

Silage Seepage: A Farm Problem Worth Avoiding

Scenario

A neighbour has contacted the Department of Environment regarding a dark liquid, with a terrible smell, that has appeared in a roadside ditch as well as a nearby brook. The neighbour believes that your farm is to blame.



Figure 1: Seepage from an upright silo

An inspector from the Department of Environment visits your farm and seepage from a silo is identified to be the source of the problem (Figure 1). You are then notified that you are in violation of the Environment Act because you allowed the release of a deleterious substance into a watercourse.

What is Silage Seepage?

Silage seepage, also known as effluent or leachate, is a by-product of silage production. Silage seepage is one of the most polluting organic materials that a farm produces. It is highly acidic and extremely corrosive.

It also has an extremely high biochemical oxygen demand (Table 1). Biochemical oxygen demand (BOD) is a measure of the amount of oxygen consumed by micro-organisms while breaking down contaminants in water. If silage seepage is allowed to enter a water system, it can rapidly deplete oxygen and has the potential to cause fish kills.

Table 1. Comparison of farm wastes

Wastewater	BOD range (mg L ⁻¹)
Clean water	<4
Parlour wash water	1,000
Liquid manure	10,000-35,000
Silage effluent	12,000-120,000

Factors Affecting Silage Quality

Moisture Content is the most important factor that influences silage quality. Silage with greater than 70% moisture content increases the chances of undesirable bacteria developing. Conversely, silage that is too dry may not undergo proper fermentation.

During the fermentation process, lactic acid bacteria thrive and work towards lowering the silage pH. At high moistures, the pH must be reduced further so that butyric acids are not formed, which reduce quality and palatability of the silage. The fermentation process is complete and the silage is preserved when a stable pH is reached.

The moisture content at which harvesting should take place depends on the structure in which the silage will be stored. To minimize silage seepage and ensure good fermentation the moisture content should be:

- **65% – 68% for bunker silos**
- **60% - 65% for upright silos**
- **55% - 65% for silage bags**

The best way to avoid seepage is to wilt forage until the moisture content is below the critical point for storage. Prior to harvesting corn silage, check to make sure that there is at least 1/3 milklane on the kernel for bunkers and 1/2 to 2/3 milklane when the silage is to be stored in an upright silo. At best this is a rough estimate of whole plant moisture. To more accurately measure the moisture content, walk through the field and cut 10-15 stalks, at the height you plan to harvest. Try to select stalks that are representative of the entire field (outer stalks tend to be drier than stalks in the middle of the field). Run the stalks through the harvester.

Moisture Content Test

- Weigh 100 g of silage.
- Dry the sample using a Koster moisture tester or microwave.
- Weigh the dried silage.

$$\% \text{Moisture} = \frac{\text{fresh weight} - \text{dry weight}}{\text{fresh weight}} \times 100$$

- Over-time you should be able to gauge moisture content of silage.

Drying with a Microwave

Select medium heat and place a cup of water at the back of the microwave with the sample to reduce burning. Every two minutes weigh the sample. Test every minute as the sample dries. Stop drying when the weight remains the same.

It is important to note that not all fields will be ready to harvest at the same time. Moisture content will depend on the variety, planting date and field conditions. Because of the narrow window for corn silage harvesting in the Maritime provinces, it is important to select an early maturing variety with corn heat unit requirements to match your growing area.

Reasons to harvest silage at the correct moisture content:

- Limited silage seepage
- Low risk of land and water pollution
- Reduced corrosion and deterioration of the silo
- Reduced dry matter loss
- Reduced loss of sugars and simple proteins in the silage
- Reduced chance of secondary fermentation
- Increased palatability
- Minimized unloading problems in upright silos

Silage Seepage Production

Most seepage will occur within 5 to 10 days of ensiling. However seepage will continue for the next 30 days. Silos with poor internal drainage (i.e. no floor drains) can continue to experience seepage for the entire silage storage period.

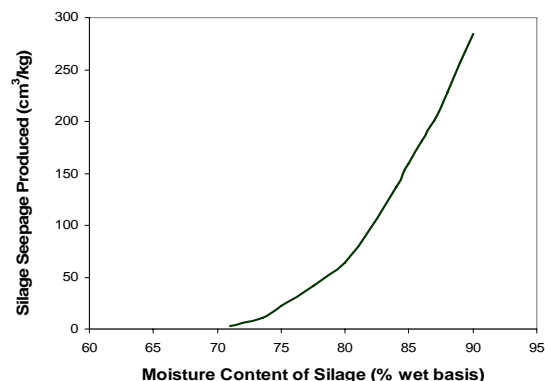


Figure 2: Volume of silage seepage produced at different moisture contents

The volume of seepage produced increases exponentially as the moisture content increases (Figure 2). Rainwater entering the pile can also contribute to silage seepage in bunker silos and silage piles. Therefore, it is important that rainwater is prevented from entering the bunk by using berms, drainage ditches and by properly covering the pile (Figure 3).



Figure 3: A properly covered bunker silo

Inoculants and enzymes have become a popular way to enhance silage fermentation and improve nutritive value. Research suggests that they can improve forage digestibility and milk production. However, increased seepage can occur in high moisture and/or short chop silages.

Best Management Practices

The following practices can be implemented to reduce the potential for silage seepage contaminating both surface and ground water systems.

Crop Practices

- Regularly check the local weather forecast when making mowing decisions. Do not mow more forage than can be picked up the following day.
- Ensure that your mower conditioner is set to maximize wilting speed, especially in cooler and humid weather.
- Wilt cut grass until it reaches the desired moisture content.

- Increase the swath width or ted out the windrows to decrease drying time.
- Check the dry matter content prior to harvesting.
- Consider leaving a longer chop length. While shorter chop lengths compact more easily in a silo, short chop has an increased potential for seepage.

Adjustments to speed crop drying

- *Wide windrows* dry faster. Open your mower as wide as practical.
- *Cutting in the morning* increases drying (evapotranspiration) with increased exposure to sunlight and warmer temperatures throughout the day.
- *Conditioning* increases moisture loss by crimping or scuffing the plant. Moisture losses may increase with crimping every 8 cm or increasing the speed of the impellers and narrowing the gap between the conditioning hood. Conditioning may not be useful at high moistures (>60%).

Silo Site Selection & Maintenance

- Locate silage storage structures a minimum of 100 m from wells and surface water sources such as streams, ditches, tile inlets, ponds, wetlands and intermittent watercourses.
- Store silage piles on a concrete pad when soils are well drained (sandy or gravelly soils).
- Inspect silos and bunks annually to ensure that they are in good condition with no cracks in the floor or walls.

Silage Seepage Collection Systems

If you cannot avoid high-moisture silage a system to collect and store seepage should be installed or a collection sump should be used to transfer seepage to an uncovered liquid manure storage. It is important that the holding tank, pump and transfer lines are capable of handling this acidic material.

Warning – Poisonous Gases

Systems for storing silage effluent must be specifically designed and operated in such a way as to reduce the hazard of poisonous gases.

Systems to collect seepage should be sized according to the estimated amount of effluent and surface water that will be collected and the frequency at which the tank will be emptied. It is important to remember to empty the tank since overflows create a pollution problem. All seepage collection and transfer systems should be designed by a qualified engineer. Collection systems should be regularly monitored for signs of deterioration. Properly trained workers should only be allowed to enter the storage tank and a self contained breathing apparatus should be worn. Warning signs should be posted.

Silage Seepage Disposal

One way to dispose of seepage is by land application using a liquid manure spreader. To reduce the risk of water pollution and crop damage the following precautions should be taken:

- Dilute the seepage at 1:10 with water and spread at a rate of 25,000 L/ha.
- Ensure the application rate does not exceed the nutrient requirements of the crop.
- Include silage seepage as a nutrient source in your Nutrient Management Plan.

- Maintain minimum separation distances of 60 m from wells, 5 m from all watercourses and 3 m from agricultural ditches.
- Do not apply to dry, cracked soils or during times of hot weather.

Seepage can also be pumped from a holding tank directly into a liquid manure storage. It is important to note that seepage should never be added to a manure storage located below a barn or to enclosed storage tanks. When seepage and manure are mixed hydrogen sulphide or other poisonous gases can be produced.

What about treatment wetlands?

While constructed wetlands can be used to treat runoff from solid manure storages they are not capable of treating silage seepage. Therefore, even small volumes of silage seepage should never be allowed to drain to a vegetated area.

Legislation

Silage seepage, like many other farm liquid wastes, is not specifically regulated although it is classified as a deleterious substance. A substance is considered deleterious if it has the potential to degrade or alter water quality to the point that fish or fish habitats are harmed. Release of such pollutants into a watercourse can trigger charges under four separate pieces of legislation. Deleterious substances must be contained, handled and disposed of in a manner which prevents their entry into water systems.