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Composting Livestock Manure

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What is compost?

Compost is an earthy-smelling, soil-like material that results from the controlled aerobic decay of organic nitrogen and carbon materials. Livestock manure is rich in nitrogen; sawdust, straw or leaves provide carbon.

What are the benefits of compost?

Composting fits into a complete manure management system and can offer additional management options for other livestock byproducts. It can be sold in niche markets for additional farm income. When done properly, composting destroys most pathogens and weed seeds and minimizes or eliminates odors. Compost is a source of slow-release nutrients, so its use helps protect water quality. Compost also contains many beneficial microorganisms that stimulate plant growth, limit diseases and improve soil.

What are some uses for compost?

- Building depleted soils.
- Preventing soil erosion.
- Making potting mixtures.
- Installing, maintaining or renovating lawns.
- Making compost teas.
- Maintaining and renovating vegetables and flower gardens.
- Controlling plant disease.

What is the composting process?

Carbon (C) and nitrogen (N) sources are mixed together to obtain a ratio of 25:1 and a moisture level of 40 to 65 percent. A rule of thumb is to use two parts "brown" (carbon materials) to one part "green" (nitrogen materials). The compost pile goes through four stages before it cures, or stabilizes. The first three stages can take as little as five days or as long as four weeks. A pile can cure in as little as 90 days, but research conducted at Michigan State University and other universities has shown that compost quality can significantly improve when it is cured for over a year. This is an important consideration for those who want to market compost to high-value users such as nurseries and greenhouses. During the composting process, the C:N ratio decreases because of carbon loss, the pH rises, the product's volume decreases 30 to 70 percent, and its weight decreases 40 to 80 percent. To destroy most pathogens, weed seeds and fly larvae, temperatures in the pile must be maintained above 131 degrees F for 72 hours.

Establishing a mixing recipe is a flexible process that takes into account the carbon, nitrogen and moisture content of the compost components. Bulletin NRAES-54, the On Farm Composting Handbook, lists carbon and nitrogen materials and composting formulas, along with details and descriptions of the composting process.

What methods are used to make compost?

The simplest method is the static pile. Manure and carbon are mixed together in long, tall windrows, turned once or twice a month with a front-end loader and allowed to decompose. This method does not require special equipment, but it generally takes the longest to produce compost and may not result in the best quality.

Windrows can be formed and turned as required using tractor-drawn or self-propelled turners. The turner aerates, adds moisture (if necessary), fractures organic matter and mixes the material as it moves through the windrow. Using a turner allows the farmer to manage the composting process and produce a finished product in less time than the static pile method.

There are two types of in-vessel composting systems—rotating drum and shallow pit. With the rotating

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drum, materials to be composted are mixed together and fed into a slow-turning drum. In a shallow pit system, materials are mixed and placed between two concrete walls. A rotating drum with paddles deep enough to turn the pile moves along rails on top of the walls. Both systems allow compost to be produced in a continuous flow or batch process and provide the greatest control of all methods over the composting process. These systems typically operate under a roof and are ideal for composting in cold climates.

Using redworms (*Eisenia fetida*) to convert organic matter into compost is called vermicomposting. Vermicompost contains a plant growth stimulant produced in the worm's gut that makes it a very desirable soil amendment. This method requires raising worms under controlled temperatures, is labor-intensive, and does not destroy pathogens or weed seed. It requires a second step involving heat to create ready-to-use compost from most livestock manure.

Pads, runoff treatment and blankets

Materials can be composted outside on sod, packed gravel and clay, asphalt or concrete. Sod is the least expensive, but when you can turn the pile is subject to weather conditions. Concrete is the most expensive but also the most durable. Pad size is contingent on the space needed to operate equipment, the volume to be composted, and windrow shape and length. Runoff management should be considered when designing a pad. It should be either collected in a settling basin or treated in a grassed waterway. Compost piles should be rotated around a field so no windrow stays in the same area for more than a year. Contact your local Natural Resources Conservation Service (NRCS) office for more details on pad design and runoff treatment. Compost blankets are geotextile fabrics that are laid over the top of a windrow to shed water and maintain the pile's moisture level while allowing it to breathe.

Composting as part of a manure management system

The annual cost of composting can be comparable to that of daily haul and storage systems. For a 120-cow dairy, this ranges from $7,663 to $13,653, depending on capital investment. For larger livestock farms, composting can be a component of a complete manure management system that may include solid-liquid separation or anaerobic digestion. Composting bedded pack manure and/or digester solids may require fewer carbon materials than separation or anaerobic digestion.

Reduced manure nutrient volume and concentration can make transportation of compost to distant fields or use in horticultural crops more efficient than other treatment options. Quality compost can be marketed to supplement farm income.

Michigan composting regulations

There are no specific regulations in Michigan for composting livestock manures produced on the farm. Composting is a manure treatment method referenced in the Michigan Right-to-Farm Act's Generally Accepted Agricultural Management Practices (GAAMPs) for Manure Management and Land Application. Those who use off-farm waste streams are regulated by the Michigan Department of Environmental Quality (MDEQ) Waste Management Division.

According to Michigan's Fertilizer Law, products sold with a performance claim must be registered with the Michigan Department of Agriculture.

Mortality composting

Composting is a cost-effective method to dispose of livestock mortalities. Specific requirements are spelled out in the Bodies of Dead Animals Act, Act 239 of 1982, as amended.

Visit animalagteam.msu.edu for more information.

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