1998

EC98-749 Farm*A*Syst Nebraska's System for Assessing Water Contamination Risk Fact Sheet 12: Improving Silage Storage

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Farm•A•Syst

FACT SHEET 12

Nebraska's Farm Assessment System for Assessing the Risk of Water Contamination

Improving Silage Storage

Silage is an important feed for livestock-based agriculture. When properly harvested and stored, silage poses little or no pollution threat, but improper handling can lead to a significant flow of silage juices (or leachate) from the silo. Leachate is an organic liquid that results from pressure in the silo or from extra water entering the silo. It is usually a problem only when silage is fresh, or just after storage. This loss of leachate represents a loss of nutrient value from the silage.

Silage liquid is often highly acidic and can be corrosive to concrete and steel. If it enters a stream, its high organic content feeds bacteria that rob the water of oxygen. The oxygen demand of silage liquid is 100 to 200 times greater than raw municipal sewage. Leachate from 300 tons of high-moisture silage has been compared to the sewage generated daily by a city of 80,000 people.

Along with the pollutants found in silage leachate, an even greater potential threat is that the low pH created by the presence of acids in silage leachate can free up and release naturally occurring metals in the soil and aquifer, which can increase their concentrations in groundwater. Groundwater contaminated with silage juices also has a disagreeable odor and shows increased levels of acidity, ammonia, nitrates, and iron.

Nitrate is another important potential contaminant to consider. Levels of 20-40 milligrams per liter (mg/l; equivalent to parts per million in water measure) can cause livestock problems, especially if feed contains more than 1,000 ppm nitrate-nitrogen. Water with levels over 100 mg/l nitrate-nitrogen should not be used for livestock. Water with over 10 mg/l nitrate-nitrogen should not be used for infants under six months of age.

1. Silage moisture content

The volume and concentration of leachate (silage juices) produced varies with the material stored, its moisture and nitrogen content, and handling and storage conditions. Of these, moisture is the most crucial.

Research indicates that materials stored at 65 percent moisture content or higher can produce leachate. For grass silage, the amount produced varies from a trickle at 75 percent moisture to 79 gallons per ton at 85 percent moisture. About three quarters of the leachate is produced in the first three weeks of storage, although it can continue to flow for up to three months.

Farmers can use several methods to reduce leachate production from silage. The most effective of these is allowing the material to wilt in the field for 24 hours. Although this may not always be possible in a humid climate, it has reduced moisture content by 10-30 percent and leachate production by 100 percent. Other methods include varying cutting and harvesting times, cutting or crimping the materials, or adding moisture-absorbent materials to the silage as it is stored.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture.
Elbert C. Dickey, Interim Director of Cooperative Extension, University of Nebraska, Institute of Agriculture and Natural Resources.

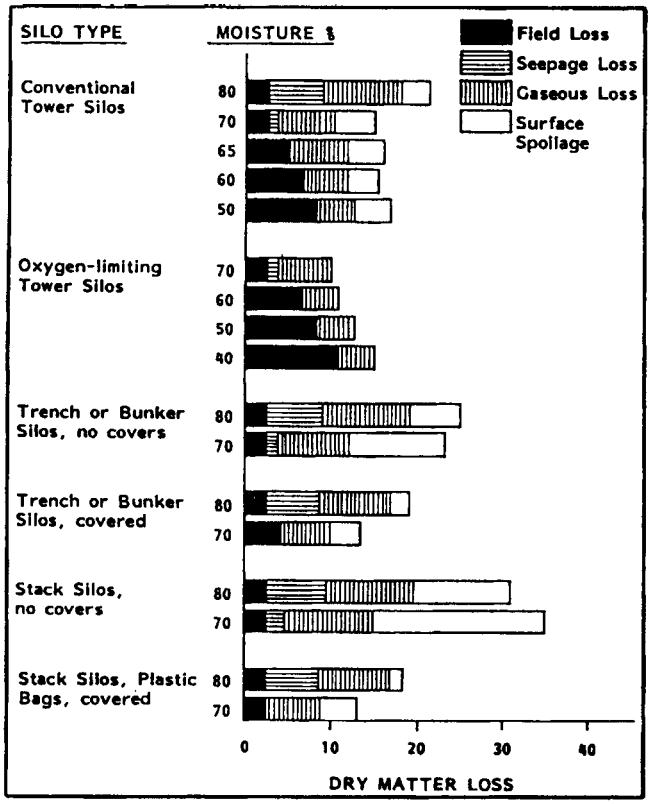

Figure 1. Estimated silage storage losses for various moisture contents and silo types. Source: *Beef Housing and Equipment Handbook,* MWPS-6, Fourth Edition, 1987, Midwest Plan Service, Ames, Iowa.

Adding absorbent materials also reduces leachate. Materials that are used include oat meal, dried sugar beet pulp, dried corn cobs, ground corn, newsprint, and bentonite clay. Most of these materials will absorb from one to three times their weight in water, and, to be effective, enough must be added to absorb the anticipated leachate.

2. Silage storage

Most harvested silage is characterized as low-moisture silage. The crop is allowed to wilt to the proper moisture content before chopping to ensure proper ensiling.

3. Silo location

To prevent possible well contamination, silos should be located as far away from wells as practical. Regulations do not define appropriate setback distances for Nebraska. However, because of the high concentration of degradable organics and nutrients in silage juice, it should be given equal or greater clearance as septic tanks or leach fields. Wells should be located at least 50 feet from septic tanks and 100 feet from leach fields. These setback distances should be considered a minimum for silos and temporary silage storage such as silage bags.

Minimum separation distances regulate new well installations. Existing wells are required by law only to meet separation requirements in effect at the time of well construction. Make every effort, however, to exceed "old requirements," and strive to meet current regulations whenever possible.

4. Silo design and construction

Silage put into horizontal silos is typically at a higher moisture content. Tower silos can produce significant amounts of silage juice depending on the crop and its moisture content. Most tower silos being built today have interiors made of concrete or, in the case of oxygen-limiting silos, a glass-like coating over steel. Silage stored in glass-lined silos typically has a lower moisture content and poses a low risk of groundwater contamination. It is possible, though, for some liquid to leak out.

Many older silos may have dirt floors or may have been dug into the subsoil 3-6 feet below ground level, adding to the potential groundwater risks from silage juice. Horizontal trench silos excavated into the

ground may affect groundwater, especially in coarse soils and sites close to the water table. Properly compacted clay soils and concrete floors can limit leachate seepage. Silage bags generally store silage of higher moisture content. Liquid can pool in the bag and leak out when it is opened.

Silo caps or covers keep rain water from entering the silage, preserving a quality silage, but also reducing the potential for producing leachate. Horizontal silos should be covered with a plastic sheet. Tires or other material can be used to keep the cover in place.

It is important to divert surface runoff water away from new and existing silage storage structures. For both vertical and horizontal silos, diverting surface runoff away from silage can protect both groundwater and surface water as well as assist in maintaining silage quality.

5. Leachate collection and disposal

Leachate can be collected from tower and horizontal silos by channeling the liquid into a water retention structure, usually a pond lined with concrete, clay, or plastic. Drain tiles around tower silos can be used to collect any seepage from the silo. Horizontal silos use channels and sloping concrete pads to direct seepage into a collection area.

The most cost-effective disposal method is land spreading (see *Figure 3*). Nitrogen in leachate has significant fertilizer value if applied during spring or early summer. Because of its high organic content, leachate can burn grasses and remove oxygen from the soil. Farmers who consider land spreading should consult a soil specialist to determine how much leachate can be safely spread on each field.

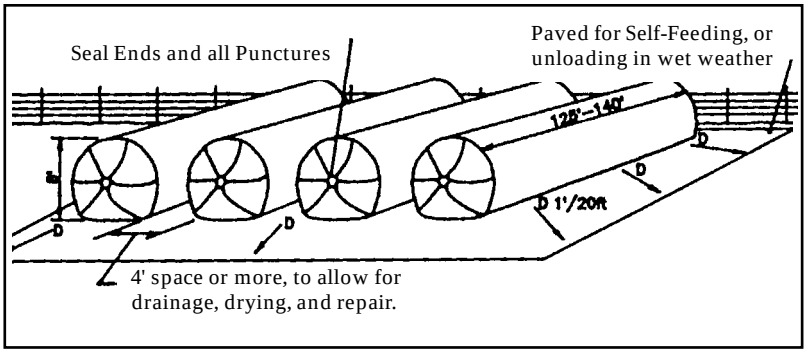

Figure 2: Recommended site for silage bag. Source: *Beef Housing and Equipment Handbook*, MWPS-6, Fourth Edition, 1987, Midwest Plan Service, Ames, Iowa.

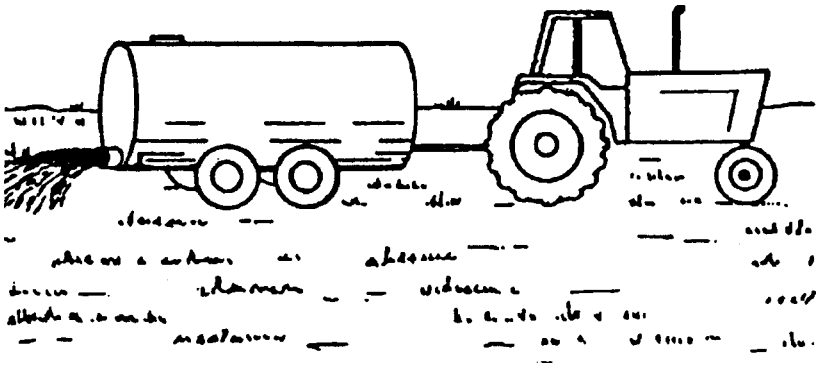

Figure 3: Land-spreading of silo leachate uses conventional liquid manure application equipment. Adapted from *Livestock Waste Facilities Handbook*, MWPS-18, Midwest Plan Service. Adapted by Andy Hopfensperger, University of Wisconsin-Madison Department of Agricultural Engineering.

CONTACTS AND REFERENCES

Who to call about...

Silage Management:
Your local University of Nebraska Cooperative Extension office or the Department of Agricultural Engineering or Agronomy, University of Nebraska-Lincoln.

Silo construction guidelines:
Available for tower silos from the International Silo Association, 8725 Rosehill, Suite 210, Lenexa, KS 66215, (913) 599-1919.

What to read about...

Publications are available from sources listed at the end of the reference section. (Refer to number in parentheses after each publication.)

Drinking Water Quality

Perspectives on Nitrates, Extension Circular EC90-2502. $2. (1)

Understanding Groundwater, NebGuide G93-1128. (1)

Drinking Water: Bacteria. NebGuide G90-989. (1)

Water Testing Laboratories, NebGuide G89-907. (1)

Well Water, Nitrates, and the "Blue Baby" Syndrome, NebFact NF91-49. (1)

Animal health effects of nitrates:

Water Quality and Requirements for Dairy Cattle, NebGuide G93-1138. (1)

Nitrates in Livestock Feeding, NebGuide G74-170. (1)

Livestock Water Quality, NebGuide G79-467. (1)

Perspectives on Nitrates, Extension Circular EC90-2502. $2. (1)

Design criteria and general information:

Dairy Housing and Equipment Handbook, Midwest Plan Service. MWPS-7. $20. (2)

Beef Housing and Equipment Handbook, Midwest Plan Service. MWPS-6. $7. (2)

Farm and Home Concrete Handbook, Midwest Plan Service. MWPS-35. $6. (2)

Silage Management:

Dairy Feeding System, Northeast Regional Agricultural Engineering Service. NRAES-38. $25. (2)

Silage Production from Seed to Animal, Northeast Regional Agricultural Engineering Service. NRAES-67. $25. (2)

Silage and Hay Preservation, Northeast Regional Agricultural Engineering Service. NRAES-5. $8. (2)

Publications available from...

1. Your local University of Nebraska Cooperative Extension office or directly from IANR Communications and Information Technology, University of Nebraska-Lincoln, 105 Ag Communications Building, P.O. Box 830918, Lincoln, NE 68583-0918, (402) 472-9712.

2. MWPS publications are available through your local University of Nebraska Cooperative Extension office or Agricultural Engineering Plan Service, University of Nebraska-Lincoln, 219A LW Chase Hall, P.O. Box 830727, Lincoln, NE 68583-0727, (402) 472-1646.

Partial funding for materials, adaptation, and development was provided by the U.S. EPA, Region VII (Pollution Prevention Incentives for States and Nonpoint Source Programs) adn USDA (Central Blue Valley Water Quality HUA). This project was coordinated at the Department of Biological Systems Engineering, Cooperative Extension Division, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln.

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The views expressed in this publication are those of the atuhor and do not necessarily reflect the views of either the technical reviewers or the agencies they represent.

Adapted for Nebraska from material prepared for the Wisconsin and Minnesota Farm*A*Syst programs, written by David W. Kammel, University of Wisconsin and Nick Houtman, University of Maine.

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