Compost Production
and
Utilization

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Whether you own one horse...
Or many cows...
Manure is a resource!! Don’t waste it!
Methods of Composting

- Active windrows: This presentation
- Passive windrows: Online Fact Sheet
- Worms: Online Fact Sheet (vermicomposting)
- Bins: CO publication in progress, also see web for info
What Are Benefits of Windrow Composting?

- Reduces volume of manure approx. 50%
- Minimizes pathogen, weed, odor, and insect problems
- Stabilizes nitrogen and phosphorus compounds which minimizes water pollution
- Produces a useful and marketable soil amendment
What is Composting?

Composting is the

– managed,
– biological,
– oxidation process that converts
– heterogeneous organic matter into a more
– homogeneous, fine-particle humus-like material.

from FIELD GUIDE TO ON-FARM COMPOSTING (Rodale Institute)
MANAGED: what YOU do!

- Provide carbon (C) and nitrogen (N) in 30:1 ratio
- Provide oxygen for oxidation process at 5-20%
- Provide water to keep moisture at 50%
BIOLOGICAL: what microorganisms (MO’s) do

- Many species of bacteria and fungi metabolize the C and N to grow and multiply, using oxygen and water in the process.

- Composting is farming MO’s, which are present in the soil!
OXIDATION

- “In the presence of air”
- Used by MO in respiration
- Oxygen is in pore space in compost windrow
- Use bulking material and turn to maintain pore space for air
A variety of feedstock materials creates lots of air pockets or pore space essential for composting!
Heterogeneous Organic Matter

- Horse manure
- Bedding
- Waste hay
- Spoiled feed or grain
- Leaves and grass clippings
- Kitchen scraps
Homogeneous, Fine-particle Humus-like Material

- This is the final product that you are aiming for at the end of a successful composting process.
How to Make Compost!

For any scale that you choose
Choose a site

- Mowed area, smooth, slightly sloping
- Near manure source
- Near water tap and at least 100 ft. from “waters of the state” or wells
- Control run-on and run-off
- Refer to CSU Factsheet to calculate the area you will need to compost specific manure volume.
This is a bad location for manure or compost. Keep them 100 feet away from open water or wells.
The Compost Recipe

Be sure microorganisms have enough C to eat!

<table>
<thead>
<tr>
<th>MANURE TYPE</th>
<th>MEAN C:N</th>
<th>MIN C:N</th>
<th>MAX C:N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef</td>
<td>10:1</td>
<td>4:1</td>
<td>18:1</td>
</tr>
<tr>
<td>Dairy</td>
<td>11:1</td>
<td>4:1</td>
<td>17:1</td>
</tr>
<tr>
<td>Chicken</td>
<td>10:1</td>
<td>6:1</td>
<td>13:1</td>
</tr>
<tr>
<td>Swine</td>
<td>12:1</td>
<td>12:1</td>
<td>12:1*</td>
</tr>
<tr>
<td>Horse</td>
<td>21:1</td>
<td>16:1</td>
<td>30:1</td>
</tr>
<tr>
<td>Sheep</td>
<td>13:1</td>
<td>8:1</td>
<td>17:1</td>
</tr>
<tr>
<td>Llama</td>
<td>16:1</td>
<td>16:1</td>
<td>17:1*</td>
</tr>
</tbody>
</table>

* Small # of data points were collected
Building the Windrow

- Layer feedstock loosely with bulking material, adding water to 50%
- Work end view into rectangular shape like loaf of bread, top flattened
- Add new material at one end only
Height and width of windrow depends on equipment!

4-6’ tall

HOT AREA

6 - 10 feet wide (?)

END VIEW OF COMPOST WINDROW
Equipment like this makes composting fast and easy.
Add material containing carbon if your manure isn’t mixed with bedding.
Compost can be shaped and mixed by hand or with equipment that has a bucket attachment. Don’t drive over your compost!
Making compost by hand works for a few horses or if you have a lot of help.
Add plenty of water when building the windrow. Microorganisms need moisture to work!!
Newly Built Windrow at Large Horse Facility

Oldest end
Large compost operation in Weld County
Experimental composting windrow at CSU
Bin composting is another option for small scale operations.
Monitor the Windrow

- Check temperature with compost thermometer (www.reotemp.com) or your hand

- Heat is an indicator of biological activity

- Graph heating cycle: increase then decrease

- After decrease, turn to aerate and add water, use graph to help with timing
Insert a thermometer into center of pile to monitor temperature, which is an indication of biological activity.
• The temperature will rise to over 140° in a newly built pile, which will kill most weed seeds and pathogens.

• Recent research suggests a composting process that generates temperatures greater than 140°F can destroy seed viability after one turning.

• This study also concluded 100% of weed seeds lost viability in watered compost (as opposed to no water added during ‘composting’) even when 140°F was not reached.

Even in winter composting organisms metabolize enough to produce substantial heat.
Relationship of Time and Temperature to Compost Turning

Days from First Building or Turning

Temperature (Deg. F)

0 20 40 60 80 100 120 140 160
Continued Monitoring...

- After turning, monitor heat cycle again
- Turn when temperature decreases
- Check water; Add if necessary
- Repeat turnings until temperature ceases to rise (about 4 turning cycles)
Curing Phase

- When temperature curve flattens, mesophilic (mid-temperature) MO’s take over to finish process
  - Keep windrow moist, less than 50%
  - Takes 1-2 months
Why cure?

- Assures highest quality product
- pH shifts to neutral
- Soil MO’s re-colonize compost, impart disease suppressing qualities to compost
- If too much C left, use of this compost as a soil amendment may cause a temporary N deficiency, just the opposite of what you want!
- Makes compost optimum for plant growth
When is my compost done?

- After heating cycles stop
- After curing
- Check for homogenous, fine-particled humus-like appearance
- Earthy smell
- Maturity tests: Solvita test (becoming recognized by highway departments), and others, experience!
  - www.woodsend.org
Now what??

- Useful soil amendment
- Contains N, P, K, micronutrients, and live microorganisms, amounts vary
- N is released slowly
- Topdressing with 1-2 inches usually OK
- Send compost sample to soil lab with soil sample to correctly determine how much to apply and compost quality class
How can compost be used?

- As a soil amendment to increase soil organic matter, fertility, water holding capacity and infiltration rate.
- Use as topdressing for lawns, gardens, shrubs, trees
- Make compost tea (new area)
- Stall bedding
- Sell to landscapers
Compost Utilization

The $10 million dollar question!!!

– How much nitrogen and phosphorus is available from applied compost in year 1, year 2, ...?

  ▪ Research suggests that 20-40% of the nitrogen is available the first year and 50% of the remaining nitrogen is available in year 2 (personal communication. L. Cooperband, February 27, 2005).

Different composts mineralize at different rates!!!

Soil sample every year!
Troubleshooting

- No heating
- Smells: rotten smell or like ammonia
- Etc, Etc!


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More Information

- Visit our website:
  - www.manuremanagement.info
    - CSU Cooperative Extension Publications (fact sheets), composting under “Livestock”
    - CSU Soil Testing Lab – soil analytical laboratory
    - Colorado Analytical Lab—local compost laboratory

- Contact us:
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