

# Managing manure to reduce negative water quality impacts: composting on WI farms



Extension  
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AGRICULTURE WATER QUALITY

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Farms with livestock have the unique advantage of being able to supply manure, which has many of the nutrients required for crop production, to their fields. However, the application of manure also comes with potential risks to water quality. In order to protect water quality and use these nutrients to support crop growth, manure has to be applied with consideration for timing, method, and rate. While all these factors are important, the proper timing of manure application reduces nutrient runoff from fields and reduces risk of water quality impacts.

One option to better control the timing of manure application is composting all or some of the farm's manure. Through the composting process, the amount of liquid in the manure is reduced, which makes it an easier product to manage, store, transport and apply. This allows for increased flexibility in the timing of manure applications.

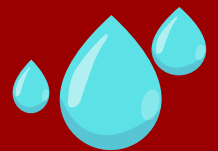
Composting has the potential to reduce phosphorus loss during high risk time periods such as periods of frozen ground, saturated soil, high precipitation or lack of soil cover. First, composting reduces the need to spread manure during a high risk time period because finished compost has the flexibility to be stored and applied when the crop needs it. Composting increases application options during the growing season by allowing application on growing hay and pastures without risking damage to the crop or decreasing palatability. Because compost is a drier product, it does not add as much moisture content to soil when runoff risk is high.

The higher dry matter content of compost can also help increase infiltration by adding organic matter which is vital for aggregate stability, a key indicator of healthy and productive soil. Good aggregate stability means that soil particles bind strongly together and are more protected from impacts of precipitation. With increased aggregate stability, the runoff risk for particulate phosphorus loss (phosphorus bound to the soil) is reduced, especially when used in combination with other erosion control methods like cover crops, waterways, and reduced tillage. Additionally, composting produces a more stable form of organic matter that should last longer in the soil compared to the application of raw manure.

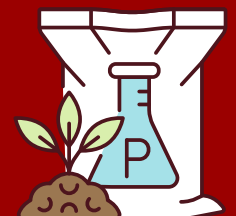
Composting is the controlled aerobic biological decomposition of organic matter into a stable, humus like product called compost. (NRCS)

Runoff contains dissolved and particulate phosphorus.

Dissolved phosphorus moves with water, and particulate phosphorus moves while attached to soil particles.



Total Phosphorus = Particulate Phosphorus + Dissolved Phosphorus

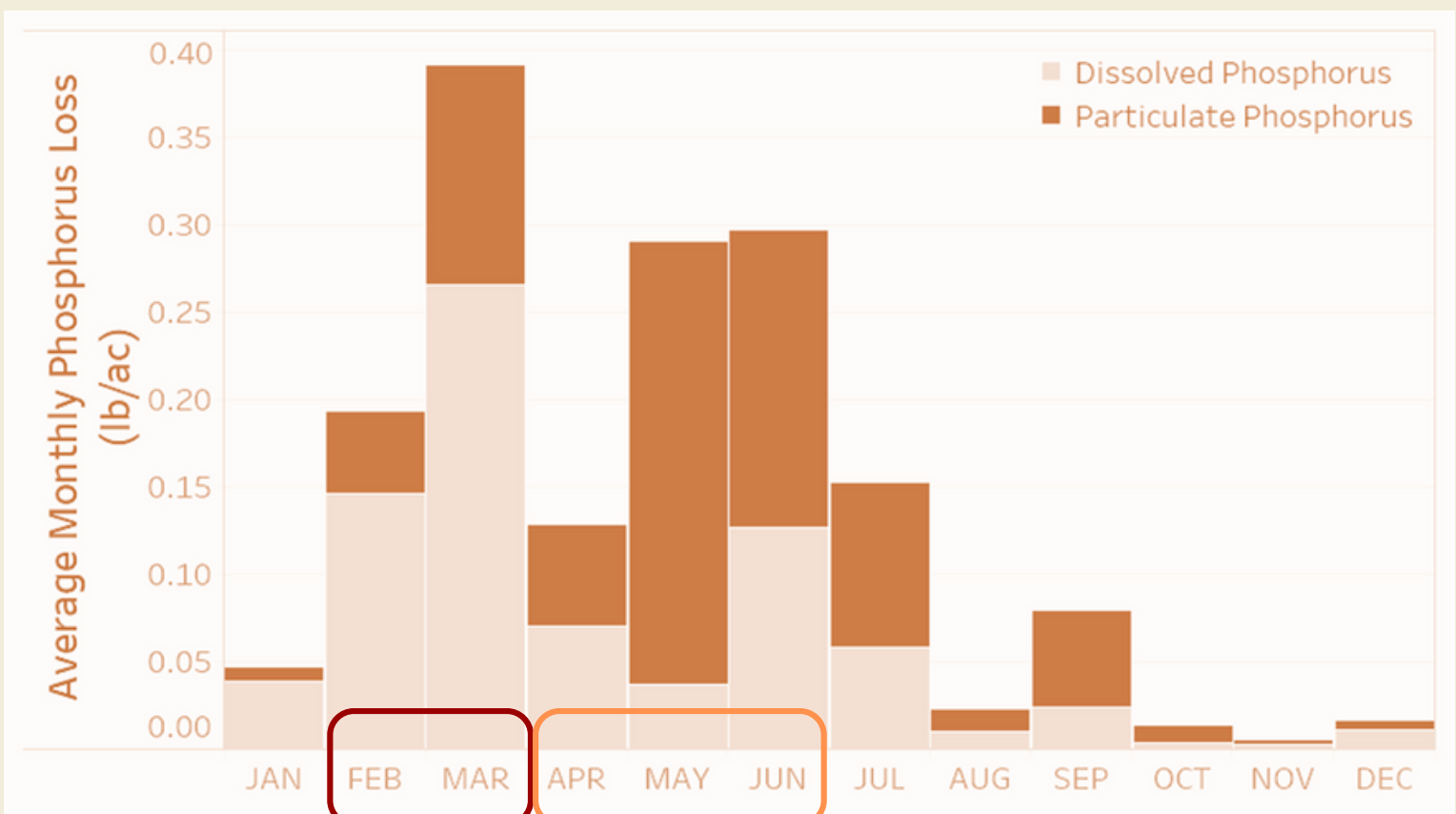


# Timing manure applications to minimize water quality impact



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According to Discovery Farms research in Wisconsin, dissolved phosphorus loss is most likely to occur while the soil is frozen during **February and March**, and particulate phosphorus loss is most likely to occur in **April, May and June** due to erosion caused by saturation levels of the soil and little soil protection.



During high risk time periods, avoid manure application and carefully consider other options to reduce dissolved and particulate phosphorus loss from farm fields. For more information on management strategies and on-farm water quality research, visit: [uwdiscoveryfarms.org](http://uwdiscoveryfarms.org).

# Composting on Wisconsin Farms



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Because of the water quality benefits of composting manure, the Agriculture Water Quality team is taking a closer look at how composting is used and managed on WI farms. This case study will highlight the how and the why of using compost as an alternative manure management method.

## Goals of this case study:

- Identify how composting addresses manure and nutrient management issues on Wisconsin farms
- Highlight benefits of composting manure including three priority areas:
  - Reducing need to spread manure and/or the amount of manure during high risk times of year
  - Providing flexibility with manure management
  - Showcasing potential water quality benefits of composting manure
- Provide better access to information on composting manure for farmers
- Provide farmer insights on using a composting system and using composted manure for bedding

## Composting manure at Five Star Dairy

Five Star Dairy is owned and operated by cousins Lee and Jim Jensen and Lee's wife, Jean Amundson, who is also the veterinarian for the farm. They milk over 1,000 cows, raise heifers and a small beef herd, raise crops on 4,500 acres, run a milk hauling and trucking business and work to incorporate conservation in every facet of their operation. The farm, located in Elk Mound, focuses on making their customers - the cows - happy. *"The cows produce the product we sell and need, so they are our customers, and we focus on always making sure they are taken care of the best we can,"* Lee said. The operation is focused on cow comfort and sustainability including everything from compost bedded pack barns for their special needs cows to creating energy through their methane digester. This case study details how and why the farm started composting manure and what benefits they have found with using the practice over the last 15 years.

## QUICK FACTS OF FIVE STAR DAIRY

- Location: Elk Mound,
- Acres: 4,500
- Animals: 1,100 milk cows; 950 heifers; small beef herd
- Crops grown: corn, soybeans, hay, wheat and rye
- Conservation practices evaluated: Composting manure
- Other practices used in system: cover crops, no-till, low disturbance manure injection, methane digester to process manure into RNG



# Manure management: weighing the options

Composting manure can be an alternative to other manure storage options such as headland stacking or using a manure storage pit. Farmers have to consider the agronomic, economic and environmental factors associated with the different options including equipment availability and cost, storage limitations, local and state regulations and whether or not the practice fits within their overall operation.

## Composting manure at Five Star Dairy

Five Star Dairy places a strong focus on conservation and farming for improved soil health and water quality, including a methane digester to process manure into RNG (Renewable Natural Gas) located right on the farm. The farm utilizes no-till or minimal till systems as well as low disturbance manure injection. **To achieve both cow comfort and improved manure management, the farm has composted manure and has used it for bedding for their cows for the last 15 years.** The farm does windrow composting and recycles the compost for bedding.

Three hundred of the farm's cows are currently on composted bedding pack which is 100% either composted or digested material. The compost barn consists of far off dry cows and springing heifers (20-50 days before calving), the prefresh group (0-20 days before calving) and the post fresh group (0-20 day post fresh calving). These are all cows with special needs that need careful attention. *"This period for cows and heifers is critical for cow comfort and specialized feeding so the cows get off to a good start for the next lactation,"* Lee said. When looking at the composted bedding back barn, **you'll notice a lot of fans and ventilation** to keep the cows cool and comfortable and to keep the bedding dry.

Continued on next page

## What are compost bedded pack barns?

Compost-bedded pack barns (compost dairy barns) are an alternative loose housing system for dairy cows. They appear to offer good comfort for lactating, dry and special needs cows.

A compost barn gives cows more room to move than tie stalls or free stalls. These barns may also reduce manure storage costs and space, and save in labor and manure handling, especially during the winter months.

## Considerations on a compost bedded pack barn

- Amount of moisture
- Space per cow
- Ventilation
- Addition of dry shavings
- 2-3x a day turning in barn

For more information on compost considerations including local regulations and karst areas, [click here](#).



# Manure management: weighing the options continued

The compost barn alleys are scraped once per day and bedding areas are rototilled twice a day to aerate the compost bedded pack. Lee noted how the cows really enjoy the amount of space they get with the compost barn compared to freestalls. When touring the barn, the cows hooves and legs looked very clean, no noticeable flies or odor and a few cows were enjoying the scratching posts available in the barn as well. The cows were certainly comfortable.

Lee's wife Jean is a veterinarian and focuses on the herd health. The cows in the compost barn need careful attention, so they adjust the bedding to the dairy cow's life from calving to pregnant, non-lactating animals to heavy lactating, non-pregnant animals.

**To find success with composting manure, it's important to consider the new management that it will take to create the environment for healthy compost and healthy cows.** It may mean a new ventilation system in a barn or to group cows differently than they once were housed. Lee found new tunnel ventilation in the compost barn helped significantly to maintain the proper temperature and moisture of the compost for bedding. Since switching to the compost barn which includes more space and increased ventilation, they've noticed a decrease in twisted stomach cases, lower somatic cell count (fewer cases of mastitis) and improved cow comfort. This has led to an increase in milk productivity.

Sawdust is purchased off site to add to separated solids to create a dry, lightweight bedding. The remainder of separated solids are put in windrows and are turned at least once per week. Lee has a compost turner that he found at an auction that can go directly over the pile to aerate the windrow. Siting compost locations does require a permit and **finding a site with low leaching and runoff potential, with little to no slope.**

When hauling the compost, it is a much lighter product than raw manure and is especially helpful when road bans are in place. Typically, composting manure can reduce the volume of manure by 60%.

## Recommendations:

- Ventilation is a key to success with the compost barn, especially with the increased heat generated by the compost itself.
- Consider the life cycle stage of the cow that will use the bedding - the bedded pack manure is great for cows who needs extra comfort and who are non-lactating.
- Work with local conservation staff to site compost location to minimize potential leachate risks and determine applicable regulations.
- Utilize existing farm equipment if possible - many farmers use a N loader to move compost within the barn and find that works well.

# Manure management: weighing the options continued

As a CAFO farm, they can't spread manure in the winter regardless but having the compost allows for a more flexible and timely manure product - they can wait to apply it until the crop needs it most and not apply it when runoff risk is high. They can also use the compost as a soil amendment on fields that might need more organic matter.

Lee is currently tweaking how often is best to turn the piles and on some nutrient and organic matter testing with his consultant to determine the best "recipe". So far, results of NPK values and increases in organic matter resulting from the composting process look promising.

Spreading the compost on soybean fields works best for them, because when spreading it on the corn fields, it seems like the compost can tie up some of the nitrogen. He noted that it is nice to have options for how and when to apply the manure.

The farm also has added an additional revenue stream by composting manure and has a wholesale fertilizer distributor pick up loads of compost from the windrow piles and then mixes it for distribution. Lee said the sale of the compost covers the cost of the sawdust that they add to the bedding.

## Conservation staff considerations

NRCS's NW District Soil Conservationist John Sippl considers Five Star Dairy's compost site a successful alternative manure management option for their farm and said it's a practice regulated similarly to headland stacking of manure.

Sippl recommends careful consideration when choosing a compost site. Farmers need to be aware of potential leaching to groundwater and adding to potential surface runoff off of compost piles. He also discussed considering the pros and cons of applying compost vs. raw manure to fields and from a storage standpoint, compost vs. adding manure into a lagoon. The importance of nutrient content and form of manure vary from farm to farm. If you have a very flat site, sandy soil and little runoff potential, composting manure can be a great option.

For anyone interested in composting, reach out to your local conservation staff on what state and local permits may be needed.

## Potential benefits of composting manure

- Improved cow comfort and health
- Decreased somatic cell count
- Increased milk production
- Decreased flies and odor
- Increased manure value
- Reduced manure storage costs
- Reduced labor costs
- Reduced manure handling
- Reduced weed seeds
- Reduced pathogens
- Reduced need to spread during high runoff risk times of year
- New potential revenue streams



## Interview Question

## Five Star Dairy

Did you have to invest in anything up front in order to get your system started?  
(Transitioning from traditional free stall barn to composting bedded pack barn)

Sawdust to add to compost  
Compost turner  
Tunnel ventilation

How has this changed your manure management? Timing, placement, space, etc.

Reduced need to spread during high runoff risk times of year  
Reduce manure volume  
Reduced odor

How have your input costs changed since switching to this system? Revenue streams?

Cost of sawdust  
Compost revenue (pays for cost of sawdust)  
Increased manure value – evaluating increase in NPK concentrations

Milk production increase or decrease?

Increase

Improved cow health? How can you tell?

Reduced somatic cell count, reduced cases of mastitis, reduced stomach twisting

Recommendations or lessons learned based on the management changes you made?

Make sure barn has plenty of ventilation.  
Spreading compost works best on soybeans – may take up N from growing corn.