Phosphorus Best Management Practices

Protecting Water Quality

Milkhouse Filters

Authors: Peter Kleinman, USDA-ARS, State College, Pennsylvania; Larry Geohring and Tammo Steenhuis, Cornell University, Ithaca, New York

Author's email
Peter.Kleinman@ars.usda.gov

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

University of Tennessee Extension

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Definition:

Vegetated and non-vegetated infiltration strips and septic type systems designed to treat milkhouse waste.

Purpose:

Milkhouse waste contains high concentrations of phosphorus (P) and total solids due to the common use of phosphate-containing detergents and acid rinses, as well as the contributions of manure, feedstuffs and residual milk in waste. Filters serve to remove particulate P by settling the solids from waste and decrease dissolved P by promoting contact of wastewater with P sorbing materials.

How Does This Practice Work?

Milkhouse filter strips serve to trap solid constituents of milkhouse waste by distributing flow evenly to promote infiltration of wastewater and deposition of solids, or by intercepting solids with surface vegetation. Septic-type systems remove solids with a settling tank and by filtration in the leachfield or filter strip.

Dissolved P is removed by putting wastewater in contact with soil or other fill material that has a high P sorption capacity. In vegetated filter strips, growing vegetation promotes infiltration and takes up some of the P. Harvesting of filter-strip vegetation helps to recover plant-available P from the soil in the filter strip, removing a small fraction of the P applied in wastewater.

Where This Practice Applies and Its Limitations:

Milkhouse filters are suited to better-drained sites, where local hydrology and wastewater-dosing regimes will not cause saturation of the soil in the filter strip. The slope of the land should be less than 15 percent to induce infiltration and reduce runoff. Filters should be located in soil or fill material with high P sorption capacity, and be of sufficient area to meet hydraulic loading requirements and the long-term phosphorus sorption requirements. Because of risks to groundwater contamination, filters should not be sited on highly permeable soils or near wells. Neither should filter areas be located near tile inlets, due to the risk of short-circuiting the wastewater flow to the tile outlet and surface water.

Effectiveness:

The long-term efficacy of milkhouse filters is dependent upon waste characteristics, including volume, organic matter and P content, maintenance of filters and effective P sorption capacity of the filtering medium. Ultimately, filters will become saturated with respect to P sorption and may need to be reconditioned. As such, minimizing P loading to the filter by controlling waste volume, eliminating P-containing reagents and minimizing waste milk, manure and feed inputs is an effective means of extending their longevity.

The effectiveness of milkhouse filter strips depends upon proper sitting and maintenance. A study reported in 1989 found that a vegetative filter removed 90 percent of total P from milkhouse waste. In contrast, in 2003 an observation that 60 percent of total P in milkhouse waste passed through a poorly sited and maintained strip was reported. Another report in 2003 gave the average P trapping efficiency of all vegetated filters as 61 percent and ranged from 31 percent in a 2-m filter to 89 percent in a 15-m filter. Filter length has been found to be the predominant factor affecting P trapping in VFS. The rate of inflow, type of vegetation and density of vegetation coverage had secondary influences on P removal.

Key issues with regard to maintenance include prevention of concentrated or channelized flow and proper dosing. A 1992 study found that poor performance of a vegetative filter strip treating barnyard runoff was due to excessive hydraulic loading rate and channelized flow. In that study, no significant reduction in P concentrations was observed, and only 12 percent of the total mass of P entering the strip was retained.

A common problem of septic systems is that fatty solids from the milk rapidly clog leach fields and infiltration trenches. As a result, septic tanks must be pumped regularly to extend the effective life of the leach field. Appropriately sized settling tanks reduce the frequency with which tanks must be pumped and maximize the hydraulic retention time to promote solids removal. Mechanically aerated septic tanks may also facilitate the breakdown of the fatty milk solids.

Cost of Establishing and Putting the Practice in Place:

The cost of establishing milkhouse filters depends upon the method installed. Septic systems are typically more expensive to install and maintain, given the frequent pumping required and replacement of leachfields. Generally, the use of a filter strip or organic filter bed to treat the leachate from the septic tank reduces the long-term maintenance costs. However, filter strips must be properly sited and graded, isolated from livestock or intensive tillage operations, and equipped with flow distribution systems that promote infiltration (e.g., gravel infiltration ditch) and sheet flow (e.g., level lip spreader or perforated pipe). Gravity-fed filter strips, where a level lip spreader or perforated pipe distributes the flow, are comparatively inexpensive, but do not provide control of dosing regime. A pump-fed distribution to filter strips is intermediate in cost, due to the need to install a pump and liquid level controls and provide electricity.

Operation and Maintenance:

The operation of a septic tank and filter strip system, even with pump distribution, is relatively automatic unless some different dosing cycle is required. Pumping of septic tanks should be done annually or a minimum of once every three years, depending on wastewater characteristics. The maintenance of filters, such as routine repairs to level lip spreaders or distribution pipes that have gone out-of-level, are important to minimize concentrated flows through the filter. Areas where channelized flows within the filter caused erosion should be re-graded. Also, the accumulation of milk solids, which restricts infiltration, should be removed, and the area re-graded.

A well-maintained milkhouse waste filter strip promotes diffuse flow and infiltration of wastewater. This filter is surrounded by a fence to exclude cattle as it is located within a loafing area adjacent to a barn.

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For Further Information:

Contact your local conservation district, USDA-NRCS or Cooperative Extension Service office.