Solid Manure

For solid manure, capacity is expressed in tons. Ideally, a scale, fixed or portable, can be used to measure the actual weight of the spreader with and without its load for each specific type of manure. The difference would be the capacity. If a scale is not conveniently available, an alternative method, based on the volume of the spreader and the manure's density can be used. The same formula as listed on page 5 for a level-full liquid spreader can be used with an additional volume added for mounding.

For box spreaders with solid manure (see Figure 1):

$$\textbf{Volume (gallons)} = [(L \times W \times H) + (\tfrac{1}{2} \times L \times W \times H_m)] \times 7.48$$

For V-bottom spreaders with solid manure (see Figure 2):

$$\textbf{Volume (gallons)} = [(L \times W_{b+a} \times H) + (\tfrac{1}{2} \times L \times W_t \times H_m)] \times 7.48$$

The density (pounds per gallon) of the manure being measured can be used to convert gallons into tons. A small scale such as a spring scale can be used to measure the net weight in pounds of a five gallon bucket of manure. When weighing a bucket of manure, attempt to duplicate the density (packing) of the manure in the actual spreader. Divide net weight of the bucket of manure by the volume (*i.e.*, 5 gal) to get density (lb/gal). The solid capacity of the spreader in tons can then be calculated.

Weight (tons)** = **Volume** (gallons as determined above) × **Density** (lb/gal as determined with 5 gal bucket) ÷ **2,000.

Summary

Manure application equipment calibration has become so important to properly manage manure nutrients that it should be routine for every dairy and livestock farm. The small investment in developing simple tools such as Ground Speed – Application Rate Charts will be recovered readily in improved accuracy of nutrient crediting in the cropping system and reduced environmental risk. As with any tool, calibration is only valuable when put into practice. If you would like further guidance or assistance in manure application equipment calibration and the implementation of the results, contact your respective Michigan State University Extension Agent, Comprehensive Nutrient Management Plan (CNMP) provider, or other qualified professional.

On-Farm Mortality Management

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Michigan's Bodies of Dead Animals Act (Act 239 of 1982, as amended) regulates the disposal of dead animals and provides for composting of dead poultry and livestock in Michigan. The intent of this law is to:

- protect human and animal health;
- reduce risk of disease transmission;
- control problems with flies, vermin, and scavenging animals; and,
- protect ground and surface water and air quality.

Conscientious management, as described in this act and accompanying regulations, is necessary for compliance with the Michigan Right-to-Farm Act and the 2002 Michigan/USEPA Regulatory Innovation Agreement (Option 1- NPDES General Permit or Option 2 – MAEAP). In addition, common sense and sound discretion are necessary as it may not be possible to abide by every specific practice, as stated, all of the time. In a time of increasing citizen complaints, it is critical to manage mortality disposal carefully, using art and science.

Under this act, there currently are five alternatives for disposal of dead animals in Michigan: burial; incineration; rendering; land-fill; or, composting.

Regardless of which method of disposal is used, all mortalities must be disposed of within 24 hours after death, unless stored secure at less than 40° F for no more than 7 days or at less than 0° F for no more than 30 days. Mortalities disposed of must only be those animals "intrinsic to an operation under common ownership or management." Carcasses may originate from multiple farm sites and be a mixture of livestock species, if all are owned by the same person or firm. Lastly, all disposal methods described in the act are for "normal or natural" rates of mortality for a given farm or system of farms. Any sudden and unexpected increases in mortality rates should be reported immediately to the Director of the Michigan Department of Agriculture, with discussion to include appropriate disposal methods for this unusual mortality.

Burial

Burial sites must have no contact with bodies of water, either surface or ground water, and must be at least 200 feet from wells. Frozen ground makes burial difficult in winter.

Individual graves must be:

1. at least 2 feet beneath the natural surface;
2. limited to 100 graves/acre or 5 tons of tissue/acre;
3. separated by a minimum of 2.5 feet; and,
4. closed within 24 hours of opening.

Common graves must:

1. be limited to 2.5 tons of tissue per acre;
2. be separated by a minimum of 100 feet;
3. have each day's mortality covered with a minimum of 1 foot of soil;

4. not remain open for longer than 30 days; and,
5. have at least 2 feet of soil as final cover.

Incineration

Michigan's Act 451, Part 55 "sources of air pollution" states that incinerators must be permitted by Air Quality Division of Michigan Department of Environmental Quality. They may require local license as well. Residue from incinerators may be buried, applied to cropland at agronomic rates, or taken to a licensed landfill.

Rendering

Traditionally, rendering services would travel from place to place collecting animal remains for free, being profitable by manufacturing animal tissues into feedstuffs for livestock and pets. In recent years, growing public concern about serious diseases in several parts of the world has decreased the use of these feedstuffs because of perceived health risks to humans (via the food chain) and directly to pets. Consequently, most renderers no longer collect animal tissue from farms, stockyards, or slaughter plants in some parts of Michigan, or they charge a substantial fee to do so (varying according to quantity, size, and condition of the carcasses). Renderers suggest that producers make arrangements for pick-up when animals are still alive or just after death. A biosecure building or trailer at the end of the lane or driveway is a way to prevent diseases from spreading from rendering vehicles coming onto the farm. Alternatively, deliveries of carcasses by the producer to the rendering plant are welcome.

Landfill

Currently in Michigan, about 20 landfills are licensed to receive dead animals. Arrangements can be made for carcass pick-up by the waste management firms, but they must comply with provisions for transportation as written in the Bodies of Dead Animal Act. If farmers deliver to the landfill, it is done with some risk of transporting disease from the landfill site back to production facilities.

Composting

This is the biological decomposition of organic material (i.e., bovine carcasses) under controlled conditions to a state where storage, handling, and land application can be achieved without adversely affecting the environment. It is the effective degradation of body tissue so that it is not recognizable and is aesthetically acceptable to other people. Following is a checklist of current, critical points for composting in Michigan.

• "Bulking agent" means any carbon source material added to compost to decrease its bulk density (lb per cubic ft), which provides aeration for the biological decomposition of carcasses. Acceptable materials must be unpainted and free from additives or preservatives, and include sawdust, chopped straw, spelt hulls, bean pods, grass clippings, leaves, shredded cardboard or newspaper, chopped cornstalks, and finished compost from a secondary compost pile.

• A composting structure is required and must be constructed according to provisions in the regulations.

1. The site for construction of a composting structure must be at least 200 feet from the nearest natural surface water and no closer to a water source than the distance between a septic drain field and a potable water well permitted by Public Act 399, the state of Michigan Safe Drinking Water Act of 1976 and Public Act 368, the Michigan Public Health Code of 1978, as amended.

2. The composting structure must be built with reinforced concrete floors impervious to moisture and adequate to bear the weight of equipment used to move composted material and capable of supporting static and dynamic frost loads.

3. The structure must consist of two or more bins, each constructed with at least three side walls built to at least the height of the highest point of any composting material contained within. A roof must cover any area used to compost dead livestock, thereby preventing seepage, runoff, and windblown movement of compost.

4. The structure must be constructed of a rot resistant material(s). The facility construction must be strong enough to resist mechanical forces generated when turning a pile.

5. The structure must be constructed large enough to handle the volume of material placed in the facility through the endpoint of the composting process.

6. The structure may be used to compost the normal and natural daily mortality associated with livestock production under common ownership or management.

• The livestock producer must manage the composting process.

1. The "primary compost pile or bin" means the first phase of composting during which the bulking agent, mortality, or afterbirth are combined to begin the process of decomposition.

2. A base of bulking agent 1 foot deep should be added before any livestock carcass is added for composting.

3. Carcasses and bulking agent must be added in layers so that the carbon-to-nitrogen ratio is between 15:1 and 35:1 (approximately 10 lb of tissue per cubic ft).

4. No livestock tissue should be placed in the pile closer than 6 inches to any bin wall.

5. Carcasses must be covered by at least 6 inches of bulking agent within 24 hours.

6. Total depth of the pile should not exceed 6 feet.

7. The "secondary compost pile" means compost material that has been turned or mixed after a minimum 60-day primary composting.

8. Primary and secondary composting are each for a minimum of 60 days. Turning aerates the material, enhancing the rate of decomposition. After the minimum 60 days, secondary piles may be turned frequently (i.e., every 30 days) until tissues are effectively decomposed.

9. A layer (3 inches minimum) of bulking agent that does not contain previously composted animal tissue (i.e., fresh

bulking agent) should cover primary and secondary piles at all times.

10. Temperature deep within the primary and secondary compost pile should be monitored and recorded twice weekly. The compost pile temperature should reach a minimum of 130° Fahrenheit on two successive readings.

11. Water may be added to compost piles in a manner which raises moisture content of the pile to 40 to 60%, but in no case should addition of water create or cause run off or leachate that leaves the composting facility.

12. Any bones or hides remaining in finished compost must be removed and added to a primary compost pile, or disposed of according to provisions under section 21 of the Act (burial or incineration) before the compost may be sold or transferred, or applied to cropland.

13. Flies, rodents, pests, vermin and other scavengers or predators must be controlled so as not to disrupt the compost piles in the composting structure or constitute a risk or health hazard to human or animal populations.

14. The disposition of finished compost may be by direct application to soils, sale, or other transfer of ownership.

15. Records containing all of the following information must be kept by the owner or operator of the composting facility for a minimum of 2 years and must be made available to the Director of the Michigan Department of Agriculture immediately upon request.

a) The start date of each primary compost pile.

b) The quantity of carcasses or afterbirth added each time an addition is made and the dates such material is added to any compost pile.

c) The internal temperature of each pile measured twice weekly with a 3-foot probe type thermometer

d) The date each compost pile is turned and becomes a secondary compost pile.

e) The final disposition, including method, location, date, and volume of the secondary pile.

Dairy Health

Practice-based Veterinary Education at MSU

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Readers of the Michigan Dairy Review may have met veterinary students as they accompany local veterinarians making visits to their farms. Those of you who have, may or may not be aware of the important role you and your livestock play in training future veterinarians from the MSU College of Veterinary Medicine. Where do these students come from? What training do they have before coming onto your farm with your veterinarian? What do they learn about livestock, livestock owners, agriculture, and economics, besides learning about veterinary medicine?

Student Profile

As with most MSU students, few students enrolled in MSU's Doctor of Veterinary Medicine (DVM) program come from farming backgrounds. Although not a requirement for admission to the CVM program, many of our DVM students have gained experience in agriculture by electing to take animal science courses as a part of their undergraduate studies. These courses provide excellent information concerning animal behavior, housing, nutrition, and management specific to livestock. These courses teach basic principles that also apply to non-livestock species.

Student Training

Classroom coursework during the 2.5 years of the pre-clinical veterinary curriculum provides important groundwork for the 18-month clinical phase of training prior to graduation. Veterinary education at MSU includes general and specific medical concepts of common domestic species including individual livestock and companion animals and populations (herds). During the clinical phase of training, 10 core clerkships (3-week clinical experiences) are required, which emphasize both livestock and small animals. In addition, 10 elective clerkships allow students to focus on areas that reflect the career path they wish to pursue. The majority of the clinical phase of training occurs in MSU's Veterinary Teaching Hospital and Diagnostic Center for Population and Animal Health.

Practice-based Ambulatory Program (PBAP)

One of the required clerkships, the PBAP rotation, occurs off-campus in private, large animal veterinary practices. Currently, the PBAP has 68 participating practices, involving approximately 200 veterinarians, located throughout Michigan (Figure 1). Students are given the option to select either a food animal directed practice or an equine practice. Approximately 100 students per year are matched to practices, of which about one-half select a food animal experience. Each practice hosts one student at a time and usually train two to four students per year. About one-half of the veterinarians that participate in the PBAP are predominantly food animal practitioners whose primary area of expertise is dairy. During their 3-week clerkship, students focus on examination, diagnosis, treatment, and prevention of common medical and surgical conditions of individual animals, plus herd-based preventive medicine and reproductive management programs. Examples of commonly encountered conditions are ketosis,