A FEW SURPRISES: WHAT ARE THE BEST RECIPES FOR COMPOSTING LARGE BOVINE CARCASSES IN THE SOUTHERN HIGH PLAINS?

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A FEW RELEVANT LESSONS (SPECIAL THANKS TO THE TAIWANESE)

- Left to their own devices, large, intact carcasses will rot from the inside out
- Rotting carcasses generate lots of nasty gases
- Intact skin makes a decent balloon
- The larger the carcass, the more spectacular the failure

YOU’VE GOT OTHER OPTIONS

- Burial (tut, tut)
- Incineration (fuel $$, air quality regs)
- Biological and chemical digestion
- Pitch ‘em out back

THE ABCS OF MESSING UP A COMPOST PILE

DO BACTERIA REALLY HAVE KNEES?

- Screwing it up means cutting off the thermophilic aerobes at the knees
  - Imbalanced diet
  - Not enough insulation
  - Too much water (or not enough)
  - Not enough air (or too much)
Atkins™ vs. South Beach™

- 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% 60%

Some Like it Hot

- The cooler the pile, the easier the screw-up
- Small piles can’t insulate themselves
- Oversized piles reduce O₂/CO₂ transfer
- Optimal pile size depends on the distribution of pore sizes

So... how might we mess up a compost pile?

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>
</tr>
<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>49.0</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>
**Tool Time™**

- Carbon-rich materials
  - Variety of pore sizes
  - Total C is not the same thing as available C
- Big, heavy, exhaust-belching machines
- Reliable water source
- Long-stemmed thermometer
- Weaponry

**BUILDING FOR FAILURE**

- 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 CAN HELP YOU BLOW IT

- 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?

FAILURE IS AN OPTION

FAILURE 101

- 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
- Show off those (livestock) body parts
- Walk away

“IDEAL” CARCASS PILE

Moist, slightly pre-composted, higher C:N
12-24"

Dry, porous, absorbent (18-24")
**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)
Cattle Manure and Horse Manure/Bedding

Average (n=2) Temperatures

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>1</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>1</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>2</td>
</tr>
<tr>
<td>7</td>
<td>Cattle manure + stall cleanout</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>8</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 composites 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