YPF Composting Partnership

In Field Manure Composting to Reduce Phosphorus Loss.

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Conservation Planner
Composting – use naturally occurring aerobic bacteria, fungus and micro-organisms to decompose carbon based materials.

- break down short chain carbon molecules (sticky part of manure!!) using readily available energy.

- leave behind stable, partially digested long chain carbon molecules to allow slow release of nutrients for use by crops.

- generate heat (120-160 degrees) and steam.
Manure Composting

Benefits of Composting

- Reduced runoff from stacking area vs. manure
- Increase nutrient uniformity in stack (blended)
- Reduced volume and weight vs. manure
- Reduced odor and pathogens vs. manure
- Lower N content (+/-?), Higher P and K content
Manure Composting

GOAL: handle composted manure as a soil amendment (fertilizer) instead of a waste product for disposal.

- More uniform nutrient analysis.
- Distribute nutrients more widely across farm to fields with lowest soil test levels.
- Allow applications onto high risk fields (steep slopes and fields near surface water/non-farm neighbors.)
Compost Turner
Compost Turner
Indoor Composting
3 bedpack manure composting piles were observed for 90 days (WI NRCS funded study).

Manure was monitored for before and after:
- N/P/K
- Temperature
- Porosity
- Bulk Density
Compost was scheduled to be turned (aerated) every 10 – 14 days.

Measurements were taken in 14 day intervals.

Bedpack manure had varying types of carbon material, density and uniformity.
Site 2
Site 3
## 2017 Composting Research

### Compost Nutrient Analysis

<table>
<thead>
<tr>
<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>N 3.5</td>
<td>N15.6</td>
<td>N8.4</td>
</tr>
<tr>
<td>N4.4</td>
<td>N4.0</td>
<td>N1.8</td>
</tr>
<tr>
<td>N2.6</td>
<td>N2.0</td>
<td>N1.4</td>
</tr>
</tbody>
</table>
## 2017 Composting Research

### Compost Nutrient Analysis

<table>
<thead>
<tr>
<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>P4.1</td>
<td>P7.3</td>
<td>P1.7</td>
</tr>
<tr>
<td>K12.7</td>
<td>K15.6</td>
<td>K3.0</td>
</tr>
<tr>
<td>P9.6</td>
<td>P7.6</td>
<td>P4.2</td>
</tr>
<tr>
<td>K29.0</td>
<td>K14.3</td>
<td>K6.7</td>
</tr>
<tr>
<td>P8.3</td>
<td>P5.5</td>
<td>P4.4</td>
</tr>
<tr>
<td>K25.4</td>
<td>K11.3</td>
<td>K7.1</td>
</tr>
</tbody>
</table>
## 2017 Composting Research

### Bulk Density (after drying)

<table>
<thead>
<tr>
<th>Site</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>7.5kg/l</td>
<td>3.3kg/l</td>
</tr>
<tr>
<td>Site 2</td>
<td>9.0kg/l</td>
<td>8.4kg/l</td>
</tr>
<tr>
<td>Site 3</td>
<td>12kg/l</td>
<td>8.5kg/l</td>
</tr>
</tbody>
</table>
### Soil Nitrate Levels (ppm - N03)

<table>
<thead>
<tr>
<th>Depth Range</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 6 inches</td>
<td>0.8 ppm</td>
<td>1.67ppm</td>
</tr>
<tr>
<td></td>
<td>0.86ppm</td>
<td>2.49ppm</td>
</tr>
<tr>
<td>6 – 12 inches</td>
<td>0.61ppm</td>
<td>1ppm</td>
</tr>
<tr>
<td></td>
<td>0.7ppm</td>
<td>1.24ppm</td>
</tr>
</tbody>
</table>

* Adjoining corn cropland tested at 9.16ppm/9.47ppm
2017 Composting Research

Observations

Composting bedpack manure:

Increase density and porosity of manure by 20-50% (weight is also affected by moisture content). Moisture reduced by same amount BUT can re-wet if left standing after heating.

Concentrate P and K and provide a loose/friable texture that spreads uniformly.

Composted manure has little to no odor when land spreading.
Observations

Composting bedpack manure (continued):

N is released as gas and DID NOT leach into the soil (allows for safer storage of manures in unlined locations).

Reduce N content by 26% to 90% (loss of valuable nutrient??)

Other research has documented reduction in pathogens and weed seeds (140-160 degrees F routinely seen in YPF sites).
Observations

Soil below composting sites appears to have been sterilized (little vegetation regrowth/no significant change in pH).

Biological activity in compost maximizes for 7-10 days following turning (aeration).

Turning pile with a loader did not stimulate as much heating.

Compost that is uniform in density and manure distribution will heat more consistently and will maximize loss of moisture and bulk density (weight).
2017 Composting Research

Observations

A minimum of 4 turns (45 days) is required to produce a noticeable change in the bedpack manure.

Compost sites that are closer to the farmstead tend to be more consistently managed when compared to remote sites (even if access is adequate).

Finished compost applied to hay following harvest resulted in a noticeable increase in alfalfa regrowth compared to adjacent areas that did not receive the compost.
2018 Winter Outdoor Composting
2018 Winter Outdoor Composting
Site selection is critical:

- Firm soil (untilled) with grass/hay or crop residue cover is preferred.
- Level site to allow turning equipment to move through the pile at a constant speed.
- Positive drainage away from stack and minimal upslope clean water entering the site.
- Site should have at least 3 feet separation from water table or bedrock and 100 feet from concentrated flow channels.
- Easy access (near all season lane or field road)
Winter Composting Stack Management

- More carbon (bedding) may be needed to achieve consistent results in winter composting.
- Immediate turning after placement produces most consistent heating.
- Piles that lose heat (too wet/too dense) can be restarted by adding more carbon and turning more frequently to re-start heating.
- During extended periods of rain/wetness “let pile sit” to prevent site rutting (minimal benefit to turning when pile is too wet).
Concerns from participants:

- May require additional labor/equipment to support compost turning in less than ideal site conditions.
- May require use of additional bedding (carbon).
- Finished compost may not spread uniformly from existing manure spreaders (set to handle heavy and clumpy manure).
- Will push spreading workload into cropping season.
- Increase in fertility value may not be significantly above break even.
2018 Winter Outdoor Composting

Benefits:

- Eliminates spreading of manure during late winter when runoff is more likely to occur.
- Finished compost is easier to load and haul compared to headland stacked manure.
- Composted manure can encourage a more prescriptive nutrient application strategy.
- Where hay is available multiple summer application windows are available. Compost has minimal negative impacts on hay vs. manure.