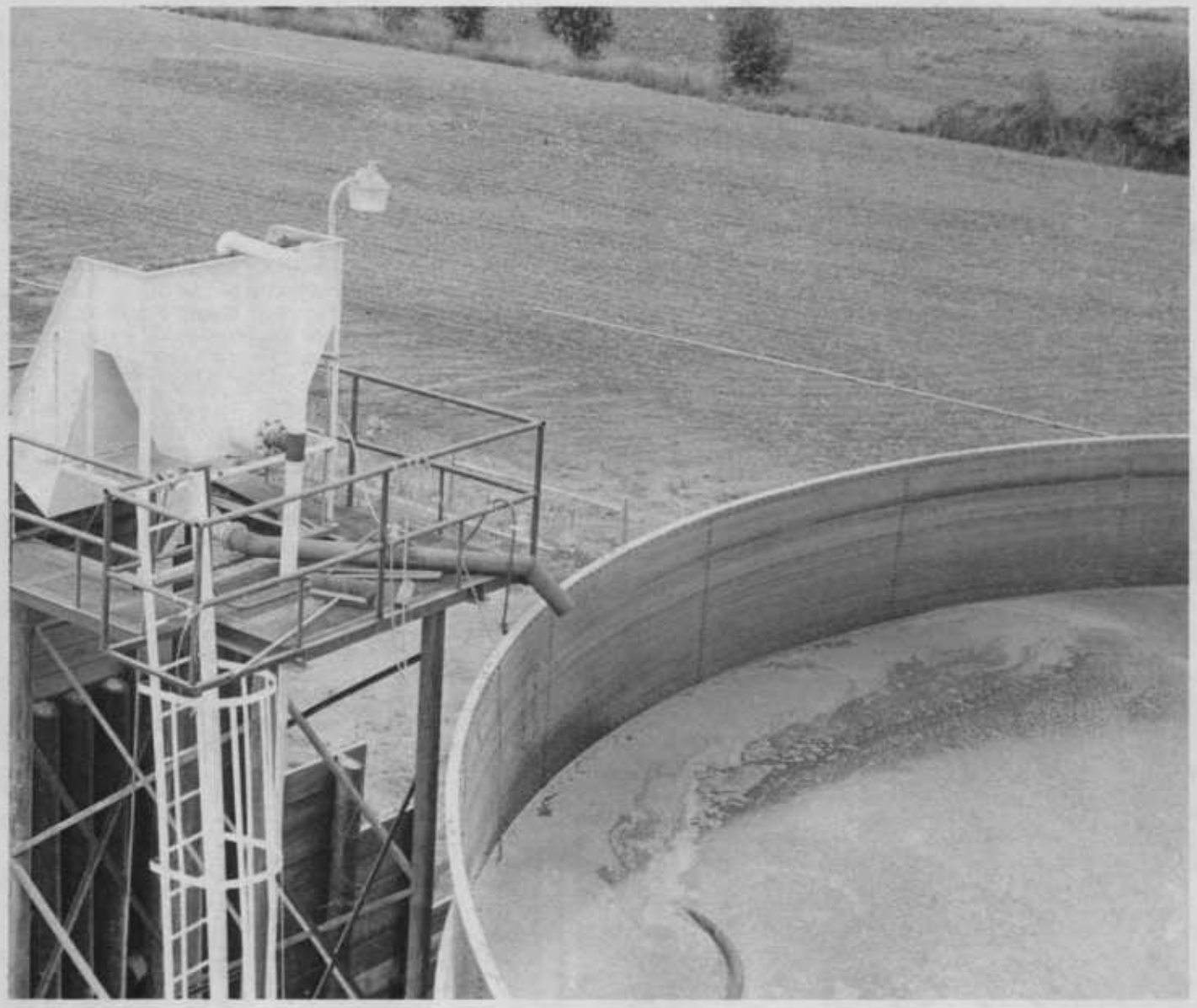
Managing Storage Facilities for Livestock Manure



Extension Circular 1108 / October 1982

OREGON STATE UNIVERSITY EXTENSION SERVICE

All livestock systems have storage facilities. In some cattle feedlots, the manure is stored on the lot surface before being collected and fieldspread. In other systems, manure is scraped into storage areas to await landspreading and utilization. These storage facilities offer options to the management of livestock manures—they increase the flexibility with which the operator must landspread livestock manure, and reduce the number of times it must be done.

Manure generated through the winter season is of greatest concern because of the high precipitation and resulting water pollution potential. A greater percentage of livestock will be confined during this period, thus increasing the volume of manure to be handled.

There are also valid reasons to store manure during the summer. For example, if a crop is growing on the receiving land, you cannot spread manure until after you harvest the crop.

Storage allows the livestock operator to make better use of the nutrients in manure on pasture or cropland. Proper handling of this material reduces the losses of nutrients and organic matter and reduces potential pollution of nearby surface water. Some areas are also concerned about the loss and movement of pathogens from livestock manure to surface waters.

An example will help in understanding how you can manage storage in a manure-handling system. Assume a 100-cow dairy that brings the animals off pasture November 1 and confines them until April 15. Assume you can spread all collected summer manure in late October and start with an empty storage unit on November 1. Assume also that on April 15 you would like the storage full of manure for putting on cropland, to maximize the use of this material as fertilizer in the cropping system.

Very few operators have storage units capable of holding their livestock manure for this 165-day winter season. Assume, in this example, that you have storage capacity to hold all solid and liquid wastes generated in a 45-day period. This means you can store only 27 percent of the manure generated through the winter season. It also means you must spread 120 days' worth (73 percent) of manure on land some time between November 1 and April 15 (165 − 45 = 120 days). To meet the objectives stated above, you must now manage the manure storage unit to maximize use of nutrients and minimize pollution problems with that 120-day supply of manure that must be spread some time during the winter season.

CALCULATE YOUR STORAGE

1. Animal numbers X Volume/day = Volume/day

Our example 100 cows X 1.85 ft^3 = 185 ft^3/day

Your value _____ cows X _____ ft^3 = _____ ft^3/day

2. Add any additional beddings, wash water, etc.:

Our example Wash water- 100 cow X 0.2 ft^3/cow-day = 20 ft^3/day

Your value Wash water- _____ cow X _____ ft^3/cow-day = _____ ft^3/day

3. Days of confinement:

Our example Nov 1 to Ap 15 is 165 days.

Your value _____ to _____ is _____ days.

4. Total volume to be spread (from above):

Our example 185 + 20 = 205 ft^3/d X 165 days - 33825 ft^3

Your value _____ + _____ = _____ ft^3/d X _____ days - _____ ft^3.

5. Your existing storage capacity:

Our example Tank 7.7′ X 40′ X 30′ = 9225 ft^3 ÷ 205 ft^3/d = 45 days

Your value Tank _____ X _____ X _____ = _____ ft^3 ÷ _____ ft^3/d = _____ days

6. Winter spreading requirements:

Our example 165 days - 45 days storage = 120 days to be spread

Your value _____ days - _____ days storage = _____ days to be spread

Evaluation criteria

In deciding where to spread the manure, evaluate all available land that can receive manure and divide it into two categories: one for the land receiving manure through the winter season; the other for land receiving manure through the summer months.

In evaluating your land, consider several factors. Perhaps the most important of these is soil type. Extremely fine-textured soils, which are high in clay, tend to drain or dewater slowly and through the winter months are generally difficult to spread on because they are usually saturated or nearly saturated. This saturated condition makes travel of tankers or manure-spreading equipment very difficult. Even when spreading liquid manure through an irrigation system, do not select these lands for use during the winter season.

In the saturated condition, additions of manure slurry will be forced to move overland and off the receiving site with additional winter rainfall. This will very likely cause pollution problems. To maximize the use of nutrients in manure, it is important to apply it when the soil is not saturated, to allow the manure to move into the soil profile when additional rain falls.

Once into the soil, the nutrients will be retained until they are used by plant growth, and bacteria will be held until they die off through natural causes.

In evaluating and categorizing land, consider also the distance to surface waters. In general, land used to receive manure during the winter should be land that is farthest from the stream or lake. This allows a maximum overland travel distance as the runoff water moves from the site to the stream. A grassy buffer strip between the manure-receiving site and the stream will help prevent nutrients, organisms, and organic matter from draining to surface waters.

When you have a choice of sites, the flatter receiving site offers the better retention of wastes. Steep slopes generally produce more runoff from a rainfall than the flatter sites. In spreading manure, a moderate application rate is suggested. Heavy application rates provide greater likelihood that not all of the manure will move down into the soil profile— leaving some on the surface to move overland and off the site.

After you have evaluated and categorized all the receiving land, you can begin to manage your livestock waste handling system. Frequency and duration of nonrainfall periods is of greatest importance. Referring back to the example, recognize that you must spread 120 days' worth of manure onto land some time during the winter. Obviously, to maximize the use of this material, spread it during good weather periods that occur through the winter months.

Utilize good weather

The best tool to predict these breaks is a good weather-forecasting system. With the help of good information, you can select those times during the winter season that will allow spreading of manure on relatively dry ground. By using the best winter-receiving land and watching the weather, you can reduce surface water pollution potential and maximize nutrient utilization.

This approach to managing storage is a concept that few people recognize and practice in today's livestock manure-handling systems. Most operators do not consider emptying their manure storage facility until it is full. To meet the management objectives listed earlier, spread manure whenever the weather permits.

Again, referring to the example, if you get a period of good weather beginning on November 20, only 20 days after beginning to use the storage facility, spread manure, even though you have 25 days of storage capacity left. This will allow you to spread 20 days of the 120 days of winter manure that will accumulate. It also means that you now have only 100 days of manure to spread some time between November 21 and April 15.

If you wait until the storage facility is full and must be emptied, you may be in an unfavorable weather pattern. Using weather forecasting, you should spread your 120 days' worth of manure any time during the 165-day winter season that the weather reports indicate will be favorable.

If you should experience a 45-day period of rainy, wet weather, the storage facility will be full. On the 46th day, spread only one day's worth, or perhaps two, of manure. As soon as the weather breaks and you get an opportunity to spread in good weather and on relatively dry soil, empty part or all of the storage facility and maximize the utilization of this material.

By accepting this management philosophy, you may empty your manure storage facility more frequently than you presently do. However, by using the land when it is capable of receiving manure, you will maximize the benefits of the nutrients and minimize any pollution potential from nutrients and organisms. Once you accept the philosophy that you must spread 120 days' worth of manure some time during the winter, you might as well maximize the use of this material and spread it on land that will receive and store the nutrients until they are used next spring.

This discussion has only covered days of manure in storage. To determine the volume of storage, you must figure in the values of manure generated per animal per day (table 1). Calculate total manure volume by multiplying the waste generated per animal times the number of animals, times the number of days of storage. To this volume additional sources of waste such as spilled water and feed, bedding, milking parlor wastewater, and other types must be added. Multiply all areas that drain precipitation into the holding unit (in square feet) times the feet of rainfall received during the storage period. You can usually neglect evaporation during the winter season. Then summarize all these sources to determine the total waste volume and number of days of effective storage in the livestock system (see chart on page 2).

Additional manure storage capacity is beneficial. Of perhaps equal importance is the *proper management of existing storage* in a livestock waste handling system.

Table 1.—Total production of manure from various farm animals

Animal	Animal size (lb)	Total manure production			% water
		lb/day	cu ft/day	gal/day	
Dairy	150	12.0	0.19	1.5	87
	250	20.0	0.32	2.4	87
	500	41.0	0.66	5.0	87
	1,000	82.0	1.32	9.9	87
	1,400	115.0	1.85	13.9	87
Beef cattle	500	30.0	0.50	3.8	88
	750	45.0	0.75	5.6	88
	1,000	60.0	1.0	7.5	88
	1,250	75.0	1.2	9.4	88
Cow		63.0	1.05	7.9	88
Swine					
Nursery pig	35	2.3	0.038	0.27	91
Growing pig	65	4.2	0.070	0.48	91
Finishing pig	150	9.8	0.16	1.13	91
	200	13.0	0.22	1.5	91
Gestate sow	275	8.9	0.15	1.1	91
Sow & litter	375	33.0	0.54	4.0	91
Boar	350	11.0	0.19	1.4	91
Sheep	100	4.0	0.062	0.46	75
Poultry					
Layers	4	0.21	0.0035	0.027	75
Broilers	2	0.14	0.0024	0.018	75
Horse	1,000	45.0	0.75	5.6	79

Source: *Livestock Waste Facilities Handbook,* Midwest Plan Service No. 18.

Do not wait until the storage pond is full to begin to sprinkle on cropland. Pump down liquid hold facilities when the weather and crops permit.

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This publication was prepared by James A. Moore, Extension agricultural engineer, and Ted L. Willrich, professor emeritus of agricultural engineering, Oregon State University. Partial support was provided by Federal funds from the Oregon Department of Environmental Quality and the Soil and Water Conservation Commission for the Confined Animal Feeding Operations project, conducted by Agri-Check, Inc.

Extension Service, Oregon State University, Corvallis, Henry A. Wadsworth, director. This publication was produced and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Extension work is a cooperative program of Oregon State University, the U. S. Department of Agriculture, and Oregon counties.