Evaluating the Need for a Manure Treatment System

Introduction

The reasons why an increasing number of producers are evaluating manure treatment systems include:

- Society has recognized that manure from animal agriculture, if not properly managed, can lead to excess nitrates in ground water, pathogens in drinking water, and excess nutrients, biological oxygen demand, and sediment in surface water.
- Manure will increasingly need to be spread during times when soils are drier, on fields where the chance of runoff and leaching are low.
- Manure storage will be standard procedure on most farms, to enable producers to avoid spreading manure on frozen or saturated soils.
- When liquid manure is stored long-term, it decomposes anaerobically. The gaseous by-products of incomplete anaerobic decomposition have an offensive odor to many neighbors and communities.

Advantages to Manure Treatment

Given the need to reduce the impact on the environment and on neighbor's noses, treating manure for odor control will become more common on farms in the near future. The following are some of the possible additional advantages of various manure treatment systems:

- **Reduction in mass**. Less material to transport and apply to cropland, and reduced soil compaction.
- **Nutrient reduction**. Reduced amounts of nutrients mean less cropland is required for spreading separated manure liquids.
- **Pathogen control**. Reduced levels of animal-borne pathogens in manure lessens biosecurity concerns and health risks.
- **By-product sales**. Treatment processes that produce energy, or marketable organic materials such as compost and bedding, could help pay for the treatment process, or in some cases add an income stream. (Note: There are biosecurity, udder health, and milk quality issues associated with recycling manure solids as bedding.)

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Match the System to the Farm

Farms vary greatly in their resources and their manure management concerns. Some farms have access to more capital, skilled labor, management ability, land resources, water resources, and markets. Some farms are under more severe constraints to control odors, air emissions, nutrients, and/or pathogens. Different manure treatment and handling systems will be needed to match the resources and needs of different farms.

Do the Nutrient Management Plan First

A nutrient management plan identifies the crop acreage available for spreading manure. It is crucial to know if a farm has enough cropland to receive the manure it generates before choosing a treatment system. Some treatment systems or components significantly partition nutrients into effluent streams that are more easily exported off-farm, while others do not. Farms without adequate cropland may need to consider exporting some manure off-farm.

TREATMENT OPTIONS

The following are some of the major options to consider for treating manure.

1. Composting

Composting lends itself well to solid manure handling systems, systems that receive manure from bedded pack pens, and the solid effluent from a

solid-liquid manure separator. Liquid dairy manure is too wet to compost. A moisture content of 60% is needed for optimum composting of dairy manure. Adding dry bulking material such as yardwaste, wood chips, finished compost, or paper pulp helps lower moisture content.

2. Solid-Liquid Separation

Manure can be mechanically separated into a "solid" portion (15-30% dry matter) and a "liquid" portion (4-8% dry matter). Liquids are easier to convey with gravity flow and pump systems than raw manure. Separated solids can potentially be used as stall bedding, spread on cropland, composted, or exported off-farm.

3. Anaerobic Digestion

Experience has shown that anaerobic digestion can almost completely control manure odor. It also produces methane that can be burned in an engine-generator to produce electricity and heat. Internal combustion engines are only 20 – 30% efficient at converting biogas to electricity. Overall utilization efficiency can be increased through the use of heat exchangers, which use some of the waste heat from the engine block to heat water. The hot water is used to heat the manure in the digester in order to increase the rate of biogas production. Skilled operation and management are required to run the biological process, material handling, and energy utilization. Most digesters have high capital costs.

4. Biological Treatment Lagoons

Anaerobic treatment lagoons break down manure solids the same way anaerobic digesters do, but at a slower rate, since lagoons are at ambient rather than elevated temperatures. Large dilution volumes are needed for lagoons to function properly. Treatment lagoons are not popular north of the Mason-Dixon line, because they can only handle a fairly low loading rate due to the shorter biological degradation season. Lagoons also require a large land area. Modified lagoon systems that include some aerobic digestion have reduced odors on some farms in New York State. In one system, shallow settling ponds 1-2 ft. deep settle some manure solids for recovery. From there the liquid effluent is piped to a passively aerated deeper pond. Lastly, effluent from the deep pond is recycled as flush water to clean the barn alleys. This system loses nitrogen to the atmosphere, reducing the fertilizer value for crop production and increasing air emission compliance concerns.

Another system first mechanically separates raw manure into solid and liquid streams. Solid particles in the liquid settle further in a settling pond, a process known as "clarification". Lastly, decanted liquid is treated by mechanical aeration in a long-term storage. Some odor reduction occurs, and the treated liquid can be irrigated onto cropland with a high-pressure, low-volume spray gun.

Further Information

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