A Few Surprises: What Are the Best Recipes for Composting Large Bovine Carcasses in the Southern High Plains?

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Making the Microbes Unhappy

- Imbalanced diet
- Not enough insulation
- Too much water (or not enough)
- Not enough air (or too much)

Microbe Nutrition

- Target carbon-to-nitrogen ratio (C:N) of 30:1
- Low-carb diet favors NH₃ release
- Conventional wisdom: don’t stray too far from 30:1

Air and Water

1. Screwing up a pile means getting air and water out of proper balance
2. Water displaces air in a pile
3. Too wet goes anaerobic; too dry goes dormant
4. Too wet = >60%; too dry = <35%

Optimal Moisture Conditions

- Thermophile Activity Decreases
- Pore Space Begins to Fill; Anaerobic Conditions Predominate
- 40% to 60%

Temperature Considerations

- The cooler the pile, the easier the screw-up
- Small piles can’t insulate themselves as well
- Oversized piles reduce O₂/CO₂ exchange
- Optimal pile size depends on the distribution of pore sizes
**Materials and Tools**

- Carbon-rich materials
  - Variety of pore sizes
  - Total C is not the same thing as available C
- Front-end loader or windrow turner
- Reliable water source
- Long-stemmed thermometer
- Weaponry

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### C:N Ratios of Some Carbon Sources

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>N (% db)</th>
<th>C:N Ratio</th>
<th>C (% db)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit wastes</td>
<td>1.5</td>
<td>35</td>
<td>52.5</td>
</tr>
<tr>
<td>Yard wastes</td>
<td>1.3</td>
<td>23</td>
<td>29.9</td>
</tr>
<tr>
<td>Paper</td>
<td>0.3</td>
<td>173</td>
<td>51.9</td>
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<tr>
<td>Sawdust</td>
<td>0.1</td>
<td>511</td>
<td>51.1</td>
</tr>
<tr>
<td>Grass clippings</td>
<td>3.7</td>
<td>15</td>
<td>55.5</td>
</tr>
<tr>
<td>Leaves</td>
<td>0.9</td>
<td>48</td>
<td>43.2</td>
</tr>
<tr>
<td>Produce waste</td>
<td>2.2</td>
<td>20</td>
<td>44.0</td>
</tr>
<tr>
<td>Food wastes</td>
<td>3.2</td>
<td>16</td>
<td>49.9</td>
</tr>
<tr>
<td>Pine wood shavings</td>
<td>0.3</td>
<td>723</td>
<td>72.3</td>
</tr>
<tr>
<td>Oat straw</td>
<td>1.1</td>
<td>48</td>
<td>52.8</td>
</tr>
<tr>
<td>Wheat Straw</td>
<td>0.3</td>
<td>128</td>
<td>38.4</td>
</tr>
</tbody>
</table>
Some Serious No-Nos

- Site selection
  - Right next to the road (or the mayor’s house)
  - Bare, sandy soils
  - Sheltered from the wind
- Base material
  - Hydrophobic
  - Thin
  - Easily compressed

Nature Sometimes Works Against You

- Rain, snow and cold are the enemies
- Easterners and Southerners have one set of concerns
- Westerners have another
- Northerners have still another
- To shed, or not to shed, rainfall?

Summary: Don’t Do This

- Choose a location with bare, sandy soil, nearby surface water and cozy neighbors
- Use whatever nasty waste materials you have on hand
- Soak ‘er good
- Leave body parts partially exposed
- Walk away

“Ideal” Carcass Pile

Moist, slightly pre-composted, higher C:N

Dry, porous, absorbent (18-24”)

Beef Manure & Hay Compost (HOBO # 1)

Date

Temperature (F)

Precipitation (In.)

Varmints
**Equine Case Study**

- Dr. Lance Baker and Ms. Laurie Brown, WTAMU
- 3 Treatments x 3 Replications
  - Beef feedlot manure only
  - Feedlot manure + hay
  - Horse manure/wood shavings (stall cleanout)
- Low-Ash Manure from Paved Pens
- Carcasses Slightly Smaller than Mature Dairy Cattle (900-1200 lb/hd)
- Interim Data (3 mos.) Only; 6-mo. Data Pending
**Beef Cattle Case Study**

- 4 Treatments x 2 Replications
  - Beef feedlot manure only
  - Feedlot manure + hay
  - Horse manure/wood shavings (stall cleanout)
  - Horse manure/shavings + feedlot manure
- Low-Ash Manure from Paved Pens
- Smaller Carcasses (400-1000 lb/hd)
How They Stacked Up

<table>
<thead>
<tr>
<th>Bin</th>
<th>Recipe</th>
<th>Overall Rank</th>
<th>Recipe Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Horse manure + wood shavings</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Horse manure + wood shavings</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Cattle manure only</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Cattle manure only</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Cattle manure + CRP hay</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Cattle manure + CRP hay</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Cattle manure + stall cleanout</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

Interim Conclusions

- HOBO devices must be watched closely while in the pile (protected cables; check them weekly)
- Horse manure/wood shavings bedding composes easily by itself but is not optimal for carcass composting
- Low C:N ratios (~15:1) of cattle manure or manure + hay are not a major detriment temperature-wise
OTHER OBSERVATIONS

- Ending moisture contents ranged from 32-47% wet basis
- C:N ratio "conventional wisdom" needs to be reconsidered, or at least taken with salt grains
  - Excellent results in rainy weather (2004) even with C:N of 11 or 12
  - C:N ratio and porosity distribution show some interactions in overall pile performance
- Effective carbon differs from total carbon