

Considerations for early winter applications of manure

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Farms with livestock have the unique advantage of producing a valuable by-product, manure, which has many of the nutrients required for crop production. However, in order for these nutrients to be available to support crop growth, manure has to be applied with consideration for timing, method, and rate. While all these factors are important, properly timing manure application is critical to reducing nutrient loss from fields.

Data gathered by UW Discovery Farms shows that when manure is applied one week or less before a runoff event, the losses of nitrogen and phosphorus are significantly increased even with relatively low application rates. When manure applications are made several weeks or months before runoff occurs, nutrient losses can be reduced by as much as 50 to 75 percent. Understanding the conditions that increase the risk of nutrient loss can help farmers better manage manure throughout the year.

Spreading manure in the winter has unique challenges. Weather conditions that greatly increase the risk of loss include: the presence of concrete frost, development of an ice crust on the soil surface, and the amount and condition of the snow cover. In the late fall and early winter (October - December) in Wisconsin, fields are often harvested and may be frozen. However, there typically is not significant snow cover, concrete frost, or ice crusted soil that is common in late winter. Manure applied during the time period before these conditions develop has a lower chance of losing nutrients through surface runoff than applications made later in the winter (February - March).

Management recommendations for this time period. Farmers with manure storage capacity of three months or more should use the early winter period to make sure that the storage is empty enough to prevent a 'must spread' situation until early April. Farms with limited or no storage should use the early winter period to spread on riskier fields on the farm and save the less risky fields for the later winter, and high runoff, months of February and March. Regardless of whether your farm has storage or not, having a manure spreading plan that outlines the most and least risky fields is important for all periods of the year.

Concrete frost. "Concrete frost" is commonly used to describe a condition when most of the pore space in the surface of the soil is occupied by frozen water. During conditions when snow melts or rain falls in the winter, the water on the soil surface begins to infiltrate the soil and then is frozen when it reaches the frost layer below. In some situations, the upper profile of the soil becomes nearly saturated with water which freezes during the night when temperatures drop below freezing.

Concrete frost decreases the soil's ability to infiltrate water and nutrients or bind with applied manure (the soil is less porous - like concrete). It takes higher temperatures and a longer time to thaw concrete frost compared to frost formed in unsaturated soils. Weather patterns including multiple thaws with melting snow or winter rain events result in substantial development of concrete frost throughout Wisconsin.

Ice crust. While concrete frost can form under a snowpack or on bare soil, ice crusts are formed when rain falls on soils that are very cold. Most commonly, we see crusts develop when rain falls on soils without snow cover. Ice crusts over an inch thick have been observed, but any thickness of ice prevents proper contact of manure to the soil.

Amount and condition of snow cover. There are two important factors to consider when evaluating the risk of manure applied on snow. First, take a look at how much snow is present. If there is more than 6-12 inches in the area you are planning to spread, the manure will not be able to come into contact with the soil. UW Discovery Farms data has shown that manure applied on top of a few inches of snow, especially in the early winter months, does not typically increase the risk of nutrient loss. This is because the manure achieves good soil contact and nutrients can attach to the soil as the sun radiates heat on the dark manure, slowly melting the snow. As the wintertime months progress and the snowpack becomes more dense or concrete frost develops in the soil, the potential for nutrient loss increases. In general, less snow on an area means a better chance for manure to bind with soil and stay in the field when runoff events happen later in the season.

Snow depth is not always a good indicator of the amount of water in the snowpack. During the early winter months, the snow is often light, easily blown around, and not densely packed. On the other hand, the snowpack in late winter or early spring has often undergone some thawing cycles and is typically more dense. A manure application on a few inches of light snow is less risky than the same application on a dense snow pack or slush. Manure applied on dense snow pack or slush has very little chance of binding with the soil before runoff occurs.

Concerns with winter spreading can be addressed if farmers understand the risks associated with varying soil conditions and consider weather forecasts prior to spreading on frozen ground. Spreading just before snowmelt or a winter rain event significantly increases the risk of manure and nutrient movement. Manure applications should also be avoided on deep and/or dense snowpack or if concrete frost or ice crusting of the soil is evident. This is not always possible, so applications made during these conditions should be done on internally drained fields (closed depressions) or low sloped (flat) fields to minimize the potential for loss. The key to reducing nutrient loss during winter manure application is to understand the local conditions and have a winter spreading plan in place.

Resources (available on UW Discovery Farms website):

Komiskey, M.J., Stuntebeck, T.D., Frame, D.R., and Madison, F.W., 2011, Nutrients and sediment in frozen-ground runoff from no-till fields receiving liquid-dairy and solid-beef manures: *Journal of Soil and Water Conservation*, v.66.

Riechers Beef 7. Manure Applications on Frozen and/or Snow Covered Ground