Disease Suppression

Fusarium

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.

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

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.

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.

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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- **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.

A 20 to 90 percent reduction in disease severity can be achieved with compost - a significant economic benefit

What is *Fusarium*?

Fusarium is the name of a group (genus) of fungi found in soil. Some species (spp.) within this genus cause diseases like root rot, stem rot and *Fusarium* wilt in plants[3].

Fusarium 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 *Fusarium* spp. in a range of crops including tomato, cucumber, sugar beet, potato and sweet basil[3]. The levels of *Fusarium* suppression can vary but range from 20 to 90 percent reduction in disease severity[3].

How does compost suppress *Fusarium*?

Compost can foster both general and specific suppression responses to diseases caused by *Fusarium* 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 *Fusarium*

Fusarium spp. can be suppressed by composts and soil with high levels of microbial activity and diversity. *Fusarium* spp. are generally poor competitors and have difficulty obtaining nutrients and colonising organic matter when many other micro-organisms are present[1]. Some biocontrol agents also produce compounds, like antibiotics which inhibit the growth of *Fusarium* species[3].

Specific suppression of *Fusarium*

Fusarium spp. can also be suppressed by specific fungi like *Trichoderma* spp. and *Fusarium oxysporum*. Bacteria such as *Pseudomonas* spp., *Bacillus subtilis* and *Flavobacterum* spp. also suppress *Fusarium* species[3].

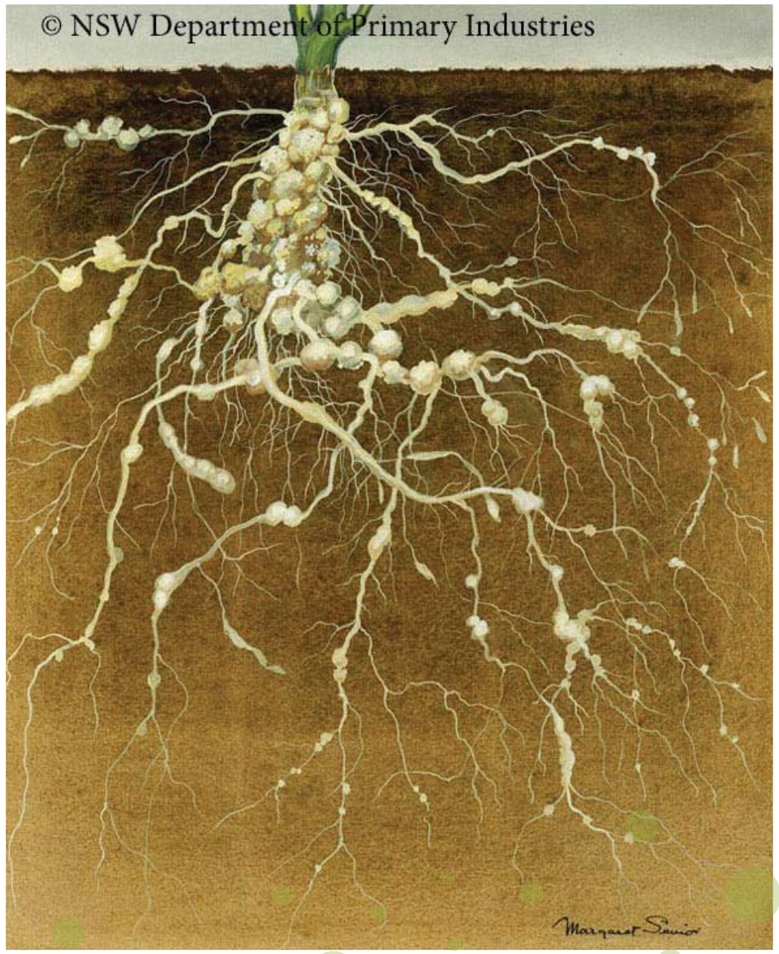
Composts inoculated with these specific biocontrol agents may be more effective at suppressing *Fusarium* spp.. The Australian compost industry is working towards the use of specific inoculants to combat plant diseases like Fusarium spp.

Compost can successfully suppress Fusarium spp. in a range of crops including tomato, cucumber, sugar beet and potato.

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

Most mature composts prepared in accordance with the Australian Standard (AS4454) will suppress *Fusarium* spp. by supporting a healthy and diverse population of micro-organisms that will out-compete the pathogen. Ensure that the compost you use has been carefully handled to prevent *Fusarium* spp. from colonising your compost before the beneficial microbes. Compost mixes with a high pH value may also help to suppress *Fusarium* wilt[3].

Composts high in nitrogen can aggravate *Fusarium* wilt and increase disease severity – talk to your compost processor to ensure that levels of nitrate and nitrogen are at the right level for suppression of *Fusarium*[3].



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.

Composts high in ammonium can increase the severity of *Fusarium* diseases