plant bioassays, or indirectly by various respirometric techniques, self-heating, or other measures of compost stability (Composting Council, 1995, p. 103).
Other potential risks in compost application include heavy metal accumulation and pathogens. Heavy metals are rarely a threat with agricultural composts, and are regulated by the DNR for composts produced from industrial wastes or sewage sludge/biosolids. As a result, composts approved for general use can be safely applied at normal rates for at least several decades before harmful levels of metals might accumulate. Pathogens are greatly reduced by the high temperatures of the composting process, and biosolids or other composts with high levels of human pathogens have been required to undergo extended thermophilic composting to insure its safety. On-farm composting may not achieve the same safety factors, which can be a concern with both livestock and plant pathogens. Temperatures greater than 130°F (55°C) for a minimum of 3 days are generally considered adequate to destroy most pathogens.

Compost materials handling issues include compost stability, nutrient concentration, and moisture content. Stability is important not just in preventing the formation of organic acids, but in minimizing odor production during storage. Large piles that are still undergoing rapid decomposition will likely go anaerobic and odors will result, especially if piles are stored for long periods of time. If compost is used in a crop fertilization program, the nutrient concentration will determine application rates, and thus has a significant impact on both transportation and application costs. The moisture content of the compost will also affect the costs of transportation and application. If compost is sold on a weight basis, high moisture levels are clearly a negative. In addition to paying for the extra water, wet composts also are more likely to generate anaerobic odors, especially if they haven’t been stabilized by composting a long time. However, if the compost is too dry it can be dusty, causing nuisance problems and increasing the risk of allergic reactions in sensitive individuals. The ideal moisture content for land application is usually between 35 and 45% H2O.

Understanding these issues will help insure that compost products will meet or exceed expectations, but there is still considerable uncertainty about how to integrate compost use in a field crop production system. Researchers in the ISU departments of Agronomy and Agricultural and Biosystems Engineering are collaborating with the National Soil Tilth Laboratory to better understand these relationships. A unique aspect of this collaboration will explore the effect of different compost feedstock and process conditions on soil fertility effects. The ultimate goal is to redefine composting as a manufacturing process, and design that process to produce the product characteristics that customers demand.

**Bibliography**


