Is Carbon on the 'Menu' for Microbes in EP soils & Will it Help to Suppress Rhizoctonia Root Rot?

RESEARCH

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Searching for answers

Location:
Kimba, Mount Damper, Port Kenny

Key messages

- **Recent carbon inputs positively influence the ability of a soil to suppress Rhizoctonia.**
- **Adding carbon as stubble or roots to Eyre Peninsula soils reduced infection of wheat seedling roots by Rhizoctonia solani AG-8.**
- **DNA of potentially suppressive microbes tended to increase in the soil after stubble or root addition and the effect was often greater from roots.**

Why do the trial?

Soil organic carbon is considered one of the main drivers of biological disease suppression by providing food or energy that allows an increase in microbes that can suppress disease. Low soil organic carbon for many Eyre Peninsula soils could be an issue for management of disease suppression. Key carbon inputs in farming systems are stubbles and roots. They contribute different types of carbon to soil but there is little information about how these influence disease suppression. Research at SARDI and other places has identified specific microbes that appear to be important in soils suppressive to rhizoctonia, although it is not known how widely these microbes occur in Eyre Peninsula soils.

So, a pot experiment was done to:

- test whether addition of carbon to soil as stubbles or roots suppressed rhizoctonia severity in a following cereal,
- investigate whether the effect of stubbles carbon was similar or different to root carbon, and
- measure the presence of specific suppressive microbes.

How was it done?

Three soils were collected from farm paddocks on upper EP; a slightly calcareous dark reddish brown loam fine sand from near Kimba (2% organic carbon), a non calcareous clay loam from Mount Damper (1.4% organic carbon) and a calcareous grey-brown loam from Port Kenny (2.6% organic carbon). Two types of carbon inputs (either wheat roots or wheat stubble) were added to these three soils, either at rates equivalent to 6 tonnes dry matter per hectare, and another set of soils had no addition of carbon. The soils were incubated under moist conditions for six months. After this a sub-sample of soil from each treatment was taken for extraction and quantification of DNA from three soil organisms potentially involved with suppression (Pantoea agglomerans, Microbacterium and Trichoderma Group A). The soils were then used for a pot bioassay to measure disease severity on wheat seedlings after inoculation and incubation with the pathogen Rhizoctonia solani AG-8.

What happened?

Addition of carbon as roots or stubble to the three soils did suppress rhizoctonia infection in roots of wheat seedlings (see Figure 1). Percent root infection ranged from 60-85% in the soils with no carbon inputs to 36-57% where carbon had recently been added. Stubble addition seemed to suppress rhizoctonia more than roots in the soils from Mount Damper and Kimba but it was the opposite for Port Kenny soil with less rhizoctonia infection after addition of roots than stubble.

Potentially suppressive microbes (measured as DNA) often increased when carbon was added but not always, the effects depending on the specific microbe and the soil. Microbacterium increased in all three soils where roots had been added, Pantoea agglomerans increased where roots or stubble were added but only in the soil from Kimba and Mount Damper. Trichoderma Group A appeared less sensitive to carbon input and only increased in the Kimba soil with addition of roots. The most calcareous soil was Port Kenny, this had very small amounts of Trichoderma compared to the other two soils and Pantoea was low also.

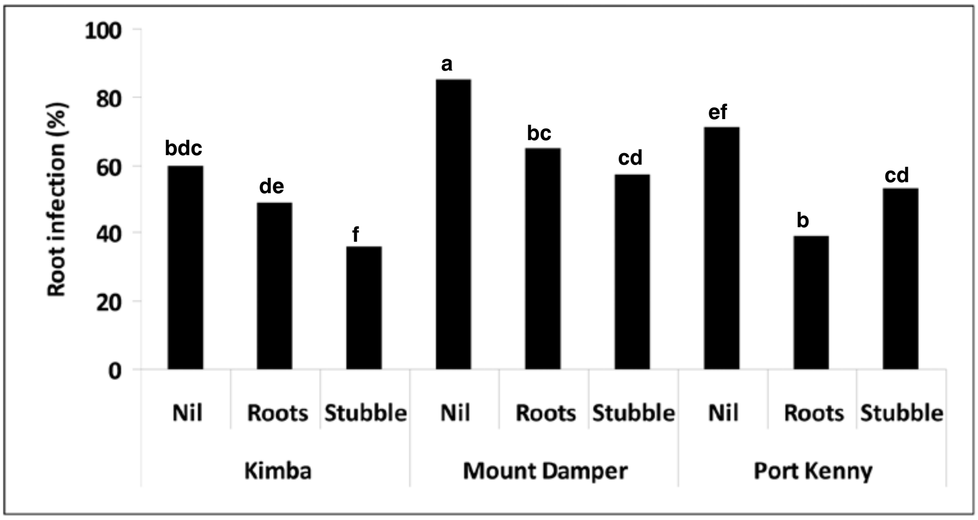

Figure 1 Rhizoctonia infection (%) for roots of young wheat plants grown in three Eyre Peninsula soils without carbon input (nil) or after addition of carbon as roots or stubble. Bars within each soil with different letters above them indicate significant difference.

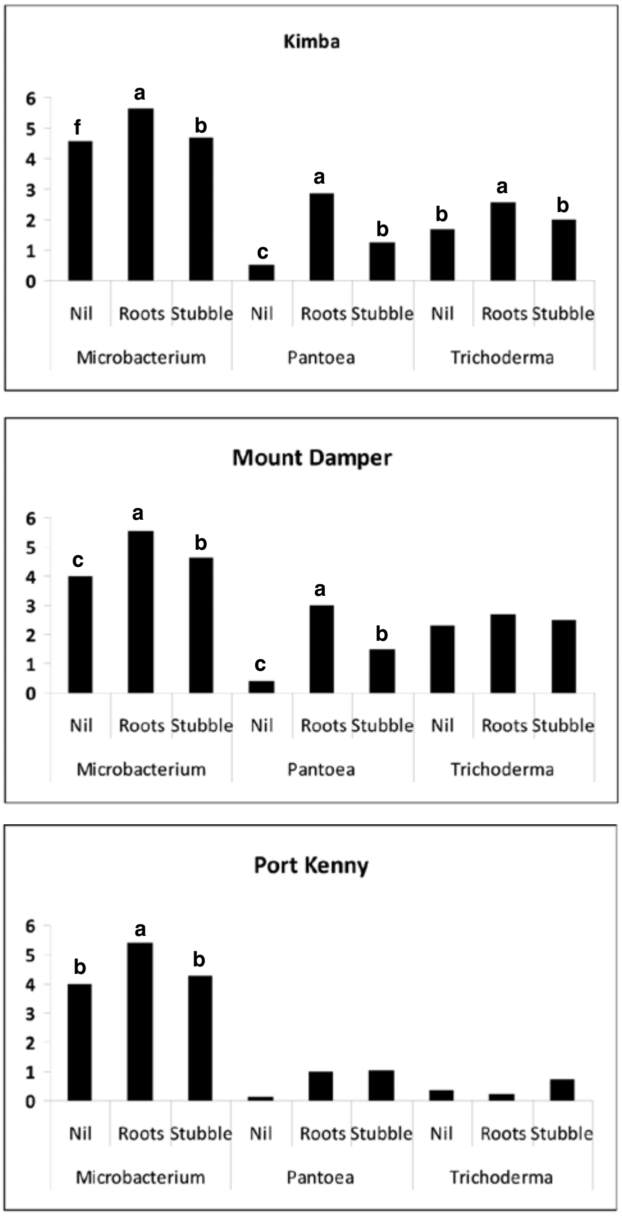

Figure 2 DNA amounts for three potentially suppressive organisms in Kimba, Mount Damper and Port Kenny soil either without carbon input or after addition of carbon as stubble or roots. Bars within each group of three with different letters above them indicate significant difference

What does this mean?

Overall the work demonstrates that carbon from stubbles and roots is an important input for increasing the potential for suppression of rhizoctonia in these Eyre Peninsula soils. The results also show that specific microbes generally thought to contribute to suppression of rhizoctonia are encouraged to increase when carbon is on the menu and that roots seem to be more 'tasty' to the microbes. The rates of dry matter and amounts of carbon added in this laboratory experiment were larger than achieved in an average season on the EP and so the effects may not be as marked under field conditions, but the importance of retaining inputs is clear.

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