

The Value of Compost in a Sustainable Agricultural System - Chris Alenson Aug '15

“Use compost during the growing season; use compost when preparing the seed bed: use compost when digging the ground in the autumn. The more compost you use, the more plants you can grow. The greater the residues you will have available for composting – and the richer and healthier your soil becomes”. Sir Albert Howard

What is Compost?

Compost is pre-digested organic matter enriched with an array of microorganisms and humic materials that can enrich and inoculate your soil thus enhancing its long-term sustainability. It is well balanced in the major plant nutrients and contains many essential trace elements, which are slowly released as the plants require them. Good quality compost has an earthy smell with a granular texture illustrating that all residues in the process have been decomposed. Compost and organically grown plants may have stronger cell structure and be less susceptible to insect pests (1,2) Food plants grown in compost have been demonstrated to be nutritionally higher in vitamin C, have less detrimental levels of nitrate and potentially protected from a range of soil-borne pathogens(3,4,5).

Compost can be made from most organic wastes of animal and plant origin. Commonly used materials include spent hay, dairy wastes, grass clippings, sawdust, vegetable scraps and domestic green wastes (6).

When the compost process takes place organic matter is changed into humus and other compounds, which plants can use for food.

Organic wastes and carbon/nitrogen ratios

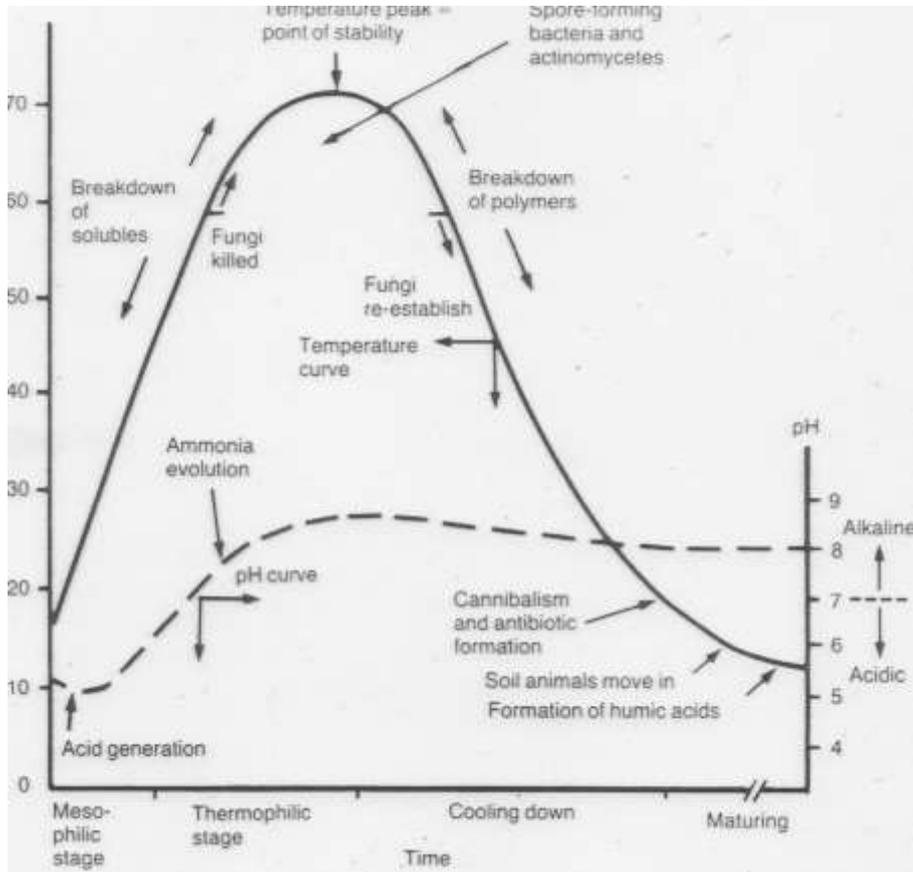
The key to successful composting is to understand how the carbon, nitrogen content of organic materials may affect the composting process. All organic materials will consist of a percentage of carbon and nitrogen. The table below indicates the ratio of a range of potential composting materials. Straw for example has a ratio of 80:100 parts carbon to 1 part nitrogen. Given that finished compost should have a ratio of about 14:1 material with higher nitrogen would have to be added to the straw to complete the composting process while lucerne hay with a ratio of 12:1 would require higher carbon material to balance the higher nitrogen. A comprehensive table of C/N ratios can be found at the Cornell University compost site <http://compost.css.cornell.edu/>



Some organic materials with their respective carbon/nitrogen ratios

Lucerne hay	12:1
Chicken litter	15:1
Compost	15:1
Animal manure	12-20:1
Weeds	30:1
Grass clippings	20-40:1
Leaf litter	60-100:1
Straw	80-100:1
Sawdust (hardwood)	500/1

The diagram below indicates the pH and temperature variation seen in the hot composting process. Note that at different temperatures different populations of microorganisms inhabit the heap until at a mature cooler stage, soil animals including worms will be seen.



Value added compost can be made by adding a range of mineral products and organic wastes such as seaweed products during the compost pile construction. Minerals often added are rock phosphate (to add P) and granite or basalt dust (to add a wide range of nutrient containing minerals). Rock phosphate added to compost has been demonstrated in the field to be as efficient as adding single superphosphate to the soil (7, 8).

Compost use

Compost can be used as a soil conditioner enhancing soil health, as high-value mulch and as a starter for the fermentation of compost teas. Surface application is generally from 2.5 -5 tonnes per hectare.

As a soil amendment it can:

- Improve soil structure, tilth & depth
- Increase soil fertility with slow element release
- Increase soil biological activity
- Increase water infiltration and storage
- Increase cation exchange
- Increase the disease suppressive nature of soil
- Enhance element availability
- Enhance microbial environment
- Increase organic matter & soil carbon storage





The use of compost in organic agriculture

There are perhaps two distinct use of compost in organic agriculture. Firstly in a perennial agricultural/horticultural system such as orchards and vineyards where it is difficult to build soil fertility with a normal rotation (although cover crops may be used), and secondly in an arable cropping system where a well-designed rotation incorporates the use of legumes and green manure crops as the major soil building strategies, but where compost may compliment this particular operation.

In organic agriculture organic standards state clearly that all off farm wastes must be composted prior to use and that any sourced materials should be free from possible contamination. Good record keeping is essential for all materials brought onto the organic farm.

All users of compost should be aware that compost quality may vary considerably, and could have quite dramatic negative effects on plant productivity. Compost is recognised as having a slow release of nitrogen as it is bound in organic forms and in the protoplasm of microorganisms. Poor quality compost (either immature or a wide carbon/nitrogen ratio) may lead to a nitrogen tie-up and suppress growth.

The following table indicates composts with varying carbon/nitrogen ratios and the percentage of total nitrogen estimated to be mineralised after applying the material. A well-made compost with a low C/N ratio is obviously going to supply more available nitrogen.

Compost C:N ratio	% of total nitrogen estimated to be mineralised after application
<10:1	Up to 25%
12.5:1	17.5%
15:1	10.0%
17.5:1	5.5%
>20:1	0.0%

Potential hazards in the use of compost

Does the nutritive value of your soil amendment come with a hidden risk?

Compost is of course a dynamic material that is continually evolving through microbial processes. Compost users are well aware of the benefits of compost in agricultural and horticultural activities but perhaps less aware of potential hazards contained in this product. Compost is a breeding ground for a wide range of microbes including some which may be dangerous pathogens. There are a number of fungal organisms, which can be potentially fatal to humans and animals. Legionnaire’s Disease is probably the most well-known one caused by the inhalation of *L. Longbeachae*.

Precautions in the handling and use of compost cannot be underestimated. The use of nose and mouth coverings is essential particularly when the material is dry and dusty and the use of gloves is to be seen as beneficial. Spreading on windy days is not to be recommended. Washing of hands should be part of any routine practice.

Compost is manufactured from a wide range of organic materials. Compost users and manufacturers should be aware that any inputs into this system might still be present at the end of the composting process. There have been instances of herbicides still being present at the end of the process causing wide damage to horticultural plant (9). Heavy metals are not going to be broken down in the composting process. They may be introduced in the composting process through the additions of coal ashes, manures and litter from industrialised animal production units. Arsenic and copper are added to feeds, and copper and zinc are used as hoof disinfectants.

Summary

Many organic farmers will make their own compost on the farm but some will purchase it, as they may be unable to make sufficient quantities. Although the Australian standard AS 4454-1999 specifies some basic requirements for composted materials and will ensure no toxic materials are present and that heavy metals are below the safety level, it is still up to the purchaser to request from the supplier an analysis to ensure compliance.

A good quality compost should have the following attributes:

- pH ranging from 7-7.5
- A carbon/nitrogen ratio <15:1
- A high cation exchange capacity (CEC)
- A healthy earthy smell
- High biological activity
- A good spread of other major, minor and trace elements



Further Information

The Compost Victoria website has a range of information, fact sheets and case studies on the use of composts in different farming enterprises. For more information go to <http://compostvictoria.com.au/index.html>

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