The Breakdown

Composting has become a favorable option for producers who have lost resources for disposal of livestock mortalities.

by ***Corinne Blender***

The beef industry faces many challenges. If you talk to cattlemen who have been in the industry for a time, you'll quickly find out how they lost access to the best vaccine available when it was taken off the market or how they lost access to the best feed additive when manufacturers had to stop making it.

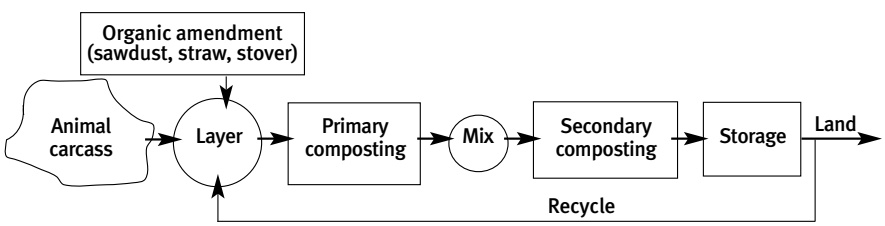
Changes and restrictions are two things producers can generally count on. One of the issues the industry has recently faced is the restriction on the feeding of meat and bone meal. Put into effect due to outbreaks of bovine spongiform encephalopathy (BSE) in Great Britain, the restriction has contributed to the closing of many rendering plants and has created the need for innovative ways to dispose of animal mortalities.

"The rendering industry is no longer interested in taking one or two dead animals from a location. There are cost economics involved, and there are also some issues regarding BSE, even though we have never had it in this country. There is no longer a premium on picking up dead livestock and taking them through a rendering process," says Harold Keener, professor at the Ohio State University (OSU) Department of Food, Agricultural and Biological Engineering.

While mortalities are not something producers want to deal with, they are a reality. The poultry industry began composting animal mortalities around the 1980s, and the hog industry later followed suit. Even though at first processes for each species were described separately, researchers began noticing similarities, and now a common practice has been adapted for all livestock, including cattle.

"The restrictions that are coming into play in terms of byproduct material available for re-feeding to animals has made this a good option in our state for farmers," Keener says. "It sure beats dragging them (animal mortalities) out somewhere and letting them decompose in the open environment."

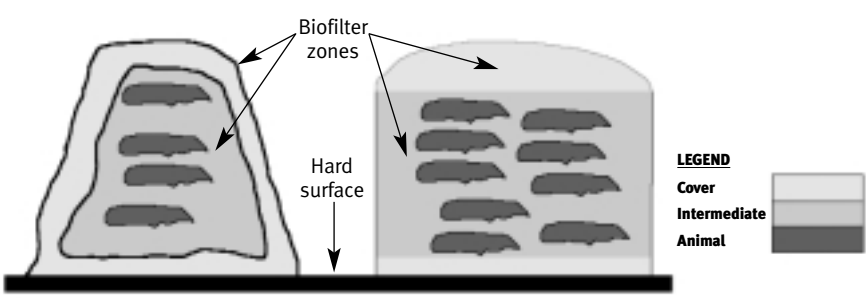
Fig. 1: Material flow in dead animal composting



Forced aeration is not used. Materials are not mixed until the flesh of the animal body is completely decomposed. Time can vary from 10 days (poultry) to more than 100 days (> 400 lb.).

Source: August 2002 *Resource Magazine*

Fig. 2: Cross-sectional views of composting in a windrow or bin for animal mortality



Layering of animal carcasses surrounded by material provides carbon (energy) for the microorganisms and acts as a biofilter. The windrow/bin is not turned until carcasses are decomposed. Pile shape will depend on whether composting is done in the open or in a bin.

Source: August 2002 *Resource Magazine*

Safe and effective

Keener and many others who have practiced composting say the process is safe if it is done correctly, and doing it correctly can be a piece of cake.

"From the earlier training programs that I was directly involved in, producers always asked the question, 'Won't it smell?'" Keener says. His experience is that it does not smell. He has even had tour groups walk by composting sites without their realizing that composting was going on before their very eyes.

Another common concern is disease.

"There is always the fear, for whatever reason, that you are going to get disease transmission from that dead animal you are composting," Keener says.

The process, if done correctly, shouldn't create any problems. For the common causes of death, the issue of disease is minute, Keener adds. The heat created in the composting process will destroy most pathogens.

"We know that almost all pathogens that we associate with human diseases, as well as livestock diseases, are going to be killed off at around 130° Fahrenheit," he says. "From the standpoint of pathogens remaining in the pile, if it is properly built so you reach these higher temperatures, you would destroy most of the organisms that would have caused the death of the animal," he says.

Clell Bagley, an Extension veterinarian at Utah State University (USU), discussed composting at the 2002 Wild West Veterinary Conference, Reno, Nev., in October. The conference proceedings state, "Composting can destroy many pathogens, but not all spore-forming bacteria. It is not yet known if composting will destroy the prions of TSE (transmissible spongiform encephalopathy) diseases. Research is currently underway in the U.S. and Canada to answer that question. Prions are very resistant to heat and to many chemicals. They are also resistant to some enzymes, but may be vulnerable to those present during the composting process."

Restrictions in Ohio, for example, require producers to report cases of death by certain diseases. Disposal in those situations is handled differently. The state allows cattle — except those more than 2 years of age showing signs of neurological disease — to be composted. Protocol may be different in

each state. Check with your local Extension agent or veterinarian to find the dead animal disposal guidelines for your state.

Simple measures

Bagley says that while rendering and other options are still available in his area, composting is a good option. Composting is recommended by the Environmental Protection Agency (EPA) "as one of the better methods for disposal of both carcasses and manure," the conference proceedings say.

Keener describes composting as "an above-ground burial in a biofilter." The biofilter, or co-compost, is a carbon (C) source that works with the nitrogen (N) that the carcass produces to feed the bacteria and protozoa at work decomposing the carcass.

While the process can be described in general, it should be adapted to specific situations. This allows producers to use a carbon amendment (material that aids plant growth indirectly by improving the condition of the soil) that is readily available in their area. Carbon sources can range from sawdust and soybean hulls to straw and manure (see Table 1). Site selection and whether the process is done outdoors in windrows or in a building structure with bins depends on the location of the operation.

Composting is controlled decomposition, Bagley points out. The co-compost is there to trap the gases and fluids. "There are really two processes that go on within the process. In the carcass, it is an anaerobic process so there is no oxygen in there," Bagley describes. "As [fluids and gases] get out of the carcass and into the compost material, then it is an aerobic process. Oxygen is needed."

Bagley points out that a lot of literature refers to a more common composting process, such as for lawn clippings. "As you read composting literature, one of the first things that is always there is that the compost should be consistent and in a consistent pile. We are going directly against that as we take a chunk of carcass and put it in the middle of a pile. We don't have any consistency there. We have a consistent pile with a carcass in the middle of it. But that can still work OK as long as some other parameters are met."

The general parameters for carcass composting include a moisture level from 40%-60%, a temperature of 130°-140° F and a recommended C:N level of 25:1; also required is a good amount of biofilter to absorb the fluids and gases that the process develops. Aeration is important and is controlled through co-compost particle size and by turning the pile.

Research specialists, in general, recommend laying down a base of at least 1-2 feet (ft.) of co-compost material. The larger the animal is, the closer to 2 ft. deep the base should be. Place the carcass on the pile and cover with another 1-2 ft. of material. Bagley also says that the rumen can be punctured to prevent the gases from being trapped and the pile's being disrupted. Keener says, however, it is best to compost the carcass whole to prevent leaching and other problems.

The internal temperature, according to Bagley's conference proceedings, is a good indicator of the current biological activity. The 130°-140° F should be reached, and the pile should be held there for a few days to weeks. A large carcass should remain in the pile for approximately three to four months (mo.) before turning, and then should be allowed to continue composting for another three to four mo. (see Table 2).

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Table 1: Co-composting materials

Corn stover	Chopped soybean stubble
Peanut hulls	Wood shavings/chips
Sawdust	Recycled paper/cardboard
Yard waste	Leaves
Hay	Chicken litter
Rice hulls	Manure and bedding* (horse, sheep, swine)
Straw	

Source: National Pork Producers Handbook
*High bedding content, low level of manure.

Table 2: Cycle time for primary and secondary composting of animal mortality, by body size

Mortality size (lb.)	50	100	220	350	500	1,000	1,500
Primary stage (days)	35	50	75	95	115	160	195
Secondary stage (days)	12	15	25	30	40	55	65
Storage stage (suggested minimum days)	30	30	30	30	30	30	30

Source: August 2002 *Resource Magazine*

The economics

The Cornell Waste Management Institute, Cornell University, Ithaca, N.Y., discusses the economics of dealing with animal mortality in their 2002 "Natural Rendering: Composting Livestock Mortality and Butcher Waste." This information won't apply to all situations, with many factors affecting supply, availability, etc., but it will provide general cost comparisons.

Pickup

Where available:
- $25-$70 per cow
- $60 per pig
- $200 per horse

Burial

- $43.50 per hour (hr.) for backhoe and loader rental (per Pennsylvania study), 1 hr. labor @ $10 per hr., and 0.6 gallons (gal.) fuel @ $1.50 per gal. = $54.40

Composting

- Wood mulch @ $5.50 per cubic yard (cu. yd.) with a 5 cu. yd. base = $33
- If reusing composted material and assuming a 30% loss of material during composting, the base would be $9.90 per carcass. The remainder would be used as cover on a new base of wood chips and mulch.
- Kiln-dried sawdust @ $4.50 per cu. yd. @ 6 cu. yd. = $27
- With a 30% loss during process, the cost per carcass would be $8.10.
- Total cost of material per carcass would be $18.
- 30 minutes (min.) for preparation and covering = $5
- Fuel for 100-hp tractor @ .04 gal. = $0.60
- Tractor rental (in the Northeast as reported by Doanes) = $28 per hr.
- The total cost for the material, equipment, fuel and labor would be $37.60 per carcass.

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Bagley recommends these steps for successful composting.

1. Be a good observer, and be willing to adjust and correct for problems.
2. Use a thermometer, and keep records.
3. Check for fluid leaching, and confine and absorb it with co-compost material.
4. Check for odors. If present, add more co-compost or water, or dry out the pile with aeration, if needed.
5. If necessary, restart the whole process with a different type, quantity or wetness of the co-compost material.

The process in action

Composting mortalities fit well into Jim Docheff's program, a 600-head dairy near Longmont, Colo., when three rendering companies in his area went out of business, and the last guy standing sent out a letter saying they would charge for animal pickup. Docheff had already been composting manure, a process that turns nearly a $75,000 profit for the dairy each year. Compost from livestock mortalities cannot be sold, but it saves about $1,000 that would otherwise be spent in pickup fees, he says.

"In February 2001 we started doing it, and we have basically composted every mortality since then," says Docheff, adding that he hasn't encountered any problems with the process.

Docheff's system involves two rows 250 ft. long, 10 ft. wide and 5 ft. high. For a carbon amendment, he uses manure that has begun composting. Manure is a good option for him because he says his cows are on a high-roughage diet that allows for a good carbon source after the manure itself has been partially composted through the process.

Because Docheff composts manure, he purchased a compost turner that costs around $30,000, but he says it is not necessary to have one if the operation is small. As mortalities happen, they are placed in a row, switching to the other row after three months. Then, after the last mortality is added, he waits three weeks before using the turner to aerate the piles. This system is designed to fit his program. He says that while it has saved him a little money, that is not the biggest benefit he has realized.

"It saved us that $1,000, but I think the biggest thing is the biosecurity. I was always nervous when those rendering trucks would come onto the dairy to pick up these animals. You never knew what animals on the truck died from and whether they were bringing those bugs onto the dairy," he says. "Composting has really eliminated our exposure to some unknown diseases."

One thing that Docheff had to consider when he added mortality composting was his neighbors. He says that within a half-mile circle around his operation there are nearly 2,500 residents.

"I was a little nervous about the odor when you start going through with the turner, but it hasn't been bad at all. There is a smell the first couple of times you go through with the compost turner, but it dissipates fairly fast," Docheff says. He says he avoids turning the pile near weekends or holidays.

Keener says that three highway departments in the state of Ohio are using composting for deer killed on roads. "Once people have done it, it seems that a large percentage find it very acceptable and think it is a good way to handle these livestock mortalities," he adds.

Helpful hints

Keener warns producers that there is a biosecurity issue when dealing with any livestock loss. While producers can use their own equipment to handle the mortalities, proper sanitation and cleaning measures must be taken. Bagley says that chains can be linked around the carcass's legs so the entire loader-bucket isn't contaminated, or a tarp can be used to cover the bucket and catch any liquids.

As a mortality is added to a windrowed pile, place a stick with a tag clarifying the date the carcass was added. This will provide an indication of what stage the process is at, Bagley recommends.

When controlling the moisture, Bagley says a good rule of thumb is to take a handful of that co-compost material and squeeze it. If it forms a little ball and crumbles apart when tapped, the moisture is about right. If it is mushy or if it won't form a ball, it is either too wet or too dry.

Many co-compost products can be used. Products such as straw may need to be chopped up because their large particle size can be a problem, Keener says. He also recommends reusing compost at 50% old, 50% new to save on the cost. The primary cost of composting is tied up in the co-composting material, so savings are important, but cutting back from the proper amount needed will lead to leaching and odors.

Site selection is important. Evaluate a site for proper drainage, relation to neighbors and water supplies, and the infiltration of the soil. A site with a lot of gravel within the earth is not recommended.

Keener says it is important to get the mortality into a composting pile the same day it occurs. Producers need to check with their individual states for restrictions on composting. Keener points out that before anyone decides to compost they must consider the utilization of the end product. Many states require carcass compost to be spread onto the land that produced the feed for the animal that was lost, but that may vary by state.

Composting surprisingly leads to very little remaining material.

"It is proportional to the size of your operation — proportional to the mortality rate. But the reality is, if you end up with a lot of material to apply to the land you are probably not in business, because your animals are going to the wrong place — they are not going to market," Keener says. "For the typical mortality rates that we expect to see on farms, the amount of material that has to be land-applied on a yearly cycle turns out to be very small."

Editor's Note: *There are many excellent sources for more information on composting. Visit Cornell University's pro-dairy on the Web at* www.ansci.cornell.edu/prodairy/index.html *and look under On-Farm Environmental Management on the left, click on Articles and look for the headline "Natural Rendering: Composting Livestock Mortality and Butcher Waste." View Colorado State University's Web site on Integrated Livestock Management at* www.cvmbs.colostate.edu/ilm/ilmintro.html *under the Composting headline on the left. OSU's "Participants Manual Ohio's Livestock and Poultry Mortality Composting Manual" can be found by contacting the OSU Extension service.*