

Compost Characteristics - what they can really tell you!

Tests that help to characterise composts can often be confusing. Understanding compost tests and characteristics can help you decide which product is right for you. Here we explain some common tests undertaken on compost products that can help you determine if a product is safe and suitable for your needs. By understanding the characteristics of different composts you can often find a product designed to suit your specific end use (e.g. seedling bed preparation, weed control, soil moisture conservation, top dressing).



Compost can

- *Build better soils*
- *Fertilise your soil and plants*
- *Grow stronger, healthier plants*
- *Improve water retention*
- *Suppress diseases*
- *Improve yields*
- *Reduce erosion*
- *Reduce weeds*
- *Save you time and money*

Particle size

% mass graded using a 16 mm sieve

A sample of the compost product is shaken over a sieve and the percentage of material that doesn't pass through the sieve is measured. This measure is used to classify the compost into three categories:

Coarse Mulch - at least 70% of the material is larger than 16 mm (i.e. retained on the sieve)

Fine Mulch - between 20% and 70% of the material is larger than 16 mm

Soil Conditioner - less than 20% of the material is larger than 16 mm

Mulches are used for surface application while soil conditioners are incorporated into the soil.

Coarse textured material is the most appropriate for use as mulch. It has larger woody particles, which help water and air reach the soil easily. Finer textured materials tend to have a higher nutrient content and can act faster to improve soil structure and water holding capacity but they can also reduce infiltration, preventing water from reaching the soil.

The decision to choose coarse or fine textured mulch will depend on your specific needs. Mulches act as a protective barrier and help with weed and erosion control as well as improving moisture conservation and water infiltration. An application rate of 50-75 mm in height is recommended for coarse materials and rates should not exceed 100 mm. Mulches of finer texture can be applied at 25 mm but they should not usually be applied at high rates (not higher than 50 mm).

When using a composted soil conditioner, use the nutrient requirements of the crop to guide your application rate. Composted soil conditioners will help with plant establishment, increase organic matter and nutrient levels as well as improve soil fertility. Soil conditioners with a smaller particle size (<5 mm) can be used for top dressing on golf courses and sporting grounds.

Coarse textured compost is the most appropriate for use as mulch. Compost used for soil incorporation should always be fully composted and adequately stabilised. As this material will often come in direct contact with the plant, it should be of high quality.

pH

measured on a logarithmic scale of 1 - 14
pH is a measure of the acidity or alkalinity where one is highly acidic and 14 is highly alkaline (also called basic or basicity). Distilled water has a pH of around seven and your compost should be in the range of pH 5.0-8.0. Most composts have neutral to slightly alkaline pH. Plants vary in their tolerance to acidity and alkalinity and pH influences the amount of nutrients available to plants.

Compost can be manufactured to a specific pH to suit your needs (within limits). Your plants might require a lower pH to thrive (i.e. native plants) but still require the high levels of organic matter and nutrients that compost provides. Talk to your compost supplier about tailoring a product for you.

Electrical Conductivity (EC)

dS/m (deci-Siemens/m)
Electrical conductivity is used to measure the amount of nutrients in the compost that are in the form of salts. EC is a common measure you will also find on your soil and water tests. Compost is mixed with a set amount of water and an electrical conductivity meter measures how much electricity moves through the water. Electricity moves better through solutions high in salts, so the higher the EC reading the saltier the product. Since nutrients occur in compost as salts, high EC may also indicate high levels of nutrients. EC can also indicate the salinity or saltiness of compost (NaCl). You should check whether high nutrient or high salt (NaCl) content is responsible for any elevated EC readings.

Compost with an EC range of 0-2dS/m can be applied at any rate to salt sensitive plants without having any impact. In most circumstances, an EC in the range of 2-4 will not cause any problems at moderate compost application rates but if the EC is above 4

then the use of that compost should be carefully considered (particularly if the soil already shows elevated EC levels). The effect of compost will also depend on the application rate.

Moisture Content

% wet weight basis

The moisture content of compost should be between 30-40% wet weight basis. If the moisture content of the compost is too low then the product may cause dust issues when being transported or spread. You also want to make sure that you get what you pay for and you are carting compost and not water! This measure is not as important in composted mulches.

Primary Plant Nutrients

mg/kg or %

There are five primary nutrients that are generally measured in compost: nitrogen (N), phosphorus (P), potassium (K), calcium (Ca) and magnesium (Mg). Nutrients in compost are often reported in milligrams (mg) of nutrient per litre (L) of compost extract but can be converted to more familiar mg/kg by multiplying by 1.5 (compost:water extract ratio) and dividing by the bulk density (kg/L). As a conservative measure, the bulk density of compost is generally around 0.6. A simple multiplication of the value in mg/kg by 10,000 reveals the percentage of nutrients in the compost.

Nutrient levels can either be described as total nutrients or plant available nutrients and sometimes both measures are reported. Not all of the nutrients in the compost are immediately available for use by plants and microorganisms - this is also the case in synthetic fertilisers and even within your soil. The available nutrient levels in the compost/soil will depend on your soil type and its chemical properties as well as the environmental conditions.

**As a general rule of thumb....
20% of nitrogen,
40% of phosphorus, & 80% of
potassium in the compost is
available in the first year after
application.**

Available nutrient levels, rather than total nutrient levels, are a much better indication of the nutrients that compost is likely to contribute to your plants over the short term.

Available nitrogen is reported as ammonium (NH₃) and nitrate (NO₃) as these are the chemical forms of soluble nitrogen.

Colwell P is the best measure for actual plant available phosphorus but Soluble P which is measured by a different test can often be reported as well. Plant available potassium is reflected in the measure Soluble K and Exchangeable Cations (CEC).

Different laboratories and compost processors will often use different measures and tests to determine plant available nutrients, but if in doubt check with your compost producer or industry development officer.

A nutrient calculator has been developed by the Recycled Organics Unit for compost mulch applications and can give you an idea of what to expect from your compost. This calculator can be found at www.recycledorganics.com/product/agriculture/mulchnutcalc/mulchnutcalc.htm

It is a good idea to check your soil nutrient test results and correlate that to your compost nutrient tests before application. Regular monitoring will help ensure you are not applying too much (or too little) of a particular nutrient and you can adjust traditional fertiliser applications where possible. You will need to account for compost nutrient inputs in your nutrient budget.

Compost Stability and Maturity

Stability and maturity are key elements of compost quality and help to determine its fitness for purpose (suitability for a specific use).

Compost stability is a measure of how stable the organic substances are in the compost. More stable composts have less microbial activity (of the type associated with decomposition) and have less easily degradable organic matter. A product becomes more stable as it moves through the various composting phases. When a product has a low level of microbial activity under optimal conditions of temperature, moisture and passive aeration it is said to be highly stable.

Maturity measures the progress of the composting process. Its assessment is complex and not determined by a single measurement alone. Maturity is a measure of how completely the substances that are toxic to plants have decomposed. It also measures the adequacy of compost for plant growth. It is most often measured by planting sensitive seeds in the compost and seeing how well it grows. Maturity is achieved through allowing the composting process to continue through a lower temperature maturation phase prior to application.

As with application of any product, using poor quality materials or incorrect application rates can result in negative outcomes. Poorly composted products can contain animal and plant pathogens, weeds, excessive levels of ammonium nitrogen (can be toxic) and can cause temporary nutrient draw down (nitrogen and phosphorus). If composts are unstable or immature they can be toxic to seedlings and other plants if this type of product is applied at an inappropriate time.

The risks associated with applying unstable and/or immature composts can be managed by delaying the time between applying compost and planting a crop. The length of delay will depend on the stability/maturity of the compost, soil conditions and sensitivity of the crop.

There are several important tests that composts undergo to measure their maturity and stability. Five common tests are described here but for more detail see the Australian Standard for Composts Soil Conditioners and Mulches (2010).

Solvita® test

score of 1-8

The Solvita® test for compost maturity measures the biological activity of microorganisms in the compost and the amount of carbon dioxide (CO₂) released (respiration). The Solvita® test also measures ammonium (NH₃) at the same time. Generally if biological activity is low (low CO₂ respiration) and ammonium levels are low then the compost is mature. Carbon dioxide and ammonium levels can be reported on your compost test but a compost maturity index has been developed to take both of these measures into account.

This is called the Solvita® Maturity Index and it ranges from 1-8, where one is immature and eight is stable and mature. Composted products that are semi-stable have a Solvita® Maturity Index of 5 or 6, while stable composted products have a score of 7 or 8.

Nitrogen Draw Down Index (NDI)

index of 0-1

Nitrogen draw-down can occur when there is a lot of woody material in the compost or a high proportion of easily degradable carbon components without adequate nitrogen in the substrate.

Microbes will draw nitrogen from the soil to break down this material. This can reduce the amount of nitrogen available to plants, resulting in less plant growth or even plant death.

A Nitrogen Draw Down Index (NDI) has been developed to give a better indication of the stability of compost and inducing microbial demand for nitrogen at the expense of the plant. Composts with an NDI close to zero have the greatest capacity to draw down nitrogen, while composts with an NDI close to one have little capacity to use nitrogen and are stable. Semi-stable compost products should have a NDI > 0.2 while stable composted products will have an NDI > 0.5.

It is important to always choose good quality and fit for purpose compost products.

All composts designed for unrestricted use must meet the Australian Standards (AS4454) as a minimum and this is the first checking point when choosing a compost product. You should ask your compost processor to provide a recent analysis of the material indicating how it meets the Australian Standard.

Some compost may not be fully compliant with the Australian Standard and therefore may only be suitable for restricted use. These products are often suitable for a limited range of soils types, specific plants/crops or are safe for use at lower application rates. In these situations, make sure you follow guidelines for application provided by the manufacturer or by the relevant regulatory agency.

Wettability

minutes

Wettability is a measure of the how easily compost can be re-wet once it has dried out. Some materials can repel water when they are dry and be difficult to re-wet. Poorly composted products can contain excessive amounts of plant waxes which makes them hydrophobic (water repelling).

Wettability is measured by the time it takes for water to absorb into dry compost (under strict testing conditions). Water should absorb into a semi-stable composted product in less than five minutes and less than two minutes for a stable composted product.

Bioassay/Plant growth tests

root length (mm)

Another test of compost maturity is to measure how well plants grow in the media. As compost is not designed to be the sole media used to grow plants, these tests are quite robust and ensure that plant growth is not inhibited. Radish seeds are grown in the compost mix and root length is measured after four days.

In the Australian test, root lengths of 60 mm or longer indicate that growth is not inhibited in any way by the compost.

Measures of wettability and plant growth tests are generally not applicable to composted mulches.

Physical Contamination

percent by weight (%)

Composts are checked to make sure that physical contamination is minimised. Contaminants are classified across three areas:

Contaminant	Maximum for unrestricted use (% by weight)
light, flexible or film plastics >5 mm	≤0.05
glass metal and rigid plastics >2 mm	≤0.5
stones or lumps of clay ≥ 5 mm	≤5.0

Is a product safe, stable and suitable for your needs?

It is important to always choose good quality compost products that are fit for purpose and can deliver the benefits you need. As a minimum, composts must meet the Australian Standards (AS4454) - this means the product will be safe for unrestricted use - but choosing the right compost will depend on your specific needs. There are a variety of compost types that can be used to achieve different aims. Your compost processor is also a great source of information - talk to them about how you would like to use compost, they will often be able to develop a product to suit your specific needs. It is also important to check the Material Safety Data Sheet (MSDS) on your product prior to use.



An initiative of Compost Australia

For more information and a list of quality suppliers, go to

www.compostforsoils.com.au

the resource for compost users