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Accumulation of Nutrients under a Swine Finisher Hoop Structure and Composting Pad

Abstract

Increasing concern about the impacts of livestock liquid waste handling, treatment, and disposal systems on water quality has caused livestock producers to look for more environmentally benign systems. Hoop structures in conjunction with composting offer a solid manure management option, which can minimize the possible impacts to water quality. Finisher pigs are raised within a deep layer of bedding, which allows for in-situ decomposition of the manure. Manure and bedding from the hoops then can be directly land applied or further composted and used in crop production.

Keywords

Agricultural and Biosystems Engineering

Disciplines

Agricultural Science | Agriculture | Bioresource and Agricultural Engineering

Accumulation of Nutrients under a Swine Finisher Hoop Structure and Composting Pad

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Introduction

Increasing concern about the impacts of livestock liquid waste handling, treatment, and disposal systems on water quality has caused livestock producers to look for more environmentally benign systems. Hoop structures in conjunction with composting offer a solid manure management option, which can minimize the possible impacts to water quality. Finisher pigs are raised within a deep layer of bedding, which allows for in-situ decomposition of the manure. Manure and bedding from the hoops then can be directly land applied or further composted and used in crop production.

Previous studies at the Rhodes Research Farm documented losses of N from the bedded pack ranging from 35 to 45% of total N inputs, and average losses of 52, 31, and 35% of the remaining N, P, and K during outdoor composting in windrows. N losses include gas emissions, runoff, and leaching whereas P and K losses are presumed to be limited to runoff and leaching. Understanding how these losses are partitioned among these pathways is important to designing effective environmental protection measures for these solid manure handling systems.

Current research is examining the extent to which these nutrient losses occur by leaching into the soils below the hoop structures or on the compost pad during the composting period. For four finishing cycles in 1997, 1998, 1999, and 2000 the soil under the hoops and composting pad was analyzed. The objective of this study was to determine the amount of nutrients lost

from the manure within the hoop structure and on the composting pad.

Materials and Methods

Soil cores were collected on a grid pattern of 12 locations within the hoop structure and on the composting pad. Cores were taken to a depth of four feet and returned to the lab for processing. Processing consisted of dividing the cores into four depth intervals, 0-6, 6-12, 12-24, and 24-48 inches. The subdivided cores were pushed through an 8 mm sieve to remove rocks and foreign debris. Then the samples were dried, ground, pushed through a 2 mm sieve, and subsampled for nutrient analysis. Subsamples were then sent to the Iowa State University Soil Testing Laboratory in Agronomy Hall to be analyzed for Total P and K, Total C and N, pH, and nitrate. Site weather data, rainfall and temperature information, were collected from the nearest weather station at Colo, IA.

Results and Discussion

Once the soil samples for year 2000 have been analyzed, calculations will be made to determine the accumulation of nutrients under the hoop structures and under the compost piles. One goal is to determine if nutrients are actually leaching from the manure and accumulating in the soil. Also, it is important to determine if the nutrients are continuing to leach downward in the soil profile and at what rate of movement. This will be correlated back to the weather information to determine if the precipitation and temperature are affecting the nutrient movement.

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