Information Sheet No. 3-10

Manufacturing Quality Products from Compost

Introduction to Australian Standard AS 4419–2002 soils for landscaping and garden use

Information Sheet No. 3-10
Third Edition 2007

Inside This Sheet

ISBN 1-876850-02-7

What is the Australian Standard AS 4419–2002?

The Australian Standard AS 4419–2002 contains guidelines to assist the recycled organics industry to produce quality soils for landscaping and garden use.

The overall objective of the standard is to provide manufacturers, landscape architects, educational institutions, consumers and growers with a set of minimum requirements which will ensure that soils can culture and maintain plant growth.

The standard specifies requirements for *general purpose soils, top dressing*, *topsoil* and landscaping mixes (e.g. *low density soil, organic soil* and *soil blend*), for domestic and commercial use, supplied in either bulk or bagged lots.

The standard also provides guidance for the selection and use of soils.

The requirements of this standard specify soils suitable for the vast majority of plants but do not cover soils for plants with special requirements, cricket pitch soils, other specialist sporting turf soils, on-site soils or fertilisers.

Given the beneficial effect that composts impart to soils for landscaping and garden use, formulation of composts into soil can be a potentially profitable method of value adding to composted organics.

Benefits from using compost in soils

Extensive extraction of *natural soils* from grassland, bushland and cultivated land (soil mining) for use in urban landscaping and gardening during the last few decades has resulted in significant environmental damage.

Exposed subsoils are extremely difficult to revegetate, due to a lack of fertile top soil which is needed to provide nutrients, moisture and a substrate for plant root development.

Plate 1. An organic soil manufactured for general landscaping purposes. The product consists of approximately 30% (w/w) mature compost (<15 mm particle size), 20% sand (w/w) and 50% (w/w) natural soil.

The use of recycled organic materials, such as compost, as a component of these mixes not only reduces demand on finite natural soil reserves, but can be associated with a number of benefits. Compost in soil mixes can:

- reduce overall bulk density, allowing for easier handling;
- improve total water holding capacity;
- improve air-filled porosity;
- improve nutrient levels;
- improve nutrient retention (through improved cation exchange capacity); and
- improve plant disease suppression properties (Hoitink and Fahy, 1986; Handreck and Black, 1999).

To manufacture a particular type of soil for landscaping or garden use that complies with the standard, composts can be blended with sand and/or natural soils.

AS 4419–2002 provides a guideline as to how the quality of soils for landscaping and garden use can be assessed, and a basis for the manufacture of various soils for landscaping and garden use.

The standard also assists manufacturers to select appropriate uses for the various types of soils made.

What range of soils are included in AS 4419–2002?

The standard provides quality guidelines for three categories of soils. These are:

Low density soil

These types of soils tend to be composed mainly of organic materials (e.g. compost), and some sand and/or natural soil.

They have a low bulk density (0.3-0.6 kg L^{-1}) and a moderately high organic matter content (10-40% by mass).

Such soils tend to be used for rooftop gardens and in large landscape containers.

The standard recommends that low density soils with an organic matter content greater than 20% and a bulk density of less than 0.3 kg L^{-1} should not be used in any outdoor landscaping situation, including on-slab situations, and only in tubs and containers.

This is because continuing decomposition of the organic matter in such highly organic materials will lead to slumping and subsidence which may not be acceptable in landscaped situations.

As low density soils tend to be composed mainly of composts, such soils may require the addition of nitrogenous fertiliser if the composted fraction is low in available nitrogen (e.g. some composts prepared from woody garden organics).

Addition of a nitrogenous fertiliser to low density soils that are low in nitrogen ensures that the soil will not cause nitrogen deficiency in plants.

Organic soil

These types of soils usually consist of natural soil and organic materials (e.g. compost). Most organic soils contain less compost than low density soils.

Organic soils have a medium bulk density (>0.6 kg L^{-1}) and a moderate organic matter content (15-25% by mass).

Definitions

General Purpose Soil
A material consisting of natural soil, amended natural soil, a blend of sand and organic materials or a blend of sand, natural soil materials and organic materials, which is suitable for the culture of plants usually grown in domestic gardens and landscaped areas.

Top Dressing
A soil which is suitable for surface application to lawn.

Topsoil
A natural soil which is the original surface layer of soil from grassland, bushland or cultivated land.

Low Density Soil
Soil for use on an artificial base material, e.g. for a rooftop garden, or in large landscape containers. Such soils will usually be blends of mineral and organic components, and will typically have a bulk density in the range of 0.3 to 0.6 kg L^{-1}. Organic matter content will generally be in the range 10% to 40% by mass.

Organic Soil
A general-purpose soil (normally an amended natural soil or soil blend) that has a bulk density of greater than 0.6 kg L^{-1}, and with an organic matter content in the range 15% to 25% by mass.

Soil Blend
A general-purpose soil derived from the blending of two or more of: sand; natural soil material or organic materials and having a bulk density of greater than 0.7 kg L^{-1}, and an organic matter content in the range 3% to 15% by mass.

Natural Soil
A soil that has been dug from the landscape and is presented for use with no more than minor amendment. This soil could be topsoil, subsoil or a mixture of them. Typically it will have a bulk density of greater than 0.7 kg L^{-1}.

Table 1. Explanations of the physical, chemical and biological quality criteria for soils for landscaping and garden use as specified in AS 4419 – 2002.

Soil property	Explanation
Physical properties	
Bulk density	Bulk density is a measure of mass per given volume. The density of soils increases as the proportion of the mineral fraction (e.g. clay and sand) increases. Composts, due to their lower density, can reduce the overall density of a soil, making it suitable for specialised applications (e.g. large landscaping tubs).
Organic matter	The proportion of organic matter is important as this affects several physical and chemical properties of soil, such as bulk density, water retention, texture, permeability, pH and nitrogen drawdown.
Wettability	This is the ease with which a soil may be rewet once it has dried out. Some materials in soil mixes repel water when dry, and are difficult to rewet. This can seriously affect the ability of a soil to support plant growth. Wettability is measured as the rate of water infiltration per minute. AS 4419–2002 states that low density soils, however, must be tested according to the wettability test described in AS 3743–2002.
Dispersibility	This is a measure of a soils tendency to disperse after watering and to set hard after drying. Some clays exhibit these properties, and such soils tend to set hard on drying and have a very low level of air-filled porosity. Ideal soils are not dispersive and remain friable (crumbly) and open when wet or dry. Low density and organic soils do not require this test as they are highly friable due to their high organic matter content.
Permeability (hydraulic conductivity)	This is a measure of a soils ability to transmit water. Soils with high clay contents usually have a low hydraulic conductivity, meaning that water slowly passes through them. Under high rainfall conditions such soils may become waterlogged, resulting in oxygen deficiencies in the root zone of plants, possibly resulting in plant death.
Texture	This test only needs to be performed on natural soil or soil blends for the purpose of classifying the soil. Texture testing provides an indication to the amount of sand, silt and clay in a soil.
Large particles	The standard states that soils will not be contaminated with excessive amounts of large particles, such as bark, roots, clay lumps, stones or other solid materials. Required particle size ranges within the soil depends of the type of soil manufactured. Specific details can be obtained from the standard.
Chemical properties	
pH	This is a measure of the acidity or alkalinity of a soil. pH can affect the availability of nutrients in a soil, and plants vary in their tolerance to pH.
Electrical conductivity	This is a measure of how salty a soil is. Soils that have a high electrical conductivity can slow the growth or kill plants by causing water stress.
Ammonium	Ammonium ions, or soluble nitrogen, is required for plant growth. However, when in excess, ammonium ions can be toxic to plant roots.
Nitrogen drawdown index	Soils composed of organic materials that are not fully mature immobilise soluble nitrogen and can result in nitrogen deficiencies in plants. The nitrogen drawdown index measures nitrogen immobilisation in soils.
Biological properties	
Toxicity index	Organic and inorganic toxins in soils can reduce or even prevent plant growth. Toxicity index determines the toxicity of a soil relative to a reference soil that is non-toxic.

Organic soils are used mainly for general landscaping, though the standard recommends that they not be applied to a depth of any more than 150 mm. This is because at greater depths, putrefaction of the lower layers is likely and this can damage plants.

Damage to plants can occur through oxygen depletion in the root zone by continued microbial decomposition of the organic fraction present in the organic soil.

Natural soil or soil blend

These soils are composed mainly of natural soil excavated from the environment, or a soil blend with a very small fraction of organic material (e.g. compost).

They tend to have a relatively high bulk density (>0.7 kg L^{-1}) and a low organic matter content (3-15% by mass).

Such soils tend to be used primarily for general landscaping. The clay content of these soils helps bind plant nutrients and organic matter when incorporated into an existing soil.

Natural soils or soil blends with a clay content above 40%, however, are considered by the standard to be unsuitable for general landscaping purposes.

This is due to the high bulk density, making handling difficult, and the high clay content which may deleteriously affect plant growth.

High clay content soils tend to have low air-filled porosity, poor drainage, reduced water infiltration and susceptibility to water logging. These factors can seriously affect plant growth.

Overview of soil quality guidelines

As with other products manufactured from compost, they must meet some basic quality criteria.

Soils should be free from any living parts (seeds, bulbs, corms, vegetative propagules etc.) of plants that are generally considered to be weeds.

Tests for soil quality assess different physical, chemical and biological properties of a mix. These are briefly reviewed in Table 1.

Testing to meet requirements of AS 4419–2002

To demonstrate compliance with the Standard, samples of product need to be periodically tested by an independent off-site laboratory.

Further details regarding off-site laboratory testing can be found in Information Sheet No. 3-5.

Further details regarding product certification systems can be found in Information Sheet No. 3-2.

Important references

- Handreck, K.A. and N.D. Black (1999). Growing Media for Ornamental Plants and Turf. University of New South Wales Press, Sydney, Australia.
- Hoitink, H.A.J. and P.C. Fahy (1986). Basis for the control of soilborne plant pathogens with composts. *Annual Review of Phytopathology,* 24: 93-114.
- Standards Australia (2002). AS 3743—Potting mixes. Standards Association of Australia, Homebush, NSW, Australia.
- Standards Australia (2002). AS 4419—Soils for landscaping and garden use. Standards Australia, Homebush, NSW.

Acknowledgement

The authors would like to extend a special thankyou to members of the peer review committee for critically evaluating this document: Dr Trevor Gibson, NSW Agriculture; Dr Kevin Wilkinson, Agriculture Victoria; Mr Darren Bragg, Resource NSW; Mr Garry Kimble, Quality Assurance Services; Dr Martin Line, University of Tasmania; Mr Chris Rochfort, EC Sustainable Environment Consultants and Dr Pam Pittaway, University of Southern Queensland.

Produced by:

Recycled Organics Unit
PO Box 6267
The University of New South Wales
Sydney Australia 1466

Online contact details:

ROU	Angus Campbell
Internet	www.recycledorganics.com