

Considerations for MID AND LATE WINTER manure applications

Winter in Wisconsin is unpredictable. We can expect some combination of snow, frozen ground, ice, warmer periods and even a bit of rain on any given year. Every year, details about how much and when runoff water moves across the land differ slightly. Factors including soil and landscape, influence the volume and timing of runoff, but weather conditions in the local area play the most significant role.

The UW-Discovery Farms Program has monitored enough locations and conditions to show that when manure is applied one week or less before a runoff event, losses of nitrogen and phosphorus are significantly increased even with relatively low application rates. This article outlines the key factors for runoff during the mid and late winter season of February, March, and even April. Farmers should be aware of these conditions and continually assess the situation in their fields before spreading manure.

Factors for runoff

- *Warming temperatures and more intense solar radiation.* Pay attention to the amount of snowpack present and the weather forecast. A rapid and dramatic temperature increase, clear sunny skies or a layer of ice over the soil often lead to higher runoff volumes during the winter months. However, a deep snowpack doesn't always mean that a large amount of that water will end up as surface runoff. Conditions that encourage infiltration of melting snow include the absence of concrete frost in the soil, temperatures just above freezing during the day and cooler at night and foggy or overcast conditions. If you must spread manure during these months, look ahead in the forecast for days that favor infiltration (instead of runoff) of melting snow.
- *Rain on frozen/snow-covered ground.* Rain events during the winter time have a strong potential to quickly generate surface runoff. The rain causes snow to rapidly melt from the top of the snowpack first, leaving little chance for infiltration into the soil. If rain occurs on frozen ground with no snow, concrete frost in the top several inches of the soil can inhibit water from entering the soil profile. Discovery Farms data shows that almost all winter runoff events in December and January (75%) are the result of a rain event on frozen or snow-covered ground. During February and March, warmer temperatures during the day lead to more frequent rain events than earlier in the winter. Pay special attention to whether rain is forecasted within the week, as even a small amount of rain (less than $\frac{1}{4}$ of an inch) can cause runoff when the ground is frozen or snow covered.
- *Concrete frost or ice crust.* The amount and type of frost present in the soil is one of the primary factors that influence the amount of surface runoff generated by snowmelt or winter rain events in any given year. These conditions in the soil vary widely across the state, and even in your local area. Whether it is solidly frozen soil, referred to as concrete frost or a layer of ice on the soil surface, rain, melting snow, or manure from a recent application cannot infiltrate into the soil in these conditions. Some evidence exists that fields with vegetative cover through the winter freeze less solidly. In a must-spread situation, try to target fields that have had vegetative cover throughout the winter and try to get the manure onto the ground surface if possible when a snowpack is present.

- *Saturated soil.* It is impossible to know exactly when the ground will finally thaw, but usually the soil conditions during this transition switch from frozen to saturated just as the rainy spring starts. Aside from February and March, the spring months of May and June are the biggest contributors to the annual runoff total. Soil moisture is a primary factor influencing runoff. When soil is at or near saturation, additional water from precipitation or liquid manure application cannot infiltrate, and thus begins to run off from the soil surface. Logistically, this time when the soil is saturated makes it hard to bring equipment out to the field. There is increased risk of soil compaction, causing ruts in the field, or even getting stuck. Targeting fields that are relatively flat and dry out more quickly are good ways to manage your runoff risk when saturated soil conditions are present.

Management Recommendations

It is clear that late winter is when most of the annual runoff in Wisconsin occurs. Therefore, timing of manure applications during this time period can be tricky. For farmers with storage, make sure that your storage is empty enough earlier in the winter to avoid spreading in February and March. If you don't have storage or must spread to avoid an overflowing storage, work with your advisors to identify the low risk fields for this high risk time period and watch the weather for a rain or melt event in the forecast. If possible, find areas with little snow cover or plow an area to try and get the manure as much contact with the soil as possible.

Don't start planning for winter manure application in February. Start tweaking your system and develop a strategy much earlier so that if an emergency situation arises, you have gone the extra mile to protect yourself and the water quality around your farm as much as possible. The key to reducing nutrient loss during winter manure application is to understand the local conditions and have a winter spreading plan in place.

For more information, visit our website: www.uwdiscoveryfarms.org

Additional resources available on UW Discovery Farms website:

Considerations for early winter applications of manure. November 2013

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