NSW GOVERNMENT
Department of Primary Industries
primefact

Using compost in macadamia orchards

May 2021, Primefact 21/281, second edition, replaces Agnote DPI-472
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This publication will help you choose and apply a quality compost product to improve crop nutrition and soil health.

Introduction

Mulch is any material that is placed on the soil surface. Mulch is not always compost (it can be wood chips or plastic material, for example) but composts make excellent mulch.

Applying compost as mulch rather than incorporating it into the soil will greatly improve soil health and is an excellent way to obtain the benefits of compost in an orchard where incorporation is not possible. (see Primefact 21/281 How to compost on farm).

Applying compost mulches will:

- increase soil microbial activity
- help suppress weeds
- help suppress disease
- protect against erosion
- reduce soil temperature variation, thus reducing soil water loss

Long-term effects from applying compost mulch include:

- improve soil water-holding capacity
- increase plant available water
- enhance soil cation exchange capacity.

Obtaining compost

Compost can be purchased from a supplier or homemade (Primefact 21/281). If purchased, make sure it is fully composted and pasteurised and that it meets Australian Standards (AS 4454-2012). Only through this process will weeds, pathogens, potential disease-carrying organisms, physical contaminants and detrimental chemicals have been excluded. To check the quality of the compost, have the pH and the carbon to nitrogen ratio (C:N) checked in a laboratory to ensure they meet the Australian standard. The ideal pH of good compost should be about 6–8. The C:N ratio will indicate the maturity of compost. Compost with a C:N of 15:1 indicates a mature compost. A higher C:N shows that the material has only been partially composted and is high in carbon. Compost that is too rich in carbon will temporarily 'tie up' nitrogen from the soil. A low C:N also indicates partially composted material, with possible detrimental effects on plants. A germination test using radish seeds can also indicate potential compost immaturity; if they fail to germinate, the compost should not be used.

Good compost will be easily recognisable and have the following distinct characteristics:

- **smell**: a pleasant earthy smell, with no bad (sour or rotten) odours
- **feel**: moist and earthy, not wet and sloppy or dry and powdery
- **appearance**: contains dark soil-sized particles, the original organic materials are not distinguishable.

Compost particle size

Using compost that is fine (particles < 15 mm diameter) in a spreader will ensure even coverage. In macadamia orchards, fine compost is preferred as it does not impede harvesting nuts off the ground. In situations where harvesting does not take place off the ground (e.g. avocado orchards), larger fractions (> 20 mm) that break down less rapidly might provide a more stable surface and protection from erosion while increasing the length of time for which the compost provides soil health benefits.

Compost moisture content

Compost with a moisture content of between 50 and 60% is best for spreading; it will feel like a moist sponge but no water comes out when you squeeze it in your hand. If the compost is too dry it can start to repel water and will not form a good orchard floor surface. If it is too wet and sloppy, it will be difficult to spread and could become anaerobic. This is a problem because the organic acids produced can be quite damaging to soil and plant health.

Recently another type of compost product has entered the marketplace; mixed waste organic outputs (MWOO) material. The NSW EPA defines this as a soil amendment that is made mostly from the organic materials found in general household waste bins (that is the red-lid bin). This material can no longer be used on agricultural land. For more information see the NSW EPA website.

How to apply compost

Tractor-drawn machinery is usually required to spread compost over larger areas. A major obstacle to applying compost mechanically is bridging, which stops the compost from flowing. This is overcome by using a spreader with a continuous or cleated belt.

For small farms, a manure dropper of about 1 cubic metre capacity can be used. This is attached to the three-point linkage of a small tractor. The bin doubles as a scoop for filling and manure or compost or other materials can then be dropped or banded where required, making this an effective one-person operation.

To cover larger areas, implements such as spreaders (Figure 1) are needed. For an orchard, a spreader between 3 and 4 cubic metres is best. For an efficient operation, a separate loader such as a front-end loader is desirable. You may decide to use a contractor if you do not have a spreader.

Disk or twin disk spreader

This will throw compost out behind the hopper and is effective at getting an even coverage to a depth of 30 mm. Compost is either thrown out to one side by a single disk or spread both sides using a twin disk. However, there is little control over where the compost is placed, making it difficult to limit the compost to a particular area, such as the drip line.

Belt spreader

A belt spreader is a large bin with a moving belt for the floor. At the end of the bin there is an opening to which the material being spread is moved. The quantity of material delivered depends on the speed of the belt and the size of the opening at the end of the bin.

A belt spreader will place the compost in the tree row in a pile about 30 mm or thicker. It

might need to be spread further using a rake or other machinery. The advantage of using a belt spreader is that more direct compost placement is possible, but further spreading may be required.

The pattern of distribution of material depends on the ground speed of the tractor and the speed of the disks or side-delivery belt. Most spreaders use rear-mounted, variable-speed rotating disks to spread materials behind the implement, but some may also provide for side-delivery and 'banding' of material (Figure 2), which is useful in situations such as vineyards or orchards. By adjusting the operation of the various components of the machine, compost or other materials can be spread fairly accurately.

Figure 1. Using a spreader to apply compost in a band beneath macadamia trees. Photo: Jeremy Bright.

How much compost to apply

Compost application rates are often described in different ways (volume, weight or depth of application), which can be confusing. An approximate guide is that 1 litre per cubic metre (1 L/m^3) equals 0.02 m^3 per tree or a 1 mm thickness cover over the ground.

The amount of compost needed will depend on why it is being applied. Soil remediation requires greater quantities (from 0.5 m^3 to 2 m^3 per tree) whereas using it as part of a crop/soil nutrition program requires smaller quantities (0.02 m^3 to 0.6 m^3); the latter will not provide the benefits of erosion and weed control.

The time between compost applications varies depending on how thickly it was applied and the coarseness of the compost. The thicker the initial application, the greater the length of time before the next application is needed, leading to a saving in application costs. If 100 mm is used, further application might not be required for 10 years.

Often the production benefit of applying compost in tree crops is not seen immediately.

However, in one macadamia orchard that received a 100-mm application, there were a large number of feeder roots mining the compost within 12 months.

Remediation

To benefit soil health, applying a layer between 0.5 and 1 m^3 per tree is sufficient. For remediation of an eroded site, up to 2 m^3 per tree might be required as this will improve soil health as well as protect the underlying ground surface from further erosion during heavy rainfall. Trial applications of compost on working macadamia farms have indicated that management practices including harvesting will not be altered by any of these application rates.

Soil/crop nutrition

If compost is to be used as part of a crop/soil nutrition program, then the nutrient content of the material should be considered and amended with fertilisers (if necessary) to lift the quantity and availability of nutrients. Nutrients in compost are in forms that are released slowly and not all at once after the initial application. Compost can be applied in a single application or split over two during the growing season. Compost application rates will depend on the nutrient content of the compost and the nutrient requirement of the trees. Due to the variability in composts and how they break down in different environments, blanket recommendations for application rates are of little use.

Figure 2. Compost on the soil surface. Note the grassed inter-row. Photo: Jeremy Bright.

When to apply compost

Compost should only be applied when fully composted (Primefact 21/281) and when it fits in best with other farm operations.

Partially composted material has the potential to harm plants because:

- pathogens and weed seeds might not be destroyed
- the decomposition process will continue after the material is spread on the orchard floor and any valuable nitrogen will be taken up by the decomposing organisms and not be available to plants, which may lead to a temporary nitrogen deficiency.

In macadamia orchards, compost can be applied before the start of the harvesting season but only if there is sufficient time for compost to settle and form a firm orchard floor. This will allow sweeping and other operations to be carried out in preparation for harvest. If compost is not applied well before harvest begins, it is best to defer to spring, after harvest is complete.

Further information

Australian Standard AS 4454-2012 Composts, soil conditioners and mulches, 4th edn, Standards Australia, https://infostore.saiglobal.com/en-au/standards/as-4454-2012-121773_SAIG_AS_AS_267608/

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NSW Environment Protection Authority website, *Protection of Environment Operations Act 1997*, https://www.epa.nsw.gov.au/licensing-and-regulation/legislation-and-compliance/about-the-poeo-act

NSW Environment Protection Authority website, recycling and reuse pages, https://www.epa.nsw.gov.au/your-environment/recycling-and-reuse

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Simpson M and Davy M. 2017. Using recycled organics in blueberry farming. Primefact 1583, NSW DPI, https://www.dpi.nsw.gov.au/agriculture/horticulture/berries/soil,-nutrition-and-orchard-floor-management/using-recycled-organics-in-blueberry-farming

The Industry Association for Organics Recycling in Australia, https://www.aora.org.au/

Reference number: PUB21/281.

Disclaimer

The information contained in this publication is based on knowledge and understanding at the time of writing (May 2021). However, because of advances in knowledge, users are reminded of the need to ensure that the information upon which they rely is up to date and to check the currency of the information with the appropriate officer of the Department of Regional NSW or the user's independent advisor.