

## Pythium

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

More recent research has shown that all significant diseases affecting vegetable production in New South Wales can be suppressed by the use of compost<sup>3</sup>.



## 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<sup>3</sup>. 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<sup>2</sup>. 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.

**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**

Increases in yield are often an added benefit of using compost in your cropping systems.

### 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<sup>3</sup>. 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<sup>2</sup>. 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<sup>2,4</sup>.

- **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<sup>2</sup>. Induced systemic resistance is the least common form of biocontrol.

## What is *Pythium*?

*Pythium* is the name of a group (genus) of fungi found in soil. Some species (spp.) within this genus are parasitic and can cause plant diseases. *Pythium* spp. can cause damping off disease in seedlings as well as root and crown rots<sup>3</sup>.

*Pythium* spp. can be a significant problem in NSW vegetable crops<sup>3</sup>. 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.

**A 30 and 70 percent reduction in disease severity can be achieved with compost - a significant economic benefit**

## How does compost suppress *Pythium*?

Applying compost can suppress disease through both general and specific suppression. General suppression occurs when a wide range of microorganisms all act as biocontrol agents, rather than just a single type of microorganism. Specific suppression occurs when one biocontrol agent or a group of biocontrol agents working together suppresses a single type of plant pathogen.

*Pythium* is controlled through general suppression. Composts that have large microbial populations and high levels of activity will generally suppress *Pythium*<sup>3</sup>.

Compost can suppress *Pythium* spp. in a range of crops including peas, cucumber, sugar cane, potato, radish and snap beans<sup>3</sup>. The level of *Pythium* spp. suppression can vary but adding compost to growing media has reduced disease severity by 30 - 70 percent<sup>3</sup>.

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

Many types of compost can suppress *Pythium* species. Composts with bark, dairy waste and biosolid feedstocks (ingredients) have all been found to suppress *Pythium* species<sup>3</sup>. Composts with low levels of nitrate (NO<sub>3</sub>) or nitrite (NO<sub>2</sub>) can also suppress *Pythium* damping off disease<sup>3</sup>.

Mature composts suppress *Pythium* spp. more effectively than immature composts – applying immature compost can actually increase disease severity<sup>3</sup>. *Pythium* spp. can easily colonise dead organic material but competition makes it difficult when lots of other organisms are present. This is why mature compost suppresses *Pythium* spp. more effectively than fresh material - mature compost has a greater number of biocontrol agents.

Although applying mature compost is the best option for suppression, it's important to make sure it hasn't been sitting around for too long. Compost that has been stored for several years does not suppress *Pythium* species<sup>3</sup>.

*Pythium* spp. suppression generally increases with higher rates of compost application<sup>3</sup>. Suppression of *Pythium* diseases should occur rapidly after compost application, but suppression effects are likely to decrease when overall microbial activity decreases (around one year after application)<sup>3</sup>.

**Applying mature, fully composted material is the best option for *Pythium* spp. suppression, although make sure it is fresh, as compost stored for several years does not suppress *Pythium***

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## 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.

**Applying immature compost or fresh material can increase disease severity**



## References

- 1 F.R. Magdoff, Soil Organic Matter in Sustainable Agriculture, (Taylor & Francis, 2004)
- 2 Harry Hoytink, 'Compost use for disease suppression', in On Farm Composting Handbook <<http://plantpath.osu.edu/faculty-and-staff/faculty-directory/hoytink-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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