Phosphorus Best Management Practices
Protecting Water Quality

Composting Effects on Phosphorus Availability in Animal Manures

Authors: Lawrence J. Sikora, USDA-ARS, Beltsville, Maryland; Peggy Preusch, University of Maryland, College Park, Maryland

Author's email
sikoral@ba.ars.usda.gov

Editing and Design:
Forbes Walker
Wanda Russell
Gary Dagnan
Anne Dalton

University of Tennessee Extension

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Definition:

Composting is a management practice whereby manure is mixed with a carbon source such as straw, sawdust or wood chips; stacked; re-mixed occasionally; and allowed to self-heat. The resulting compost has little odor, is drier and about half the volume of the original manure mixture. Nutrient mineralization or fertilizer value is lower than manure, resulting in fewer nutrients in runoff when compost is applied to soil, as compared to manure applications.

Purpose:

To reduce the amount of water-soluble phosphorus (P) present, so that when it is applied as a compost, runoff will contain less phosphorus than if manure were applied. This benefit is in addition to making a product that is more readily transported off-site.

How Does This Practice Work?

Manures are collected and mixed with a carbon source 1:2 (v/v, manure: carbon source), unless the manure already contains at least one-third bedding, in which case no additional carbon source is needed. The mixture is stacked or placed in windrows and allowed to compost for approximately 12 weeks. During this time, the stack should be mixed or turned at least four times, and temperatures should exceed 50 degrees C for two consecutive weeks. Moisture content should be maintained at 40-60 percent to ensure continued decomposition. There are several excellent publications outlining methods for on-farm composting, including the *Field Guide to On-Farm Composting*, NRAES-114. The method chosen will depend upon each farm's animal operation, area and available equipment.

Compost can be applied using a manure spreader with either a rear or side delivery system. The drier the compost, the easier and more uniformly it will spread. Application rates are determined by nutrient requirements of the crop and the soil nutrient analyses. If the land has been evaluated using a P site index, the application of compost may be based on its total P content.

Recent studies suggest that P in compost is as available to the plant as triple super phosphate. This result appears inconsistent with a previous statement that soluble P is reduced after composting. However, when compost is added to soil, compost organic matter may block sites where P normally is adsorbed, plus the biologically active compost may cause a release of

soil-bound P, resulting in net plant P uptake equal to that of triple super phosphate. Incorporation of compost into soil minimizes both P and nitrogen (N) losses from compost application. Applications of immature compost or less stabilized compost will likely result in more P runoff than with fully mature compost. Tests for maturity and stability of compost may be found at the US Composting Council Testing and Methods Web site http://tmecc.org/tmecc/index.html.

Because N is immobilized and P generally remains plant-available, the addition of compost as a N source would add greater excesses of plant-available P than if uncomposted manure were added to fields.

Where This Practice Applies and Its Limitations:

All solid manures can be composted. Liquid manures and manures from wash-down systems, lagoons, etc. are not easily composted, because a large amount of carbon material or bulking agent is required to dry them out sufficiently to allow air to penetrate and escape the mass. The location of the compost site is important, because it will be a depository for manure during composting and a point source for nutrient run-off and leaching. The field guide includes excellent directions for locating and maintaining a compost site.

Effectiveness:

The greatest loss of nutrients from applied manure comes during the initial rain event. The nutrients lost from manure are directly related to the soluble nutrient content of the manure. In some cases, composting reduces the soluble N content by 50 percent, which translates into 50 percent less soluble nitrogen in runoff. In studies conducted using a rainfall simulator, water-soluble P losses from compost application were at least 50 percent less than from manure.

Cost of Establishing and Putting the Practice in Place:

The cost of establishing a composting area includes expenses related to transport of materials, preparation of feedstocks, mixing and placement of feedstocks into windrows and preparation of the windrow area and run-off collection areas. Choice of handling, mixing, turning, screening and bagging equipment affects the overall cost and varies based on the complexity and size of the equipment chosen. These choices are all related to the volume of materials to be composted and result in different size, shape and spacing of windrows or stacks. The decision to cover the windrow area may be an additional cost. In addition, if compost will not always be applied or transported immediately upon completion of the composting process, a storage area for finished compost may be needed.

Operation and Maintenance:

Establishing and managing manure compost activities requires time to establish and monitor the compost and an area dedicated for composting. Equipment can range from a front end loader or a skip loader to expensive windrow turning equipment. Maintenance equipment is simply a temperature probe. Assuring that the compost does not get too wet or dry, too hot or no heat allows the compost process to proceed to completion.

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For Further Information:

Please contact Dr. Sikora at ljsikora@pivot.net or Ms. Pruesch at pp78@umail.umd.edu.