Manure Storage Selection

Process Improvement for Animal Feeding Operations

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Introduction

The objective of this fact sheet is to help producers understand the factors that might influence the selection of a particular type of manure storage facility. Manure storage facilities covered include solid systems, slurry systems, and liquid (lagoon systems).

What type of manure storage facility should I select?

Manure storage facilities are one component of an overall manure management system. The design of the overall system considers the production unit, the relationship between manure production and available crop/ land resources, and the producer's goals and objectives. The type of manure storage selected for a particular operation depends upon many factors and considerations and some primary ones are listed below.

1. Manure form or consistency. Manure is usually handled and stored as a solid (> 15% dry matter), slurry (5%-10% dry matter), or liquid (< 5% dry matter). The form or consistency of the manure handled will influence the type of manure storage facility selected.

2. Land application handling method and equipment. If manure is hauled, a solid or slurry is more ideal than a liquid, because more solids and nutrients are contained in each load. If manure is irrigated, a lower solids content may be more ideal for the pumping and nozzle equipment used. Labor and equipment requirements are significantly different for solid vs. liquid or slurry manure land application systems. A different type of manure storage might be used in either case.

3. Nutrient conservation. Solid and slurry systems generally conserve more nutrients than a liquid system. Bacteria can thrive in a liquid system, which results in stabilization and treatment of the manure, but with more nitrogen loss due to volatilization than with a solid or slurry. If nutrient conservation is a high priority (sufficient land availability, high-value crops), then a manure management system that retains a higher portion of the nutrients might be selected. Conversely, if land availability is limited or manure will be spread on low-value crops, nutrient conservation may be a lesser priority than time/labor/ equipment requirements for spreading. Table 1 shows typical values of nitrogen retention and loss when manure is

Table 1

System	Nitrogen Lost, %	Nitrogen Retained, %
Daily scrape and haul	20-35	65-80
Manure pack	20-40	60-80
Open lot	40-55	45-60
Deep pit (poultry)	25-50	50-75
Litter	25-50	50-75
Under floor pit	15-30	70-85
Aboveground tank	10-30	70-90
Holding pond	20-40	60-80
Anaerobic lagoon	70-85	15-30

Adapted from MWPS-18, Livestock Waste Facilities Handbook 1993.

handled and stored in different types of systems.

4. Need for treatment. If treatment is needed for odor control or solids degradation, a lagoon may be considered for both treatment and storage.

5. Space limitations. Limited space at a manure storage site may favor a manure tank rather than an earthen impoundment since less area is required for a tank.

In addition to the primary features noted above, other determining considerations may be associated with different types of manure storage facilities.

Cost and economics of manure storage facilities

The cost of different types of manure storage facilities should be considered in selecting a type of storage structure. However, cost considerations should be integrated into an economic analysis of the entire manure management system. A complete analysis may not support the lowest cost manure storage facility as the best economic choice. Hence, the cost of a manure storage facility should be only part of a group of inputs to a complete economic analysis of the manure management system.

Table 2

Storage Type	Approximate Cost $/1,000 gal
Naturally lined earthen basin	25 to 36
Clay-lined earthen basin using clay onsite	50 to 70
Clay-lined earthen basin using clay from off-farm borrow site (varies with hauling distance)	80 to 100
Earthen basin with plastic liner	100 to 140
Earthen basin lined with concrete	120 to 280
Aboveground pre-cast concrete tank	200 to 250
Aboveground concrete tank poured in place	230 to 270

Cost estimates based on 500,000-gallon storage capacity. Cost per 1,000 gallons will usually be less for larger storages and more for smaller storages. Data from personal communication with John Huntamer, Utah NRCS Area Engineer.

Manure storage facility costs are related to factors such as materials required (concrete, steel), earthmoving and excavation required, labor costs, size of the facility, appurtenances required (pumps, agitators), and a number of additional factors. Costs associated with these factors can be highly variable from one location to another and will change over time. Without specific data on local costs of the inputs noted above, an actual cost for a given type of manure storage facility cannot be accurately estimated. Table 2 shows the costs of different types of manure storage facilities on a “per unit” basis. Actual facility costs at a given location may vary considerably from the costs given in the table. However, the relative cost of the different types of facilities may be more consistent and accurate from one region of the state to another and over time.

Reference: Livestock and Poultry Environmental Stewardship curriculum, lesson authored by Charles Fulhage and John Hoehne, University of Missouri, courtesy of MidWest Plan Service, Iowa State University, Ames, Iowa 50011-3080.