Maine Farm-A-Syst

Farmstead Assessment System Fact Sheet 9

Reducing the Risk of Groundwater Contamination by Improving Silage Storage

Silage moisture content

Silage can be made from corn, small grains, grass and legume crops, and canning company wastes, such as from sweet corn processing. The amount 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.

Topics Covered:

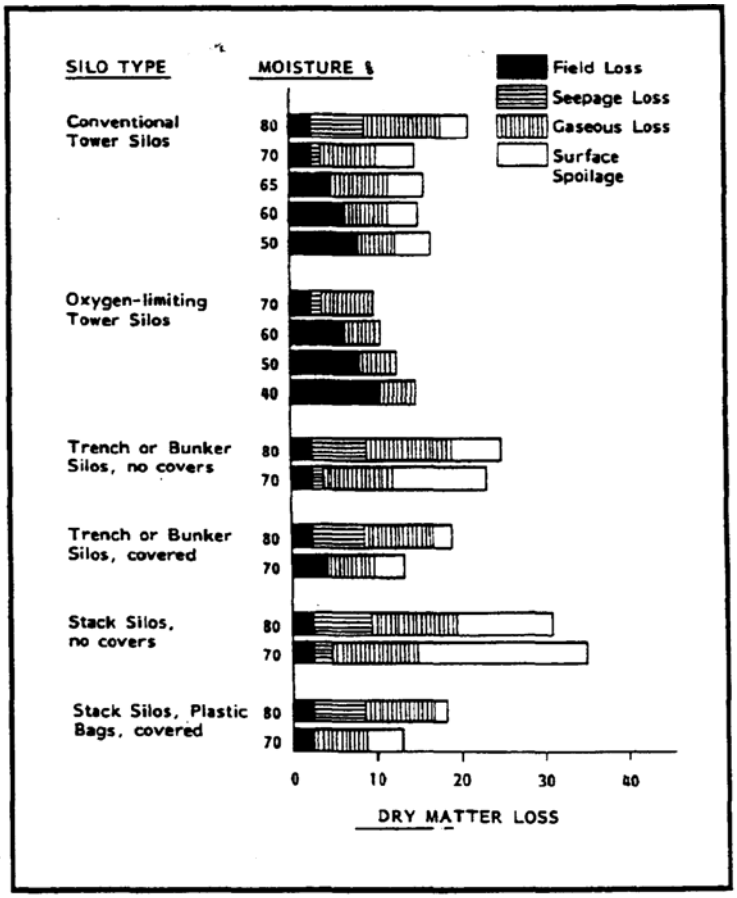

Figure 1: Chart of silage moisture content.
Source: Beef Housing and Equipment Handbook, MWPS-6, Fourth Edition, 1987, Midwest Plan Service, Ames, Iowa.

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 like Maine's, it may reduce moisture content by 10 percent and leachate production by 100 percent. Other methods include varying cutting and harvesting times, crimping or conditioning the materials, or adding moisture-absorbent materials to the silage as it is stored.

Adding absorbent materials not only reduces leachate, but it also raises the nutrient value of the silage. Materials to use may include oat meal, dried sugar beet pulp, dried corn cobs or ground corn, barley, and oats. 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.

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. Silage put into horizontal bunkers or silos is typically at a higher moisture content. Haylage stored in tower silos has been reported to produce significant amounts of silage juice when stored at high moisture levels. Although many older silos may have dirt floors or may have been dug into the subsoil 3-6 feet below ground level, new silos are built with concrete foundations and floors.

Bunker or trench silos on bare ground can threaten groundwater.

Silo location

To prevent possible well contamination, the silo should be located as far away from wells as practical. Silos with a pit, or without a pit but with a concrete floor and drain, must also be at least 50 feet from a well. Earthen trenches or pits should be at least 250 feet away from a well.

Silo design and construction

Silo construction for most agricultural uses is not regulated in Maine. Most silos being constructed in Maine are made of concrete (pre-cast) or are trench silos with earthen walls. Many producers are also using silo bags or individually wrapped balage. Silo bags generally store silage of higher moisture content. Liquid can pool in the bag and leak out when it is opened.

It is important to divert clean water away from new and existing silage storage structures. For both vertical and horizontal silos, diverting clean water away from silage can protect both groundwater and surface water.

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.

The type of silo on your farm often has less effect on its potential to contaminate groundwater than the condition of the silo. For example, an old wooden silo with an earthen floor poses a higher risk than a concrete horizontal silo with a concrete floor (see Figure 2). Older structures can be relined to make them relatively watertight.

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

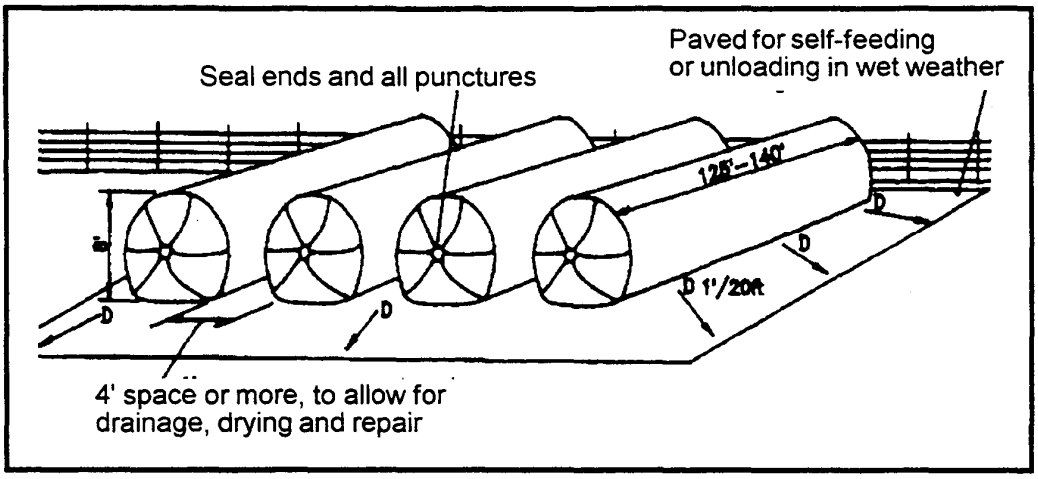

Figure 2: .*Horizontal silo. Source: Beef Housing and Equipment Handbook*, MWPS-6, Fourth Edition, 1987, Midwest Plan Service, Ames, Iowa.

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 or into manure storage structure. Drain tiles around tower silos can be used to collect any seepage from the silo. Horizontal silos use channels to direct seepage into a collection area. Contact your county Extension office or Natural Resources Conservation Service office for assistance with design.

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.

The most cost-effective disposal method for leachate 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 acid content, leachate can burn grasses and remove oxygen from the soil. Farmers who consider land spreading should consult a soil specialist and follow their Nutrient management plan (NMP) recommendation to determine how much leachate can be safely spread on each field.

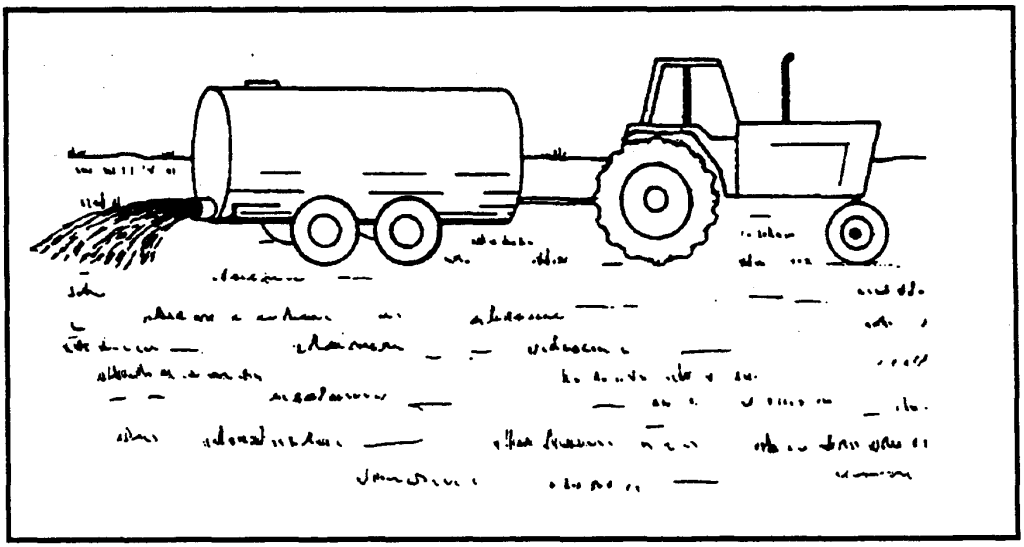

Figure 3: Land-spreading of silo leachate.Adaptedfrom Livestock Waste Facilities Handbook, MWPS-18, Midwest Plan Service. Adapted by Andy Hopfensperger, University of Wisconsin-Madison Department ofAgri cultural Engineering.

Source Water Protection / Wellhead Protection Area

Almost half of Maine's population depends on groundwater for its drinking water supply from either private or public wells. We are lucky to have some of the best water supplies in the world, and it is our job to keep them safe. Being aware of potential problems on your property that might pollute drinking water sources is important. You may not even know that there is a potential threat. Taking the time to read and fill out the applicable Farm-A-Syst sections is a great first step. From there you will sit down with a district employee or someone trained in Farm-A-Syst to discuss some possible solutions such as best management practices (BMP) that can be applied. BMPs are a method, measure, or practice that, when correctly installed or performed, will prevent, reduce, or minimize water pollution. In this case, the focus is on drinking water supplies and the areas that provide them with water.

There are some laws that pertain to areas within a source water protection zone that don't apply to other landowners. Be sure to check with your local water district and municipality for local ordinances or if you are unsure if you live in a source water protection area.

It is the landowner's responsibility to know local and state laws pertaining to their land, although it is hard to navigate sites and wade through the legal jargon of written laws.

If you are living or operating in a source water protection area (the surface and subsurface areas surrounding a drinking water supply for a public water system where activities can contaminate the supply) or wellhead protection area (an area used to protect groundwater, a form of source water) you should pay extra special attention. We have tried to find pertinent information pertaining to this section. You can find links to these laws along with helpful information in the following Contact & Reference section as well as in appendices A: Law and Regulations & B: Resources.

The following, authored by Maine Drinking water program, is excerpted from the document "Best Management practices for Groundwater Protection". This manual is intended for the use of local officials, public water suppliers and landowners in Maine. It is intended to

encourage educated decisions, informed practice, and directed planning in regard to groundwater protection, particularly in the vicinity of public drinking water supply wells. http://www.maine.gov/dhhs/eng/water/forms/Sections/BMPv2%200A.htm

A. Chemical Storage

Definition: Chemical storage includes storage in tanks (above and underground), and in drums or other containers. It can also include storage of solid chemicals in bags, or in bulk (in piles or silos). If you use silos for this purpose it is recommended that you take the time to read the whole section A. Chemical Storage. It is 2 pages long.

CONTACTS AND REFERENCES

Who to call about...

Silo design and construction

Your county Extension office
University of Maine Cooperative Extension (800) 287-0274
Your county NRCS office

Silo construction guidelines

Available for tower silos from the International Silo Association, (913) 599-1919
8725 Rosehill, Suite 210, Lenexa, Kansas 66215
NRCS

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.)

Nitrates: Groundwater and livestock Health. University of Maine Cooperative Extension Water Quality. Bulletin #7086. (1)

Nitrate: Health Effects in Drinking Water. University of Maine Cooperative Extension Water Quality Fact Sheet #22, Publication # 7107. (1)

Design criteria and general information

Dairy Housing and Equipment Handbook. University of Maine Cooperative Extension Bulletin #1020; $7.00. (1)
Farm and Home Concrete Handbook. Midwest Plan Service. MWPS-35. (2)

General information about silage

Silage Additives. Part 1: Can You Justify a Silage Additive? University of Maine Cooperative Extension Bulletin #2178; Free. (1)
Silage Additives, Part 2: .Inoculants and Enzymes. University of Maine Cooperative Extension Bulletin #2179; Free. (1)
Silage and Hay Preservation. University of Maine Cooperative Extension Bulletin #1138; Free. (1)

Publications available from...

1. Your county Extension office. There may be charges for publications, postage and sales tax.
2. Your county NRCS office.
2. Your county Extension office or the Midwest Plan Service Secretary, Agricultural Engineering Department, 460 Henry Mall. University of Wisconsin, Madison, Wisconsin 53706, (608)262-3310.

Websites:

This link will take you to the Natural Resources Conservation Service (NRCS) Conservation Practice Standards. Here you can find technical guides that are the primary scientific references for NRCS. They contain technical information about the conservation of soil, water, air, and related plant and animal resources.
http://efotg.nrcs.usda.gov/treemenuFS.aspx

Below is a link to "Manual of Best Management Practices for Maine Agriculture" put out by the Maine Department of Agriculture, Food & Rural Resources Division of Animal Health & Industry. January 2007. This resource has links to many different BMPs that apply to a farm.
http://mainegov-images.informe.org/agriculture/narr/documents/BMPManual2007.pdf
This manual doesn't have any of the actual BMPs written out. It is literally a guide that will lead you to other links. To make things a little easier you will find direct links to BMPs suggested by the manual that pertain to this specific section.

- **Preventing Silage Storage Losses.** University of Wisconsin/U.S. Dairy Forage Research Center,
  http://www.uwex.edu/ces/crops/uwforage/storage.htm

- **Reducing the Risk of Groundwater Contamination by Improving Silage Storage.** Washington State University, Fact Sheet 9, Pub. EB 1746-F9,
  http://cru.cahe.wsu.edu/CEPublications/eb1746-f9/eb1746-f9.html

- **Silage Leachate & Water Quality.** Environmental Quality Technical Note N5, USDA, NRCS.
  http://www.info.usda.gov/CED/ftp/CED/neh651-ch4.pdf

- **Environmental Factors to Consider When Expanding Dairies**. NRAES – 95,
  www.nraes.org and the direct link is:
  http://www.nraes.org/nra_order.taf?_function=detail&pr_id=81&_UserReference=B6F72AA5ACE0D91547BDD793

Maine Department of Agriculture's Animal Health & Industry Natural and Rural Resources "Manual of Best Management Practices (BMP) for Maine Agriculture."
Go to page 36 for the section entitled "13. silage management."
http://www.maine.gov/agriculture/narr/documents/

University of Maine Cooperative Extension: "Nitrate, Groundwater and Livestock Health"
http://www.umext.maine.edu/waterquality/Publications/7086.htm

University of Maine Cooperative Extension: "Nitrate: Health effects in drinking water".
http://extensionpubs.umext.maine.edu/ePOS/form=robots/item.html&item_number=7107&store=413&design=413

http://www.maine.gov/dhhs/eng/water/forms/Sections/BMPv2%200A.htm

See "Appendix A: Laws and Regulations" and "Appendix B: Resources" for additional links.

Acknowledgments

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Original Fact Sheet #9 Adapted by John Jemison, Jr., and Richard J. Kersbergen, University of Maine Cooperative Extension. 1995.