Composting
FACTSHEET

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MORTALITY COMPOST BIN DESIGN

This factsheet covers composter sizing and design, with general information on each and special instruction on poultry and pig mortality composting. The last section deals with composter construction.

COMPOSTER SIZING

A composter should be sized to adequately process the mortalities typically expected on the farm.

Poultry

Bin systems constructed for composting poultry typically consist of bins having a total volume of 125 litres for each kilogram of average daily loss. Of this, 62 litres is required for primary composting and 62 litres for secondary. In imperial units this is equivalent to one cubic foot each of primary and secondary bin volume per pound of average daily loss. For example, a broiler farm averaging 100 kilograms of loss per day would need approximately 6.2 cubic metres of primary bin capacity, and the same amount in secondary bin space. If half or more of the birds to be composted are large (7 kg - 15 lb or more) increase total bin volume by 50% to 190 litres per kilogram average daily loss (three cubic feet per pound).

Pork

Bin systems constructed for composting pork typically require about 2.5 cubic metres of total bin volume for each kilogram of average daily loss. Of this 1.25 cubic metres is required for primary composting, and 1.25 cubic metres for secondary. In imperial units this is equivalent to 20 cubic foot each of primary and secondary bin volume for each pound of average daily loss. For example, a farrow-to-finish farm averaging 50 kilograms of loss each day would need approximately 62.5 cubic meters of primary bin capacity and the same amount of secondary bin space. See Managing Pork Mortality Composting Systems, Factsheet No. 382.500-9, for information on estimating average daily losses.

General

While some producers find that they can manage with less capacity, the extra space costs little and provides valuable operating flexibility for contingencies such as short periods of higher than average mortality, busy times of the year when bins cannot be emptied on schedule, or occasional batches that require additional time to decompose completely.

Total bin volume recommendations suggested here assume only average daily death losses. Catastrophic losses due to disease, ventilation failures, or other unpredictable events would require considerably larger facilities.

COMPOSTER DESIGN

Composter design and layout can be determined once primary and secondary composting volumes have been estimated. Layout of a composter should be as flexible as necessary to accommodate existing features, restrictions, traffic patterns, equipment or other factors peculiar to a given operation. No specific layout is necessary or best in all cases. Following are some considerations in designing a mortality composter.

1. Provide primary and secondary composting volumes as calculated previously.

2. Depth of compost bins should not exceed 1.8 m (6 ft) so as to reduce compaction effects and the potential for spontaneous combustion. An ideal bin depth is 1.5 m (5 ft).
3. Since small carcasses are usually placed inside the primary composting bins by hand, the front of the bin should be designed so that carcasses need not be lifted over a five foot high door. This can be accomplished with removable dropboards that slide into a vertical channel on each side of the bin or with doors that split horizontally.
4. Width of compost bins is usually selected to accommodate the loading/unloading equipment to be used. Tractor front-end loaders, or skid-steer loaders are typically used to load and unload bins. Bin width should be at least 300 mm (12 in), and preferably 2/3 to 1 m (2-3 ft) wider than the bucket used for unloading, in order to prevent excessive mechanical damage to the bin or loader. If wheels on the loading/unloading equipment are wider than the bucket, the bin should be widened accordingly.
5. Length of compost bins is typically 1.5 m (5-6 ft) for poultry and 3 to 4.5 m (10-14 ft) for pork. Longer bins are more difficult to enter and exit, and composting proceeds more efficiently if the composting mass lies in a somewhat square configuration, rather than in a long rectangular bin.
6. Several, smaller primary composting bins work more efficiently than a few very large bins.
7. Even though calculations may indicate fewer, a minimum of two primary bins is required. This allows use of the second bin while the top layers of the first bin are still composting.
8. Secondary composting volume may be provided in bins which are duplicates of the primary bins, or may be provided in one bin equal to the total required secondary volume.
9. It may be desirable to add one or two extra primary composting bins in a composter design. These bins can be used for storage of ingredients such as litter, sawdust, etc. If unusually high mortalities occur during some period, these extra bins could be put into service to compost the extra mortalities. Experience has shown that some ingredient storage at the composter site greatly facilitates management of the process.

Poultry

The number of bins in a composting system will depend on individual bin dimensions and the total required bin volume. Bins with up to 7 to 8 cubic metres (250-300 cubic feet) of capacity are recommended for small carcasses. These bins would have floor areas of about 5 square metres (50 square feet). Extremely large bins that take a long time to fill are undesirable since they lead to unnecessarily long heating times for the first carcasses placed.

Example 1 illustrates the method of determining the number of primary bins needed for a poultry mortality composting system. Since fractional sized bins cannot be used, the calculations suggest that three primary bins be provided. Two bins might be adequate some of the time, but primary composting volume may be inadequate during periods of high death loss with only two bins. Three or four bins would provide some room for ingredient storage, with excess composting volume available in the event of expansion of bird numbers or higher than-expected death loss. The primary bins may be arranged in any configuration suitable to the operator. Generally, it is most efficient to arrange bins so that primary compost can be easily and quickly moved to the secondary composting area.

Figure 1/Layout A, is a schematic of a composter layout using three primary bins, with secondary composting volume provided in bins opposite the primary bins. A litter/ingredient storage area is provided at one end of the unit to facilitate management of the system.

Figure 1/Layout B, is a schematic of a composter integrated within a litter storage unit. In this system, litter is available as needed from the litter storage area. This area also provides long term storage for finished compost and litter not used in the composting process. As environmental concerns increase, the need for a litter storage facility is likely to become more acute. Litter spreading (including finished compost) should be done when climatic conditions and crop nutrient needs are most favorable to minimize environmental impacts.

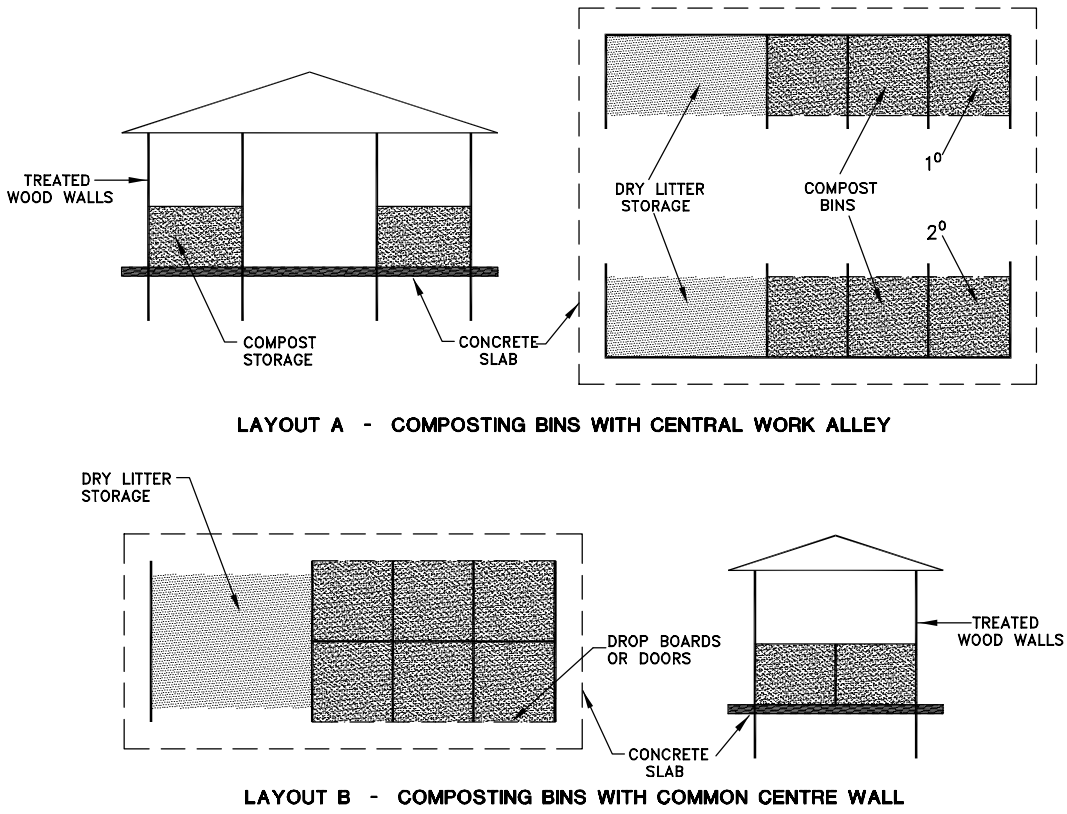

Figure 1 Two Typical Composting Unit Layouts

EXAMPLE 1
How many primary compost bins are needed for mortalities from a chicken broiler operation that has an average daily death loss of 160 kg (350 lb)?
1. Primary composting volume: 160 kg x 62 litres/kg = 9920 litres = 9.92 cubic metres or 350 lb x 1 cubic foot/lb = 350 cubic feet
2. Primary bin depth: 1.5 metres (5 ft) recommended
3. Primary bin width: bucket width plus 2/3 to 1 m (2-3 ft) recommended if bucket is 1.2 metres (4 ft) wide then width should be about 1.9 metres (6 ft)
4. Primary bin length: 1.5 metres (5 ft) recommended
5. Primary bin volume (depth x width x length): 1.5 m x 1.9 m x 1.5 m = 4.28 cubic metres or 5 ft x 6 ft x 5 ft = 150 cubic feet
6. Number of primary bins (total primary volume / primary bin volume): 9.92 cubic metres / 4.275 cubic metres per bin = 2.32 bins or 350 cubic feet / 150 cubic feet per bin = 2.33 bins

Pork

The number of bins required in a composting system will depend on individual bin dimensions and the total required bin volume. Bins with 15 to 30 cubic metres (500 to 1,000 cubic feet) of capacity are recommended for large carcasses. Bins of this volume would have a floor area of about 10 to 20 square metres (100 to 200 square feet). Extremely large bins that take a long time to fill are undesirable since they lead to unnecessarily long heating times for the first carcasses.

Example 2 illustrates calculations and assumptions in determining the number of primary bins needed for a pork mortality composting system.

A minimum of three months composting time is needed in both the primary and secondary phases. It may be necessary to extend this period of time if an unusual number of large carcasses are composted, or if ambient temperatures are low.

In most cases a minimum of three bins will be required, two of which are used for primary composting and the third for secondary composting. In a typical scenario, the first bin is filled with three months of death losses, at which time the second bin is started. At the end of the second three-month period, the second bin is full, and the last carcasses placed in the first bin have composted for three months. The contents of the first bin are then ready to move to the third bin for the secondary composting phase. After three months of secondary composting, the material can be moved out and applied to land, and the secondary bin (the third one) is available to receive the contents of the second bin. Larger operations will require more than the minimum three bins. Experience has also shown that having extra bins available for storage of fresh sawdust and finished compost is beneficial.

COMPOSTER CONSTRUCTION

Actual construction of a composter can be of many different forms, all producing good results. Some essential features to consider are location, type of structure, construction materials and ingredient storage. All good composters will include some or all of the following characteristics:

EXAMPLE 2
How many primary bins are needed for composting mortalities from a 200 sow farrow-to-finish operation that has an average daily death loss of 55 kg (120 lb)?
1. Primary composting volume: 55 kg x 1.25 cubic metres/kg = 68.75 cubic metres or 125 lb x 20 cubic feet/lb = 2500 cubic feet
2. Primary bin depth: 1.5 metres (5 ft) recommended
3. Primary bin width: bucket width plus 2/3 to 1 m (2-3 ft) recommended if bucket is 1.5 metres (5 ft) wide then width should be about 2.44 metres (8 ft)
4. Primary bin length: 3 to 4.5 metres (10 to 14 ft) recommended select a length of 3 metres (10 ft)
5. Primary bin volume (depth x width x length): 1.5 m x 2.44 m x 3 m = 11 cubic metres or 5 ft x 8 ft x 10 ft = 400 cubic feet
6. Number of primary bins (total primary volume / primary bin volume): 68.75 cubic metres / 11 cubic metres per bin = 6.25 bins or 2500 cubic feet / 400 cubic feet per bin = 6.25 bins

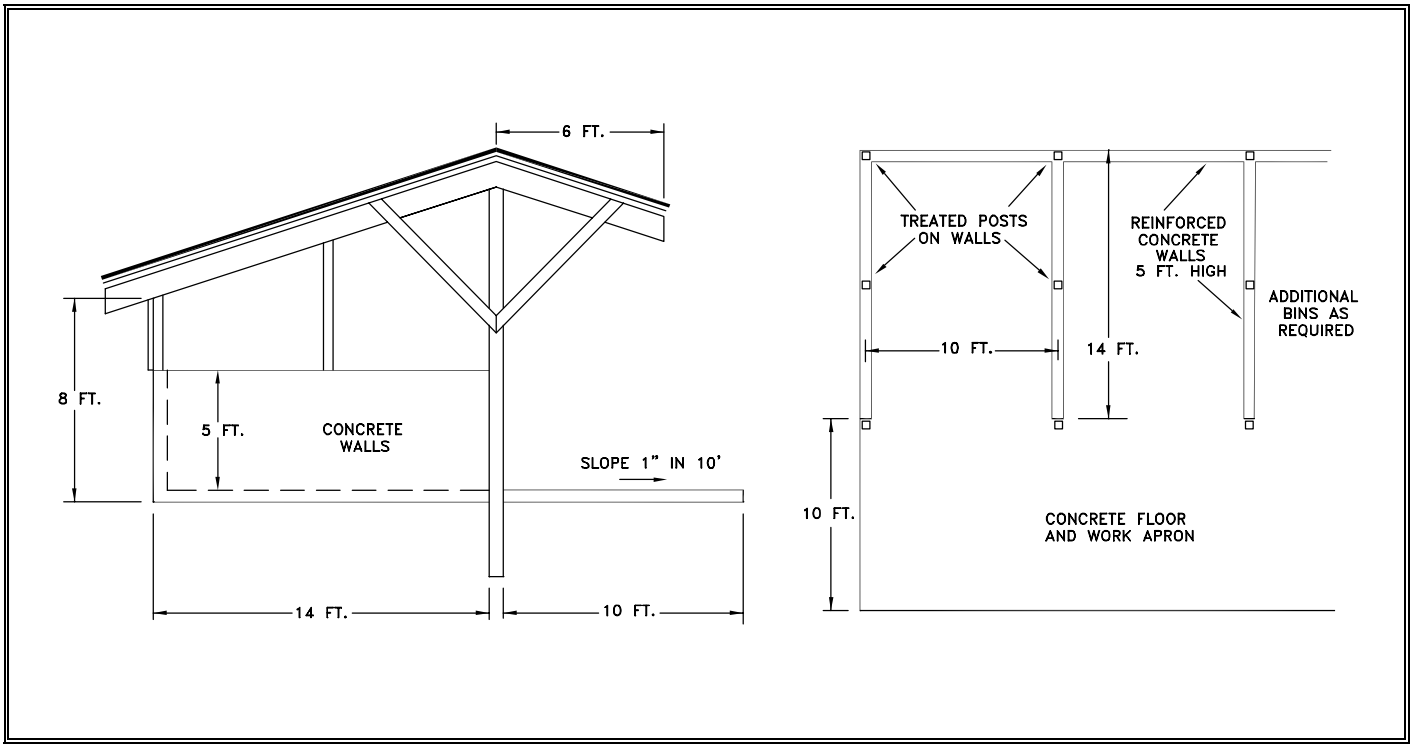

Figure 2 Schematic of a Pork Composter

Location / Access

Location of a composter should take into account any impact it may have on the farm residence and any nearby neighbor residences. While offensive odors are not usually generated in the composting process, the handling of dead birds and pigs, manure and litter on a daily basis may not be aesthetically pleasing. When locating a composter, consideration should be given to traffic patterns required in moving dead birds or pigs, moving the required ingredients and removing finished compost from the composter. The composter site should be well-drained and provide all-weather access roads and work areas.

Foundation / Floor

An impervious, weight-bearing foundation and floor should be provided for all primary and secondary composting areas. This feature ensures all-weather operation, helps secure the composter against rodent access and generally minimizes the potential for contamination of the surrounding area. In addition to providing concrete under the compost bins, themselves consideration should also be given to providing a similar concrete floor in traffic areas and work alleys. Experience has shown that, with the frequent loading and unloading activities associated with composting, dirt or even gravel areas tend to become rutted and potholed. This condition is worsened even more if the work alleys are not roofed.

Construction Materials

Any portion of the composter structure such as poles, and sidewalls which will be in contact with dirt or composting material should be constructed with pressure treated lumber or other rot-resistant materials.

Roof

Experience has shown that a roof covering the primary and secondary composting bins is necessary to control rain water and the moisture content of the composting mass. Roofing the working area as well facilitates all-weather activities. Additionally, any ingredient storage areas or bins should be roofed to preserve the ingredients at the desired moisture content. Roof heights must be adequate to ensure clearance for front end loaders; however, a high roof may allow too much direct rain or draining roof water to be blown into the composter. This problem can be minimized with the addition of partial sidewalls, and roof gutters.

Ingredient Storage

Experience has shown that having sufficient amounts of ingredients such as sawdust, and litter, present at the composter greatly facilitates day-to-day management of the process. Litter, however, may only be readily available during periods of partial or total building cleanout. Inclement weather can also hamper the handling and transfer of ingredients in a timely fashion. In determining the amount of storage needed, consideration should be given to the frequency with which ingredient transfer and restocking can be managed. Storage requirements may vary considerably among different operations. It has been suggested that providing a minimum of two bins (of primary bin size) for ingredient storage will sufficiently facilitate the operation of a four-primary bin composter. If more than four primary bins are required, ingredient storage may need to be increased according to the above ratio. Bins used for storage can double as primary composting bins if needed, during periods of high death loss, or may facilitate expansion of the composter if the farm is increased. Ingredient storage does not have to be in bins, but the ingredient storage area should be roofed.

If the composter can be constructed in conjunction with a litter storage facility, ingredient handling may be greatly simplified. Litter will be readily available from the litter storage area and other ingredients can be stored appropriately in the same location.

Although most poultry operations in British Columbia do not use litter storage facilities, experience has shown that such facilities can greatly enhance the management of building cleanout and field spreading operations. Since outside storage of litter in uncovered piles represents a potential environmental liability, litter storage facilities are required by regulation to be covered from October through April.

Finished Compost Storage

Secondary compost bins provide a place for compost to undergo a second heating cycle and further composting. However, as secondary bins become full, the compost must either be spread on the land or moved to a finished compost storage area. Any compost storage area should be covered to prevent rainfall from saturating the pile, which could cause leaching. A litter storage facility can also be used to store finished compost until land spreading can be conveniently carried out.

Utilities

A water line with freeze-proof hydrant at the composting facility will aid in adjusting the moisture content of the recipe if needed, and further facilitates cleanup and washdown of personnel, equipment and the composting area as needed. A minimum 20-amp electrical circuit will allow the use of power tools, lights or other appliances which may be needed at the composting facility.

This is one of a series of Factsheets on Composting. A list of references used in producing this series is included in the Composting Factsheet "Suggested Reading and References."

COMPOSTING FACTSHEET SERIES PREPARED BY:
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