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Effect of Windrow Management on Ammonia and Nitrous Oxide Emissions from Swine Manure Composting

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Abstract : In the era of sustainability, utilization of livestock wastes as soil amendment to provide micronutrients for crops is very economical and sustainable. It is well understood that livestock wastes are comparable, if not better, nutrient sources for crops as chemical fertilizers. However, the large concentrated volumes of animal manure produced from livestock operations and the limited amount of available nearby agricultural land areas necessitated the need for volume reduction of these animal wastes. Composting of these animal manures is a viable option for biomass and pathogenic reduction in the environment. Nevertheless, composting also increases the potential loss of available nutrients for crop production as well as unwanted emission of anthropogenic air pollutants due to the loss of ammonia and other compounds via volatilization. In this study, we examine the emission of ammonia and nitrous oxide from swine manure windrows to evaluate the benefit of biomass reduction in conjunction with the potential loss of available nutrients. The feedstock for the windrows was obtained from swine farm in Kentucky where swine manure was mixed with wood shaving as absorbent material. Static flux chambers along with photoacoustic gas analyzer were used to monitor ammonia and nitrous oxide concentrations during the composting process. The results show that ammonia and nitrous oxide fluxes were quite high during the initial composting process and after the turning of each compost pile. Over the period of roughly three months of composting, the biochemical oxygen demand (BOD) decreased by about 90%. Although composting of animal waste is quite beneficial for biomass reduction, composting may not be economically feasible from an agronomical point of view due to time, nutrient loss (N loss), and potential environmental pollution (ammonia and greenhouse gas emissions). Therefore, additional studies are needed to assess and validate the economics and environmental impact of animal (swine) manure composting (e.g., crop yield or impact on climate change).

Keywords : windrow, swine manure, ammonia, nitrous oxide, fluxes, management
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