

Volume 8  
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## This Month's Topics

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## Ideas? Suggestions?

Welcome to the Compost Dairy Barn Newsletter. This newsletter is intended to facilitate networking among people interested in compost dairy barns. We encourage your input. If you would like to share some of your experiences or have ideas for topics in future newsletters, contact Mindy Spiehs, Wayne Schoper, or Vince Cray.

## Newsletter Schedule

In order to maintain the quality of the Compost Dairy Barn Newsletter, the newsletter will now be published every other month, instead of monthly. We will continue to have a featured article, Frequently Asked Questions, and as space permits a Producer Spotlight. To view previously published newsletters visit the University of Minnesota Extension Dairy Team website at [www.extension.umn.edu/dairy](http://www.extension.umn.edu/dairy)

## Frequently Asked Questions—Equipment, Compaction on bedded pack

**Question:** What is the best tool for stirring or mixing a bedded pack?

**Answer:** Dairy producers with compost dairy barns are using various tools to stir and aerate the composting pack. We don't have research results to document which tool or practice is best. Most producers are using modified cultivators or harrows with either pointed shovels or sweeps attached to the front of skid loaders or the rear of utility tractors. Some producers are using rotary tillers attached to a small tractor. Both cultivators and rotary tillers reportedly work well.

The purpose of aerating is to loosen the pack and add air for the aerobic microorganisms that are composting the manure and urine. Stirring the pack freshens the pack surface, mixing manure and urine into the pack. We think that stirring helps dry the pack

too. Our best compost barn operators aerate the pack to make it fluffy. Some producers go over the pack a couple of times with their aerating equipment to make it fluffier if one pass does not do the job. Producers with inadequate stirring will end up with clumps of bedding, which need to be broken up. If the pack gets too wet it will be difficult to make it fluffy.

We have heard about one producer that was using a chisel plow before adding new dry fine sawdust to aerate the pack more deeply than was being done with the cultivator. At this point, we don't have information to know if the chisel plow is beneficial to the pack and worth the effort.

**Question:** Do I need to worry about compaction of the compost barn pack?

**Answer:** There are concerns about compaction of the compost barn pack from skid loaders,

small utility tractors, and tractors that can pull a chisel plow driving over the pack. Cows walking on the pack will compact it too. One producer was concerned enough about compaction that he added tracks to the skid loader he uses for aeration. Compaction is expected to be more of a problem if the pack is allowed to get too wet. Fresh dry fine sawdust needs to be added when it begins to stick to the cows. We recommend that producers make sure that the top 10 to 12 inches of the pack are fluffy twice a day. The deeper material may compact but compost dairy barns are expected to work well if the top 10 to 12 inches of the pack are well aerated and fluffy.

*Answers provided by Kevin Janni, Extension Engineer U of MN Dept of Bioproducts and Biosystems Engineering*



Various types of equipment have been used to successfully turn the composting bedded pack.

If you would like to receive this newsletter or want to remove your name from our mailing list, contact Mindy Spiehs at (320) 589-1711 or toll free at (888) 241-4532. If you prefer to receive this newsletter in an electronic format e-mail [spie0073@umn.edu](mailto:spie0073@umn.edu).

## Compost Dairy Barns—What did the bedding analysis tell us?

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Last summer, my graduate student, Abby Barberg, and I conducted a descriptive study on 12 compost dairy barns in Minnesota. One of the aspects we evaluated was bedding. The compost barns in this study were generally bedded with dry fine wood shavings or sawdust. According to the questionnaire responses, a semi-load of bedding was added every one to five weeks, varying by season, weather conditions and cow density. Fresh bedding was added when the bedding particles became moist enough to adhere to the cows. This article summarizes the chemical analysis and temperature results.

#### Chemical analysis

Each compost barn pack was subdivided into 12 equal areas from which 1-quart bedding samples were collected. Bedding samples were taken at two depths in each area with a hand-operated soil auger. Bedding samples were analyzed for moisture, ammonia, pH, total Carbon (C), Nitrogen (N), Phosphorus (P), Potassium (K), and electrical conductance (soluble salts) concentrations.

The moisture content of the bedding material ranged from 28.0% to 78.9% across the two depths in 12 locations in all barns. The average

moisture content across all barns was 54.4%, within the recommended range for composting of 50% to 60% moisture. The moisture content varied based upon time since the last addition of fresh bedding, weather and cow density in the sampling area. The average pH was 8.5, slightly above the recommended pH level for composting of 6.5 to 8.0.

The average total N of the bedding material in all compost barns was 2.54% with a range of 0.57% to 4.22%; the average P was 3,247 parts per million (ppm) with a range of 378 to 6,668 ppm; and the average K was 15,270 ppm with a range of 2,568 to 29,570 ppm. These compare to typical manure of lactating dairy cattle consisting of 5.1% N, 8,764 ppm of P, and 11,573 ppm of K. Sawdust, on average, has an N content of 0.24%. The average carbon to nitrogen (C:N) ratio of all barns in all locations and depths was 19.5:1, which is below the preferred range of 25:1 to 30:1 for composting. A C:N ratio below 25:1 may emit ammonia odor, which may influence the ammonia levels in the compost barns. The ammonia-nitrogen concentrations were greater deeper into the pack than in the top 6 inches. One barn seemed

to have poorer air quality, possibly higher ammonia levels, compared to the other barns based on subjective evaluation. This barn had the lowest space per cow and poor air movement. Electrical conductance averaged 9.6 mmhols/cm (millimhols per centimeter -- a measure of electrical conductivity used to estimate the amount of soluble salts) across depths, which is only slightly below the 10 mmhols/cm maximum concentration desired for composting.

#### Temperatures

Pack temperatures were taken twice, one week apart, at each of 12 locations across the pack, at various depths (6, 12, 24 and 36 inches) with a compost thermometer. The average bedding temperature across all depths, across all pack barns was 108° F, with a range of 76 to 138° F. The pack surface temperatures were similar to the ambient temperature. Temperatures tended to be lower on three farms that utilized larger particle wood shavings rather than sawdust for bedding. Temperatures were greater in the areas of the pack that were fluffier, that were not as heavily soiled or packed by the cows. This observation is consistent with the need for oxygen and air for microbial activity that promotes composting. The ideal temperature for composting is between 130°C and 150°F.

For the producers we interviewed, bedding availability was their main concern. Most producers inquired about what other sources of bedding besides sawdust could be used. Our compost dairy barn team has started a follow-up study to investigate what other materials could work.

*Marcia Endres is an Extension Dairy Specialist with the U of MN Dept of Animal Science*

	Average	Range	Recommended
<b>Bedding Temp F</b>	108	76 - 138	130-150
<b>Moisture %</b>	54.4	28 - 78.9	50 - 60
<b>pH</b>	8.5	6.5 - 9.9	6.5 - 8.0
<b>N %</b>	2.54	0.57 - 4.22	xxxxx
<b>P ppm</b>	3247	378 - 6668	xxxxx
<b>K ppm</b>	15,270	2568 - 29,570	xxxxx
<b>C:N ratio</b>	19.5:1	10.9 - 87.5	25:1 – 30:1
<b>Electrical Conductance mmhols/cm</b>	9.6	2.4 - 20.5	10 maximum