Composting on Horse Farms

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Composting is a biological process!

FRESH ORGANIC MATERIAL

Microbial Metabolism
(Heat + water + CO₂)

Water Vapor, CO₂

Oxygen

Compost Mix

STABILIZED ORGANIC RESIDUE

=>
Why Compost Manure?

- Destroys (animal) pathogens
  - temperature maintained at $\geq 131^\circ F$ for 3 days.
- Destroys weed seed ($\geq 131^\circ F$?)
- Stable product –
  - little odor potential, minimal attraction to flies
  - less leaching, timed release of N
- Plant disease suppression with finished compost
Why Compost Manure?

- **Less volume**
  - 20 - 50% less

- **Less weight – moisture & dry matter loss**
  - 70% reduction in weight
  - (40% dry matter loss & moisture drops from 70% down to 40%)

- **Improved C/N ratio**
  - Over 30:1 initially, decreases to less than 15:1
Disadvantages of Composting Animal Manure

- **Cost**
  - Labor, equipment, utilities, amendment additions (moisture, C/N control)

- **Nitrogen losses**

Dairy (Wisconsin) $100/dry ton produced??, Poultry $40/ton??
Horse ??????

Selling Price for Compost (yd³)
- $ General Public $7.00 pickup load ,
- $ Nurseries, Landscapers in bulk $12-20/yd³
Bacteria are major players!
Don’t need compost starters!

- Start with 1.
- Every 20 minutes it divides.
  - 20 minutes   2
  - 1 hour (3rd division)  8
  - 6.6 hrs (20 divisions) > 1 million

Limits on growth: nutrients, temperature, moisture
## Major Factors Affecting Process

<table>
<thead>
<tr>
<th>Factor</th>
<th>Ideal Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon/Nitrogen Ratio</td>
<td>25 - 40</td>
</tr>
<tr>
<td>Initial Moisture Content</td>
<td>50 - 65%</td>
</tr>
<tr>
<td>Porosity (Oxygen Level &gt;5%)</td>
<td>35 - 70%</td>
</tr>
<tr>
<td>Temperature</td>
<td>120 - 150 °F</td>
</tr>
</tbody>
</table>

**Pathogen Control**  **131°F, 3 days**

Formulate right mix and control the process to achieve goals. 50-60% moisture = a few drops of liquid when squeezing.
Design system to manage emissions, rainfall and runoff to achieve goals.

Clean Water Diversion
Surrounding Ground Slopes Away from Site
Current Production Facilities
Runoff Collection
Primary Pile
Secondary Pile
Filter Area
Avoid ponded water. It creates odor, high acidic compost, breeding ground for flies.
Avoid working on clay ground in Ohio months of December to May.
Getting Started

- Why do you want to compost?
- Determine amount of compost components.
- Formulate compost mix.
- Design compost site.
- Register with OEPA if want to sell compost.
OHIO Rules and Regulations

- Don’t need to register if use compost yourself
- Class III – register < 3 acres
- Class II – licensing > 3 acres

http://www.epa.state.oh.us/dsiwm
Rules 3745-27-40 to 3745-27-47
From Adrienne La Favre (Ohio EPA):

Free Composting Seminar. April 6 from 8:30-4:00 at the OEPA Twinsburg office. The workshop will address composting rules, including compliance with surface water, air pollution and hazardous waste rules.

Continuing education and Registered Sanitarian credits will be offered. To register or for more information, contact Adrienne La Favre at Adrienne.LaFavre@epa.state.oh.us
## Chemical Analysis for Horse Manure/Bedding
(sawdust vs. cardboard)

<table>
<thead>
<tr>
<th>Material</th>
<th>pH</th>
<th>water</th>
<th>Ash</th>
<th>C</th>
<th>N</th>
<th>C/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horse M./sawdust</td>
<td>8.2</td>
<td>57.3</td>
<td>5.6</td>
<td>46.9</td>
<td>1.0</td>
<td>47.1</td>
</tr>
<tr>
<td></td>
<td>±0.7</td>
<td>±2.1</td>
<td>±1.1</td>
<td>±1.2</td>
<td>±0.1</td>
<td>±4.5</td>
</tr>
<tr>
<td>Horse M./cardbd</td>
<td>8.1</td>
<td>56.4</td>
<td>12.9</td>
<td>42.3</td>
<td>1.25</td>
<td>33</td>
</tr>
</tbody>
</table>

1Note the carbon to nitrogen ratio is very dependent on how stalls are cleaned.
Composting in piles. Practical dimensions: width 10-20 ft., height 6-12 ft. (minimum 3.5’).
Composting in windrows. Practical dimensions: width 9-20 ft., height 4-9 ft.
Composting in bins. Practical dimensions: width 9-20 ft., height 4-9 ft.
Calculating bin size for horse manure + bedding

- Compost shavings 180 days, straw >120 days. Figure about 2.4 ft³ /day/horse
- Need to chose number of bins.
  
  **Example: 12 horses, 3 bins**
  
  - 2.4 ft³ /day/horse x 12 horses = 28.8 ft³
  - 60 days per bin (180 days/3 bins)
  - 28.8 ft³/day x 60 day = 1728 ft³
  - 1728 ft³ = 17ft x 17ft x 6 ft

Reference:
http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex7956
## Number & Size of Bins Needed

### Continuous Composting System

(See example diagram in next slide)

<table>
<thead>
<tr>
<th>Number of Stalls</th>
<th>Number of bins</th>
<th>Width</th>
<th>Length</th>
<th>Number of Post</th>
<th>Number and length of Fencing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 3</td>
<td>1</td>
<td>6'</td>
<td>18</td>
<td>8</td>
<td>1x50'</td>
</tr>
<tr>
<td>3 to 5</td>
<td>1</td>
<td>6'</td>
<td>30</td>
<td>12</td>
<td>1x75'</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>6'</td>
<td>18</td>
<td>16</td>
<td>2x50'</td>
</tr>
<tr>
<td>7 or 8</td>
<td>2</td>
<td>6'</td>
<td>30</td>
<td>24</td>
<td>2x75'</td>
</tr>
<tr>
<td>9</td>
<td>3</td>
<td>6'</td>
<td>18</td>
<td>24</td>
<td>3x50'</td>
</tr>
<tr>
<td>10 or 11</td>
<td>3</td>
<td>6'</td>
<td>30</td>
<td>36</td>
<td>3x75'</td>
</tr>
</tbody>
</table>

Okahoma State University web site:
Example of a 3 Stall System

The wire fencing is secured on the outside perimeter of the bin, leaving one end open. Materials to compost are placed against the enclosed end. As materials are added, the first 6’ of the pile are moved forward and the new material placed on top. Once filled, close the open end then remove compost from the other end until actively composting material is reached.

For more information of building a continuous composting bin, go to:
How does your bedding rate?

<table>
<thead>
<tr>
<th>Bedding Material</th>
<th>Low Dust</th>
<th>High Absorptio</th>
<th>High Cushion Support</th>
<th>Management Ease</th>
<th>Comping Rate</th>
<th>Low Palatability</th>
<th>Cost</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straw</td>
<td></td>
<td></td>
<td></td>
<td>Fast</td>
<td></td>
<td>Low</td>
<td></td>
<td>Can shift expose bare floor if not bedded deep enough or if horse is very active in stall</td>
</tr>
<tr>
<td>Shavings</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Slow</td>
<td>✓</td>
<td>Med</td>
<td></td>
<td>Do not use treated wood or certain hard wood (black walnut, yellow poplar). Kiln dried pine shavings recommended</td>
</tr>
<tr>
<td>Peat</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Fast</td>
<td></td>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recycled wood/paper combos</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Med</td>
<td>✓</td>
<td>Med</td>
<td></td>
<td>Variability between products</td>
</tr>
<tr>
<td>Hemp</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Med</td>
<td></td>
<td>Med</td>
<td></td>
<td>Variability between products</td>
</tr>
<tr>
<td>Synthetic</td>
<td>✓</td>
<td></td>
<td></td>
<td>N/A</td>
<td>✓</td>
<td>Med/High</td>
<td></td>
<td>Variability between products</td>
</tr>
</tbody>
</table>

Equine Research Centre, Guelph, Ontario.
Benefits of Turning

- Breaks up channeling in compost, more uniform airflow.
- Mixes in added water.
- Speeds up process - breaks apart clumps, mixes materials, makes more homogenous.
Recordkeeping

- Keep daily records of temperatures to identify problems. *(recommended)*
For more information:

Ohio Composting and Manure Management Program web site:
http://www.oardc.ohio-state.edu/ocamm/

On-Farm Composting Handbook.
To order, go to:
http://www.nraes.org/publications/nraes54.html