Department of Agriculture and Food

Gardennote

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Soil conditioning reduces pests and diseases in the home garden

By officers of the Department of Agriculture and Food: reviewed by Harald Hoffmann, Biosecurity Communications, South Perth

Most home gardens in the metropolitan area of Perth are located on deep, sandy soils. These sands have low fertility, poor moisture and nutrient retention, and are at times non-wetting and water-repellent. Some of these soils may also be too acid or alkaline for the healthy growth of some plants. Some native species, such as Banksias and Grevilleas have adapted to the poor sands, but many non-native species, particularly ornamentals, fruit trees and vegetables, grow poorly unless soils are improved considerably.

Western Australian soil profiles are variable, ranging from deep sands to sandy loams to non-cracking clays. Soils, with different soil layers (eg sandy loam over clay) are also common.

If plants grow poorly due to poor soil structures or nutrient deficiencies, their natural immune systems are weakened and they become more susceptible to pest and disease attacks.

Poor drainage and aeration, due to a number of soil structural problems, can lead to a build-up of harmful soil diseases, such as damping off (caused most commonly by fungi like *Fusarium, Pythium* and *Rhizoctonia)* which attack garden plants.

Nutrient-rich, well drained soils with good aeration, water-holding capacity and neutral soil pH are essential for healthy plant growth (Photo taken at City Farms, Perth).

Water repellency may lead to uneven water penetration into the soil and dry patches in lawns.

Materials that improve moisture and nutrient retention, soil pH and overcome water repellence are known as soil conditioners. This Gardennote describes some of the most commonly used soil conditioners and their effect. Soil conditioners available to the home gardener include:

Soil conditioners for sandy soils	
Soil property	Conditioner
Moisture retention and nutrient retention	Loam and clay Peat Compost Manure Water-absorbent gels
Soil acidity	Lime
Soil alkalinity	Sulphur Iron sulphate Aluminium sulphate (Alum)
Water repellence	Soil wetting agents Loam and clay

Kitchen- and garden-waste can be composted to boost soil nutrients and improve soil water holding capacity.

The different materials in this Gardennote overcome different problems. It is important to recognise the particular problem being encountered in the garden and then to treat it in the most effective and economical way.

Poor water-holding capacity

Sandy soils drain readily and hold little water in the range available to plants because of their large pores.

Moisture retention may be improved by adding:

Organic materials – compost, local peat, European peat, composted animal manure etc. This will improve the soil's ability to hold water several times over. However, most of these materials are water-repellent when dry.

Fine mineral particles – clay, loam, red mud, fly ash, other mineral spoils. The aim is to lift the clay content of the soil to about 5 to 10 per cent. This will improve water-holding capacity and wettability because the fine particles exert a stronger attraction to water than the sand.

Water-absorbent gels – various products, although differing in structure and survival in the soil, all of these materials absorb 30 to 1000 times their own weight of water. When added to a soil they improve its ability to hold water. Add the recommended rate to a depth of 30 cm. In flower pots, add to the entire volume of the pot.

Incorporating green or dry crop residues, or a green manure is a further means of improving the organic matter content of the soil and its water-holding capacity. Before planting anything following a green manure crop, make sure that organic material is well broken down. Undecayed organic material may cause *Rhizoctonia* disease in new plants.

Worm farms convert organic materials faster than compost bins. The products of worm farms, worm cast (right) and leachate(left), contain nutrients and beneficial bacteria, which improve plant health.

Poor nutrient holding

Sandy soils are inherently infertile and retain few of the essential nutrients applied in fertilisers. Clay, loam and peat can retain the essential nutrients potassium, calcium, magnesium, iron, manganese, copper and zinc but have limited ability to retain phosphorus or sulphur.

Therefore, minor nutrients need only be applied once or twice a year whereas nitrogen, phosphorus and sulphur need to be applied frequently during the plant growing season. Most red loams and clays are able to retain phosphorus and sulphur, so a mixture of organic material and loam will improve nutrient supply to the plants.

Nitrogen is easily lost from soils, particularly with over-watering.

The gels, by holding water in the soil, may retard nutrient-leaching and contribute to a high availability. Nutrient-holding, like water-holding, will be related to the amount of gel, and hence nutrient solution in the soil.

Many shires provide free mulch, which may consist of shredded tree prunings. Check with your local council. For good water retention, place a 50 mm thick mulch layer on top of the soil.

Poor wetting of dry soil

The organic component in Western Australian sandy soils is commonly water-repellent. This may be contributed to the soil by compost, lawn clippings, animal manures, peat, sawdust or native vegetation and is then broken down in the soil. Water repellence is only apparent when the soil is dry. Any treatment must aim to improve the re-wetting properties of the soil. Possibilities include:

- Adding fine mineral particles such as loam, red mud or fly ash. About 5 per cent by weight will improve the wetting properties in the soil as well as improving the water and nutrient-holding ability.
- Treat affected areas with an effective wetting agent that has proven re-wet properties. Wetting agents are available from garden centres and hardware stores.

Adding some loam or clay to sandy soil may resolve some of the water repellency problems.

Soil acidity and alkalinity

Soil acidity and alkalinity are described using the pH scale which ranges from 1 to 14.

Acid soils have a pH less then 7. Soils with a pH of 7 are called neutral.

The general pH range on local (Perth and environs) sandy soils is 4 to 8.5 with the most acid (pH 4.0 to 5.0) applying to the peaty soils in low-lying swampy areas. The higher pH soils are located on a narrow strip along the coast, where limestone is close to the surface.

Whether a soil is acidic, neutral or alkaline affects the availability of essential nutrients, the concentration of toxic elements such as aluminium and manganese, and the activity of micro organisms. These factors all directly or indirectly affect plant growth. At a pH below 5.5, plant growth may be affected by aluminium and/or manganese toxicity, and molybdenum deficiency. At a high soil pH, the essential plant nutrients, iron, manganese, copper and zinc may be in short supply.

Most plants grow in the pH range 5.5 to 7.5. Some species such as gardenia require acid conditions, while others such as carnations only grow well under alkaline conditions. Where it is desired to grow these species on soils outside the plant's preferred pH range, liming or acidification is necessary.

pH kit available for home gardeners

Soil acidity can be overcome and pH raised by applying lime, usually as garden or agricultural lime which is fine-crushed limestone. Where magnesium is also low, dolomite can be used. The quantity of lime required varies, but as a rule of thumb it can be assumed that 200 g/m^2 of fine-crushed limestone will increase the pH by one unit. The lime should be applied several weeks before planting and thoroughly mixed with the soil. Frequent watering will speed the neutralising process.

Over-liming should be avoided as it can lead to deficiencies of the essential elements, iron and manganese. Home gardeners contemplating liming may find it helpful to purchase a portable pH kit.

Alkaline soils reduce the availability of iron, manganese, copper and zinc. In most cases these elements can be supplied, but in the long term it may be more expedient to lower the pH. Common soil conditioners or ameliorants to lower soil pH, include mineral sulphur, iron sulphate and aluminium sulphate (Alum). These materials should be thoroughly mixed with the soil and well watered as for lime.

When sending or delivering samples for identification, the following information is required:

- Collector's name, location (where the specimen was found), full address, telephone number and e-mail address, description of the damage and date collected.

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