

# *Whole Animal Composting of Dairy Cattle*

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Even the most well managed dairy operations experience animal loss due to weather, natural causes, and/or illness each year. Rendering services currently pick up most on-farm mortalities. However, with the concern of Bovine Spongiform Encephalopathy (BSE; commonly know as Mad Cow Disease), the feeding of animal-derived protein to cattle is prohibited. This has decreased the need for animal rendering and increased the cost of removing mortalities from the farm. The abundance of stockpiled manure and old feedstuffs on dairy operations make whole animal composting a feasible alternative to carcass disposal.

## *Proper Composting Procedures*

Composting is the natural decomposition of organic materials by microorganisms that require oxygen (aerobic). Although many aspects of composting are not exact, there are several factors that affect the success of the composting process which are:

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|---|--------------------------|
| 1) carbon and nitrogen ratios (C:N ratio) | 2) moisture content      |
| 3) particle size                          | 4) oxygen concentrations |
| 5) temperature.                           |                          |

The proper mix of composting materials requires both carbon and nitrogen at a 25:1 to 30:1 ratio. With the proper C:N ratio, odor will be kept to a minimum, and an environment conducive to the growth of microorganisms will be obtained. It is usually necessary to add plant materials such as old feedstuffs or straw to have the proper carbon levels in the manure compost mix. Sawdust is the preferred carbon source due to its high absorbent characteristics and ability to make contact with the carcass. Moisture content of the compost mixture should be 50 to 60%. Moisture concentrations of greater than 60% will generate odors and increase the chance of leachate (runoff) from the compost pile. A general rule of thumb is if the mixture feels moist but no water drips from a handful when squeezed, the moisture is adequate. To ensure aeration of the compost pile, particle size of composting materials should range between 1/8 to 1/2 inches in diameter. Particle sizing increases the porosity (air space) of the pile allowing air to enter, maintaining oxygen concentrations to optimize microbial growth. Aeration by turning also introduces air into the compost pile. Optimal composting temperatures range from 110 to 150°F. Compost piles need a layer of inactive material (~1 foot thick) to insulate the pile and maintain high temperatures. Temperatures above 131°F for 72 hours are necessary to destroy human pathogens and most plant pathogens. Furthermore, weed seeds usually are destroyed at 145°F. Extremely high temperatures are detrimental to the composting procedure with microbial activity declining at temperatures greater than 160°F.

## *How To Compost Whole Cow Carcasses*

Contrary to popular belief and practice, simply covering mortalities in manure is not considered composting. An animal carcass is generally a mass with a low C:N ratio (high nitrogen levels with relatively low carbon), a high moisture content, and relatively no air. Consequently, compost materials must include high C:N ratios, moderate moisture, and satisfactory porosity for aeration. Proper composting consists of layering the carcasses with composting materials in a static pile until the soft carcass tissue has fully decomposed.

Site selection is important to the overall success of the composting procedure. Location of the composting pile should allow easy access, minimal travel, convenient handling of manure and straw/old feedstuffs, and a proper distance from live cattle. Sites near neighbors and water sources or streams should be avoided. Make certain that surface runoff and other pollution controls can be implemented at the site. Good drainage of the compost pile also is necessary to prevent pooling of water. Ideal slope should be 1 to 3% for proper drainage. The composting

pad should be firm but does not need to be paved. Sand or gravel at a depth of 6 inches is desirable when current soils conditions are not acceptable.

Construction of the compost pile should begin by placing a plastic liner (6-mil) 10 to 12 feet wide and the length of the pile or windrow. Next, place a base of compost materials (manure and straw/old feedstuffs) on top of the plastic liner approximately 1.0 to 1.5 feet deep. A general recommendation is a 50:50 ratio of manure and the carbon source. This ratio will vary with the chemical and biological characteristics of the manure and carbon source. Laboratory analyses of raw composting materials are necessary to get the optimal compost mixture. The carcass should then be placed on the top of the base. To decrease composting time and to allow the carcass to be laid flat, the body cavity of the animal should be opened. Water can be added at this time. Finally, completely cover the carcass with 8 to 12 inches of the compost mixture. Repeat layers as necessary until the pile or windrow is approximately 6 feet high. A thermometer should be placed 2.5 to 3 feet into the pile to monitor internal temperatures. When temperatures fall below 145°F, the pile can be turned using a front-end loader or windrow turner. Make certain carcasses remain fully covered after turning.

Large square hay bales can be placed around the perimeter of the pile to protect from pests. Furthermore, if there is runoff from the compost pile, the hay will act as an absorbent.

In a properly managed compost pile, the core temperature of the pile should reach 145°F in 3 to 4 days. After approximately 2 weeks, volume of the pile will reduce to 1/2 its original size; the pile then should be turned. Decomposition of a mature dairy cow carcass generally takes 6 to 8 months with a few small bones remaining. The remaining bones will be soft and shatter easily when passed through a manure spreader during land application.

### ***Bovine Composting Experiment in New Mexico***

Recently, twelve cow mortalities were used to initiate whole animal composting on a large (~3000 lactating cows) southern New Mexico dairy operation. Compost pile construction was established by spreading a sand/manure mixture on a level site to a depth of approximately 10 to 12 inches. A single mortality was then placed on the mixture and covered with the compost mixture to a depth of 1.5 to 2 feet. A similar technique was used to cover each mortality. Dimensions of the final pile were 14 to 15 feet wide and 6 feet in height. A temperature data logger was placed 2 feet into the pile to record internal temperatures. Rainfall totaled 2 inches at the dairy during the experiment, and no additional moisture was added. Carcasses were uncovered at 8 weeks and 3 months to determine time needed to decompose cows. Compost pile temperatures reached a high of 143°F approximately 1 week after pile establishment. At 8 weeks, carcasses were 60 to 65% decomposed. The bones were clean, and the flesh was 90% decomposed. After 3 months, carcasses were somewhat difficult to find with several small bones (7 to 10 bones/carcass) remaining. It should be noted that the pile was not aerated nor were other carbon sources added. The goal was to mimic what would actually be completed on a dairy operation. It is obvious from this study that the addition of moisture, aeration, and other carbon sources would have decreased composting time but would have increased the dairy's labor and cost.

### ***Summary***

By following a few general composting recommendations, whole animal composting can be a successful, environmentally safe, and economically feasible method to dispose of on-farm mortalities. Remember, composting procedures are not absolute and are somewhat forgiving. Trial and error accompanied with close monitoring of pile characteristics will usually produce successful results. It is advised that prior to implementing whole animal composting on your dairy, check local and state requirements regulating animal mortality disposal. The biological process of composting animal mortalities is similar to the processes of composting other organic materials. Mortality compost is an excellent source of fertilizer for crops utilized by the dairy farm. However, the compost generated from the decomposition of animal carcasses should not be given or sold as compost for use off-farm.

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