compost for soils

Disease Suppression

Rhizoctonia

Studies dating back to the late 19th century[1] show that compost can reduce the occurrence and severity of common plant diseases caused by fungi, nematodes and bacteria[2-4].

More recent research has shown that **all significant diseases affecting vegetable production in New South Wales** can be suppressed by the use of compost[3].

How does compost suppress disease?

Adding compost to soil improves soil physical and chemical properties and increases the number and diversity (different types) of bacteria and fungi in soil[3]. These changes encourage healthier plants that are better able to withstand diseases while limiting disease-causing microbe populations.

Improving soil and plant health

The relationship between compost and healthy soils and healthy plants has been shown in many studies[2]. Compost contributes to healthy soils and plants in at least three important ways:

1. by increasing the soil organic matter (soil carbon) that is vital for good crop growth
2. by improving soil structure and moisture retention, making water available for your plants when they need it, and
3. by increasing the amount of nutrients that are available to plants and steadily releasing nutrients over time.

Healthy plants are better able to resist diseases. So, by improving soils' ability to produce healthy and robust plants, compost also protects your plants against disease.
Increases in yield are often an added benefit of using compost in your cropping systems.

Compost encourages healthy plants that are better equipped to fight off disease

Increases in yield are often an added benefit of improving soil and plant health

Boosting soil microbe numbers

Amending your soil with quality compost that conforms to the Australian Standard (AS4454) will boost the populations of naturally-occurring bacteria and fungi that can suppress the organisms that cause disease[3]. These helpful microbes are called biological control or biocontrol agents. Biocontrol is the use of natural predators, parasites or pathogens to control pests. Biocontrol agents suppress plant diseases in four main ways.

- **Competition** is the most common method of disease suppression. Beneficial organisms out-compete disease-causing plant pathogens in the search for nutrients or colonisation space in specific habitats such as the root zone[2]. Increased competition prevents pathogens from becoming established and multiplying to levels that cause plant disease.

- **Antibodies and secretions produced** by some microorganisms inhibit the growth of plant pathogens[2,4].
- **Predation and parasitism** of plant pathogens by biocontrol agents (where beneficial microbes use pathogens for food).
- **Induced systemic resistance** caused by beneficial microorganisms activating a plant's disease defences. Plant defences against disease can include thickening of the cell walls in plant roots and foliage to make it more difficult for pathogens such as fungi to get into plants[2]. Induced systemic resistance is the least common form of biocontrol.

Up to 70 percent reduction in disease severity can be achieved with compost - a significant economic benefit

What is *Rhizoctonia*?

Rhizoctonia is the name of a group (genus) of fungi found in soil. Some species (spp.) within this genus can cause diseases in both root and aerial plant parts. Damping-off, wilt rot, crown rot and root rot can all be caused by *Rhizoctonia* species[3].

Rhizoctonia spp. can be a significant problem in NSW vegetable crops[3]. It is important to make sure you correctly identify the pathogen causing problems on your farm. Talk to your local agronomist, industry development officer or relevant government department to access help with disease identification.

Studies have shown that compost can successfully suppress *Rhizoctonia* spp. in a range of crops including tomato, cucumber, peas, sugar beet, cotton, potato and radish[3]. The levels of *Rhizoctonia* spp. suppression can vary but tests have shown that compost can reduce disease caused by *Rhizoctonia* by up to 70 percent[3].

How does compost suppress *Rhizoctonia*?

Compost can foster both general and specific suppression responses to diseases caused by *Rhizoctonia* species.

General suppression refers to the combined suppressive effect of a wide range of microorganisms while specific suppression refers to the suppressive effect of one or more particular biocontrol agents.

General suppression of *Rhizoctonia*

Competition for food (particularly cellulose) and nutrients with other microbes is the main means of *Rhizoctonia* spp. suppression since *Rhizoctonia* spp. are not good competitors[3]. Composts with high microbial activity will limit *Rhizoctonia* spp. and some microbes also produce antibodies which antagonise pathogenic *Rhizoctonia*[3].

Specific suppression of *Rhizoctonia*

Rhizoctonia spp. are also suppressed by specific fungi and bacteria including *Trichoderma* spp., *Penicillium* spp., *Psuedomonas* spp., *Bacillus cereus* and *Flavobacterium* species[3].

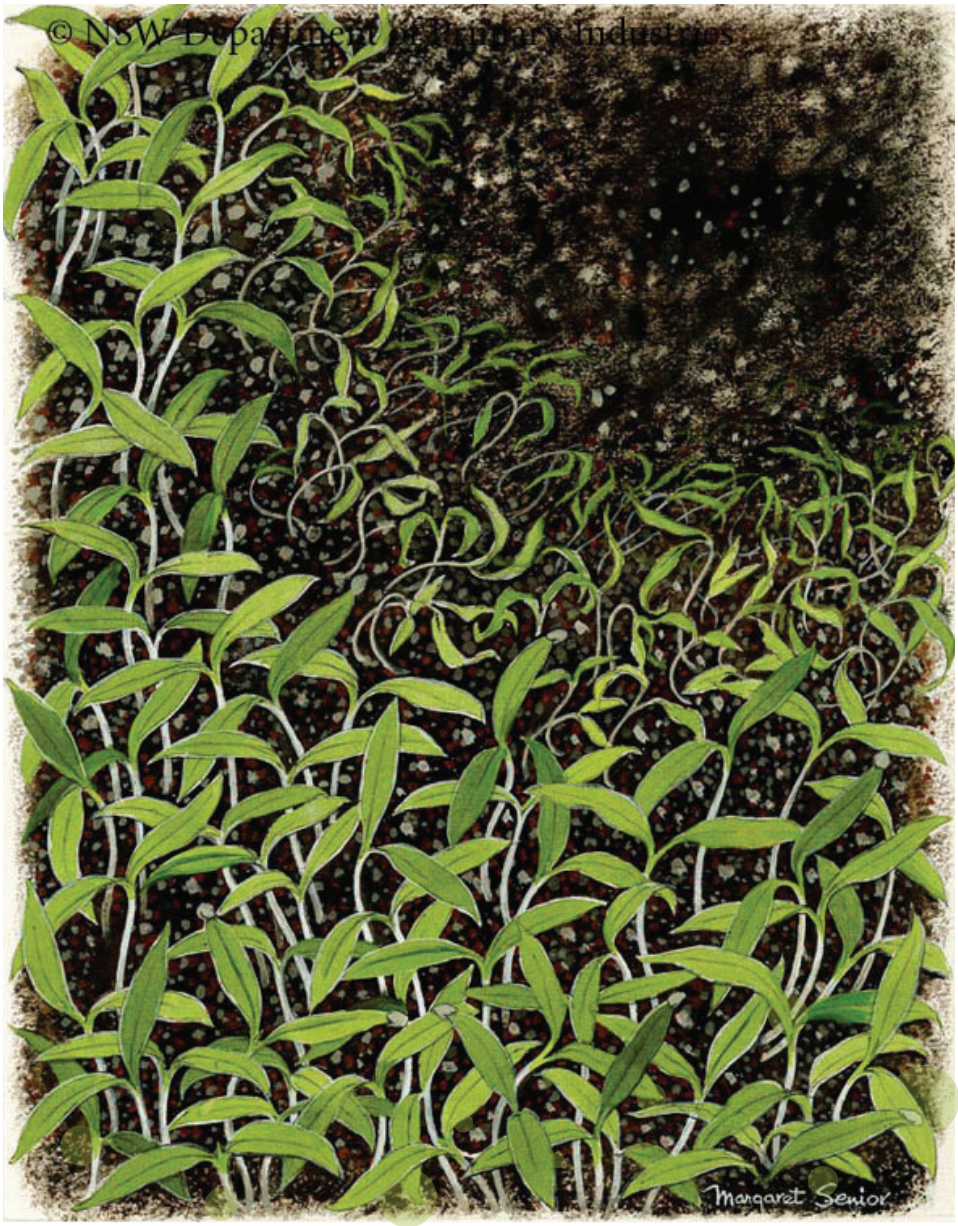
Composts inoculated with these specific biocontrol agents will be more effective at suppressing *Rhizoctonia* spp.. The Australian compost industry is working towards the use of specific inoculants to combat plant diseases like *Rhizoctonia* spp.

Applying fresh, non-composted material can increase disease severity

What kind of compost should I apply to combat *Rhizoctonia* on my farm?

Apply mature, fully composted material to combat *Rhizoctonia* spp. on your farm (Recycled Organics Unit, 2006). Avoid using raw green materials or compost high in glucose that encourage growth of *Rhizoctonia* spp. and repress the beneficial Trichoderma species[3].

Compost colonised by biocontrol agents after peak heating can stimulate natural suppression to *Rhizoctonia* damping off[19]. Up to four months 'curing' will help deliver consistent natural suppression in compost[3]. Inoculation with biocontrol agents specific to *Rhizoctonia* spp. may enhance disease suppression of compost.



Compost application

Apply compost to the poorer performing areas of your farm first to maximise the benefits provided by compost. Manure spreaders are frequently used to apply compost and then typical cultivation methods are used to incorporate compost into soil. Compost needs to be applied before seed bed preparation and sowing. If your plot requires additional fertiliser, only add this after compost has been applied. While compost can be applied at any time of the year, it is recommended to apply compost during dry weather to avoid compaction. The amount of composted soil conditioner to apply per hectare varies considerably with the type of soil, the crop, and the climate. Depending particularly on soil NPK levels, application rates will probably be in the range of 20 – 80 tonnes per hectare, however your local agronomist can advise on quantities.

References

1 F.R. Magdoff, Soil Organic Matter in Sustainable Agriculture, (Taylor & Francis, 2004)

2 Harry Hoitink, 'Compost use for disease suppression', in On Farm Composting Handbook <http://plantpath.osu.edu/faculty-and-staff/faculty-directory/hoitink-harry-a-j/>

3 Recycled Organics Unit 'Compost use for pest and disease suppression in NSW', (2006) and references cited therein.

4 G. Stirling, 'Biologically active soils help suppress nematode pests' in Soil health: the foundation of sustainable agriculture, Proceedings of a workshop on the importance of soil health in agriculture, ed by R. Lines-Kelly (June 20-21 2001), Wollongbar Agricultural Institute, NSW Agriculture, Bruxner Highway Wollongbar 2477.

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