



Proper storage, handling, and application of manure from dairy operations can protect Massachusetts's water resources and increase profits for animal and crop enterprises.

Introduction

Dairy manure is a valuable fertilizer resource and can reduce a producer's commercial fertilizer costs by about \$50 per acre. If mishandled, however, dairy manure can contaminate surface and ground waters. Proper storage, handling, and application of manure from dairy operations can protect Massachusetts's water resources and increase profits for animal and crop enterprises.

Store or Spread?

Accumulated manure can cause health, odor, and water quality problems if not properly dealt with. One option is to collect the waste daily, load it in a spreader, and spread it on cropland, hayland, or pasture. This is time consuming and also has to be done regardless of the soil moisture, weather, or time of year. Spreading on saturated soils compacts and compromises soil quality; spreading on frozen soils can lead to offsite runoff of manure. The alternative to daily spreading is to stockpile or store the manure for a period of time, at which point it may be spread or hauled away and utilized beneficially elsewhere.

Therefore benefits of manure storage include:

- Reduce the need for frequent hauling and land spreading.
- Allows for land spreading at a time when soil and climatic conditions are suitable.
- Allow nutrient application at or near the crop's growing season.

Limitations of Manure Storage

Manure storage is generally a large capital cost item. Most producers want to invest this capital where it produces a good income stream (cows, housing, milking parlor etc). Manure storages are not noted for producing a large income stream. The large capital cost of storage contributes to a large annual cost for depreciation, interest, repairs, taxes and insurance. The cost of putting manure into storage and removing it must be considered in annual cost.

Stored dairy manure generally smells more offensive than fresh manure. Measures should be taken to minimize the effects of odors. Also, the cropping seasons in spring and fall are very busy times with narrow windows of time to get all the work done. The need to empty large manure storage at either or both times can constrain the dairy operation.

Manure Storage Design

Calculating the capacity of manure storage needed for a dairy operation is not difficult with the assistance from UMass Extension staff or your county NRCS office. The choices for storage facilities include, but are not limited to metal, concrete, and fiberglass. Lagoons can be excavated if the physical space required is available.

Dry Storage

Typical dry storage facilities are designed to handle the solid manure from dairy cattle separated or scraped solids from dairy operations and other materials such as bedding.

Advantages include:

- Less volume due to high solids content of greater than 15 percent dry matter.
- Fewer odors since bacterial action producing compounds is reduced at lower moisture levels.

- Less runoff potential.
- Relatively high nutrient retention.

Disadvantages include:

- More labor in manure collection and handling (mechanical vs. hydraulic handling) than liquid storage.
- Runoff management from storage areas.
- Labor and equipment requirements for the larger number of loads to haul and spread for land application.

In higher rainfall areas, solid manure storage facilities usually have a concrete bottom and may have concrete walls to confine the solids and provide a push wall for stacking and loading of the solids. Examples for dairies are picket dam storage and solids settling basins. Contaminated runoff from these facilities must be managed in an environmentally sound manner.

Proper roofing should be considered to avoid runoff. The roof will divert additional moisture to the manure and will ease handling during inclement weather. Composting may also be an integral part of the solid manure storage system.

Liquid Storage

Liquid manure storage facilities (lagoons) are earthen structures but are larger than those designed for slurry storage due to the additional treatment volume. Since they are earthen structures, site investigations for proper soil material, rock, or bedrock characteristics and water table elevation must be performed as part of the site evaluation. A seal on the lagoon bottom and sides must be constructed to meet permeability standards required by regulation or good construction practice. A source of dilution water (usually a pond or lake) may be needed to maintain the lagoon treatment volume. Adding dilution water reduces the effects of salts in the lagoon during periods of low rainfall when evaporation may reduce the treatment volume below the design level.

Advantages of lagoon storage of manure may include cost per animal unit and their ability to store large amounts of manure and/or runoff. Disadvantages of lagoons may include lack of appropriate soil materials for construction, the need for solids separation or sludge removal equipment if bedding or other non-biodegradable materials are present, aesthetic appearance and/or public perception, and relatively high nitrogen losses and greenhouse gas emissions.

Slurry Manure Storage

Slurry manure storage facilities store manure in slurry form that is between 5 to 10 percent dry matter. One type is the under-floor pit in which manure is deposited directly into the pit through slatted floors. Other slurry manure storage facilities may be fabricated or earthen structures.

Fabricated manure storage tanks are usually concrete or coated metal with a glass lining and may be above or below ground. Manure is usually pumped into the tank from a collection sump or reception pit. Agitation is necessary to suspend solids and facilitate complete removal of the contents. If odor control is needed, storages can easily be covered.



Figure 1. Slurry manure storage tanks store manure that is between 5 and 10 percent dry matter.

Slurry manure can also be stored in earthen structures or basins. Since storage volume can be obtained at less cost in an earthen basin,

these facilities are chosen when manure and wastewater volumes are large. These structures require a high degree of planning to ensure that proper seal occurs at the bottom of the basin. If the native soils will not seal, imported soil or geo-textile fabrics need to be used. A disadvantage of these structures is the potential for higher odor problems.

Resources

Animal Manure Management. Livestock and Poultry Environmental Stewardship Curriculum.
<http://www.extension.org/animal+manure+management>

Dairy Environmental Handbook; Best Management Practices for Dairy Producers.
http://www.nmpf.org/publications/dairy_handbook

For more information visit www.umass.edu/cdl

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