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FATE OF NUTRIENTS DURING THE COMPOSTING OF YARD AND AGRICULTURAL WASTES

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Descriptors: Animal waste, denitrification, nitrogen, soil- water relationships, water quality management

Problem and Research Objectives:

This project was a continuation of FY 93.

In order to understand the fate of nitrogen during the composting process, a mass balance equation was developed in this form:

Input - Uptake - Solid Forms =

This mass balance was based on the results of monitoring and analysis of nitrogen species contained in the fresh organic waste, precipitation and compost additives (input), in the gaseous losses (uptake), in the finished product (solid forms), and in the soil water (fugitive). It is the fugitive nitrogen that is of concern with regard to the possible degradation of ground water flowing beneath a facility such as the Compost Technology Center. Studying the fate and transport of nitrogen in the unsaturated zone can, in general, indicate the potential impacts of the composting process on ground water quality.

Principal Findings and Significance:

Ammonium concentrations in soil water samples were below detection (0.10 mg/L) in all areas except the composting area. Nitrate concentrations in the rain samples ranged from 0.30 to 2.2 mg/L, with a median of 0.60 mg/L. As expected, the lowest soil water nitrate occurred in the undisturbed forest, where nitrogen is efficiently recycled and little is lost. Higher nitrate concentrations in the cleared area can be attributed to the lack of vegetation. Clear-cutting not only eliminates the major N sink, but also allows for increased soil temperatures and moisture availability which can lead to accelerated N mineralization. By far, the highest nitrate concentrations occurred in the composting area , especially beneath the windrow. Nitrate concentrations in excess of 100 mg/L were consistently observed at depths as great as five feet below the windrow during composting, and reached levels as high as 900 mg/L by the end of the process. Nitrate in the soil adjacent to the windrow was higher than in the cleared field without compost, indicating that some nitrate was transported from the composting windrow laterally into the adjacent soil.

In general, the median nitrate concentration increased by an order of magnitude between each of the different sites: the forest, the clear-cut areas, the soil adjacent to the windrow, and the soil beneath the windrow. This substantiates the claim that the windrow is a source of fugitive nitrogen. Within each site, the median nitrate value did not change substantially with depth, indicating that there is little attenuation of the nitrate as it moves toward the ground water. Nitrate concentrations of this magnitude can be expected to have a major impact on ground water quality in the immediate area. A strong inverse relationship between ammonium in the farm waste and nitrate in the soil directly below the windrow was found: as ammonium in the waste decreased, nitrate in the soil increased dramatically. Nitrate concentrations in the soil profile beneath and adjacent to the yard waste windrow remained low throughout the sampling period.