Nutrient value of compost
Theoretical value of compost application:
- Increase organic matter
- Improve aggregate stability
- Reduce bulk density
- Increase water holding capacity
- Increase cation exchange capacity
- Enhance the soil microbial community
- Suppress soil pests
- Provide nutrients
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Reality check:
1) Compost application should increase soil organic matter and improve tilth; the practical significance of these and other effects varies on a case-by-case basis.
2) Nitrogen contribution likely to be modest, whereas the P and K contribution may be excessive.
General nutrient properties of composts:

Nutrient content (dry weight basis):

<table>
<thead>
<tr>
<th>Type</th>
<th>% nutrient content</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Poultry manure</td>
<td>2 - 4</td>
</tr>
<tr>
<td>Feedlot manure</td>
<td>2 - 3</td>
</tr>
<tr>
<td>Dairy manure</td>
<td>1 - 2</td>
</tr>
<tr>
<td>Urban yard waste</td>
<td>1 - 1.5</td>
</tr>
<tr>
<td>Crop residue</td>
<td>1.5 - 2.5</td>
</tr>
</tbody>
</table>

Forms of N present:
Organic N > 90%
Mineral N (NH₄-N, NO₃-N) < 10%
How much plant-available N do composts provide?

UCD N mineralization studies:
25 composts tested
• Poultry manure
• Feedlot manure
• Dairy manure
• Crop residue
• Urban green waste

Blended with moist soils, and net N mineralization was measured by:
- incubation for 12 weeks @ 77 °F constant temperature
- 18 week greenhouse bioassay measuring N uptake by fescue
Seasonal net N mineralization no more than 10% of initial organic N
% N mineralized

C:N ratio in compost

Fescue bioassay  Lab incubation
Do other researchers agree?

- These results on the lower end, but recent research generally showed net N mineralization of common types of compost to be < 10% of initial N in the first growing season after application.

- The exception is very high-N manure-based compost (> 3% N), especially if not well composted.
Composting slows down N mineralization:

Average of 4 materials of each type:

18 week UCD lab incubation
N mineralization over time:

N mineralization starts fast, slows over time.

By the end of one season after field application the remaining compost N behaves much like soil organic matter.
Calculating the N ‘credit’ from compost:

Example: Feedlot manure compost @ 2% N

If the application is 5 dry tons/acre = 200 lb total N/acre
5 to 10% of 200 lb = 10 to 20 lb available N for this season’s crop
Manure compost application can result in excessive P and K:

- 5 dry tons/acre of compost with 2% P ≈ 450 lb P$_2$O$_5$ equivalent
- 5 dry tons/acre of compost with 2% K ≈ 250 lb K$_2$O equivalent
How available is P in animal manures and composts?

<table>
<thead>
<tr>
<th>Material</th>
<th>% of P content in organic form</th>
<th>% of P content in inorganic form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedlot manure</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>Composted manure</td>
<td>16</td>
<td>84</td>
</tr>
<tr>
<td>Dairy manure</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>Poultry litter</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Swine manure</td>
<td>9</td>
<td>91</td>
</tr>
</tbody>
</table>

Studies show that manure or compost P can substitute nearly 1:1 for synthetic fertilizer; the limitation is that it cannot easily be banded unless the material is pelleted.
K is not incorporated into organic compounds in plants or animals, so K in compost is readily available.

How about K availability?
Nutrient contribution from surface-applied compost?
✓ N contribution will be slowed due to surface drying, but heavy rate or repeated application can still cause excessive N availability

✓ Excessive P and K loading an issue if the compost is manure-based
Is compost tea a significant nutrient source?

- Most teas contain a range of essential nutrients, but at very low concentration.
- At typical application rates the nutrient effect is insignificant.
  - A spray application of a typical compost tea @ 30 GPA would apply < 0.1 lb N / P / K per acre.