Highfields CENTER FOR COMPOSTING

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Determining Your Compost Pad Size

The following worksheet has been created to help you work through the necessary calculations for determining the size of your composting site. In each step a description of the step is provided, along with an example. After the example provided in each step you will find a calculation provided with blank spaces in which you can insert your specific information. Cumulatively, these steps will help you determine the area required for your composting activities. Below you will find a list of questions to answer in order to size your composting site appropriately. This worksheet will help you address these questions step by step. In addition, you may find it helpful to develop a diagram as you go along in order to help you think through some of your space needs and how they might fit into a potential site. This process will help you determine the suitability of a location for your composting operation. This worksheet is specific to designing rectangular sites; additional steps will be required to assess the dimensional requirements of non-rectangular locations. Additionally, this worksheet is designed only to assist you with sizing the composting area and does not address the sizing of storm or wastewater management systems.

Basic Information Required for Sizing a Composting Site:

- How much material per day or week?
- How long is the composting period?
- What will your windrow dimensions be?
- What will the volume of material in each windrow be?
- How many windrows will you need to fit on the site at once?
- What space needs do you have for working area – alleys, perimeter travel lanes, etc.
- What additional space needs, such as for curing, mortalities, feedstock storage, wastewater management and access roads, might you require?
- What is the size and type of equipment you intend to use and what is your management strategy?

Step 1. - Volume of Feedstocks

A. Volume of Primary Material per day or week

Note: choose the timeframe by which you will base your projections, based on how often new feedstock will enter the site. Stick with this time period throughout the calculations – i.e. composting period

- Ex. – One 1400-pound cow generates 115 pounds manure per **day**
  50-cow herd generates 5,750 pounds manure per day
  Manure bulk density – 1700 pounds per cubic yard
  60 poundss dairy manure = 1 cubic foot
  50 cows = **96 cubic feet** of manure **per day**

YOUR ENTRY (primary ingredient from Recipe Development Worksheet):

Manure -

- Manure generation per day per animal: _____pounds
- Number of animals: _____
- Total generation per day
  - pounds per animal per day _____ x number of animals _____ = _____pounds/day
- Manure bulk density: _____Pounds/ YRD^3
- Convert to cubic feet
  - Bulk density _____ / 27 = _____pounds per cubic foot
- Total cubic feet per day
  - Pounds per day _____ / Pounds per cubic foot _____ = Cubic feet per day_____ft^3/day

Food Scraps (or other material with similar generation rate) **–**

- Food scraps per day per week: _____pounds
- Food scrap bulk density: _____pounds per cubic yard
- Convert to cubic feet
  - Bulk density _____ / 27 = _____ pounds per cubic foot
- Total cubic feet per week
  - Pounds per day _____/ Pounds per cubic foot _____= ___ Cubic feet per wk

B. Volume of Second Ingredient (second ingredient from Recipe Development Worksheet)

- Ex. – recipe - 3 yards wood shavings to one yard manure
  (3 ft^3 sawdust/ 1ft^3 manure) x (96 ft^3 manure/ day) = 288 ft^3 sawdust/ day

YOUR ENTRY:

- Ratio **(Step 8 of Recipe Development Worksheet)** of second ingredient **per cubic yard** of primary feedstock: _____
- Cubic feet of primary feedstock per day _____ x ratio of second ingredient to primary feedstock _____ = Cubic feet of bulking material per day_____ft^3/ day

C. Total Volume -

- Ex. – 96 ft^3 manure per day + 288 ft^3 shavings = 384 ft^3/ day

YOUR ENTRY:

- Cubic feet primary feedstock per day _____ + Cubic feet of bulking material per day _____ = Total cubic feet per day_____ft^3/ day

D. Adjusted Volume (Reduction from feedstock combining 15-20%) –
Total Volume per day (or wk) x (100 – percent reduction/ 100) = Adjusted Volume

- Ex. (20% vol. reduction) - 384 ft^3 x (100 – 20)/100) = **307 ft^3/ day**

YOUR ENTRY:

- Total cubic feet per day _____ x (100 - percent volume reduction ___ / 100) = Adjusted volume per day_____ft^3/day

Step 2. – Volume of Material on Pad

A. Determine length of composting period (commonly 120 – 360 days). Correspond the unit of time (day or week) with the period of time incoming feedstocks are measured in.

- Ex. - 120 days

YOUR ENTRY:

- Length of composting period (can be in days or weeks): _____

B. Total Volume on pad

- Ex. - 120 days x (307 ft^3/ day) = 36,840 ft^3

YOUR ENTRY:

- Length of composting period _____ x Adjusted volume per day _____ft^3 = Total Volume on pad at one time _____ft^3

C. Account for Shrinkage during composting (25-60 %)

- Ex. - Shrinkage factor – 25%
- Ex. - 36,840 ft^3 x 0.75 = 27,360 ft^3

YOUR ENTRY:

- Shrinkage factor: _____%
- Total volume on pad _____ft^3 x (Shrinkage factor ___ / 100) = Adjusted Total Pad Volume _____ft^3

Step 3. – Windrow Dimensions

A. Windrow Dimensions – size of your piles
- Ex. - 6' tall x 12' wide x 100' long

YOUR ENTRY:
- Windrow Dimensions: _____ft tall x _____ft wide x _____ft long

Step 4. - Windrow Volumes

A. Windrow Volume –
- Cross-sectional Area
  - parabolic windrows – 0.66 x base width x height
  - triangular windrows – 0.5 x base width x height
  - Ex. – 2/3 x 12 x 6 = **47.5 ft²**

- Windrow Volume
  C-S Area x Windrow Length = ft^3 per windrow
  - Ex. - 47.5 x 100 = **4,750 ft³**

YOUR ENTRY:
- Determine windrow shape (parabolic or triangular): _____
- Cross- Sectional Area Factor: _____ (2/3 or ½)
- Cross-Sectional Area Factor _____ x base width _____ft x height ___ft = Cross Sectional Area _____ft^2
- Cross-Sectional Area _____ft^2 x Windrow Length _____ft = Total Volume Per Windrow _____ft^3

Step 5. – Number of Windrows Required

A. # Windrows = Total Volume of Material/ Individual Windrow Volume
- Ex. - 27,360 ft^3 / 4,750 ft^3 = 5.76 windrows
- Ex. – Round – 5.76 windrows = 6 windrows

YOUR ENTRY:
- Total Volume of Material (**2C**) _____ft^3 / Single Windrow Volume _____ = _____ Windrows on Site → Round → _____ windrows

Step 6. – Work Space Needs

A. Windrow Spacing (10' for tractor-drawn windrow turners, 15' for skid steers, 20-30' for tractors, 30-35' for pay loaders)

- Ex. – 20' between windrows

  5 alleys x 20' ea. = 100'

YOUR ENTRY:

- Width of alleys: _____ft.
- Number of Windrows _____ - 1 = Number of Alleys _____
- Width of alleys _____ft. x Number of Alleys _____ = Total Alley Space _____ft.

B. Perimeter Travel Lane

- Ex. – 15'

  Perimeter – pad width (perimeter travel lane x 2) = 30'

  Perimeter – pad length (perimeter travel lane x 2) = 30'

YOUR ENTRY:

- Perimeter travel lane (pad width) _____ft. x 2 = _____ft.
- Perimeter travel lane (pad length) _____ft. x 2 = _____ft.

C. Total Work Space Needs

- Ex – Work Space Pad Width = 130'

  100' (Total alley space) + 30' (Perimeter travel lane) = 130' Total Width of Work Space
- Ex – Work Space Pad Length = 30'

  30' (Perimeter travel lane) = 30' Total Length of Work Space

YOUR ENTRY:

- Total Alley Space (width) _____ft. x Width of Perimeter _____ft. = Width of Work Space _____ft.
- Perimeter (Length) _____ft. = Length of Work Space _____ft.

Step 7. – Total Pad Area

*These calculations are based on a square pad

A. Width –

- Ex -Windrow width – 12' ea. x 6 windrows = 72'
- Ex - Work space width – 130'
- Ex - **Pad width = 202'**

YOUR ENTRY:

- (Windrow Width (**3A**) ___ft. x Number of Windrows (**5A**) ____) + Total Width of Work Area _____ft. = Total Width of Pad _____ft.

B. Length –

- Ex - Windrow length – 100'
- Ex - Work space length – 30'
- Ex - **Pad length = 130'**

YOUR ENTRY:

- Windrow Length (**3A**) ___ft. + Perimeter Length_____ft. = Total Length of Pad _____ft.

C. Total Area for Windrows–

- 130' (length) x 202' (width) = **26,260 ft2**

YOUR ENTRY:

- Pad Length _____ft. x Pad Width _____ft. = **Total Pad Area _____ft.2**

Step 8 – Total Site Area

In addition to the actual composting area, referred to here as the Pad Area, you may have additional space needs for activities that will support your composting, such as access roads and turnarounds, sheds, storage, curing, and feedstock receiving.

- Ex. - Identifying additional space needs:
  1. Storage & Receiving – 1500 square feet
  2. Curing – 500 square feet
  3. Shed – 500 square feet
  4. Turnaround – 1600 square feet
- Ex. – Total additional space needs – 4,100 square feet
- Ex – Total entire site square footage
  Total pad area + Additional space needs = Total Site Area
  26,260 sq. ft. + 4,100 sq. ft. = **30,360 sq. ft.**

YOUR ENTRY:

- Additional space needs (list item and necessary square footage):
  1. _____
  2. _____
  3. _____
  4. _____
  5. _____
- Total additional space needs –
  _____ + _____ + _____ + _____ + _____ = _____square feet
- Total entire site –
  Total pad area _____ + Total additional space needs _____ =
  _____ **TOTAL SITE AREA**