Grower Summary

PE 010

Improvement of soil health by manipulation of microbial community characteristics

Final 2013

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Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of the full report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

HDC
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

Tel – 0247 669 2051

HDC is a division of the Agriculture and Horticulture Development Board.

Project Number:	PE 010
Project Title:	Improvement of soil health by manipulation of microbial community characteristics
Project Leader:	Dr Mark Pawlett
Contractor:	Cranfield University
Industry Representative:	Dr Neal Ward
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Project Cost:	£3,500

Headline

There were no positive short term impacts on soil biological and chemical characteristics of adding organic amendments to an organically-grown sweet pepper crop.

Background

This project was undertaken by an MSc thesis student at Cranfield University in collaboration with a UK commercial sweet pepper grower. The student was supervised by Dr. Mark Pawlett and co-supervised by Professor Karl Ritz. The project evaluated the ability of two proprietary products and a nursery-brewed aerated compost tea to alter soil microbial characteristics with a view to optimising soil health for sustainable soil management practices. An MSc student was selected to perform the supervisor-led research for a dissertation which included a literature review, an experimental trial, and formulating conclusions as to the ability of the treatments to influence soil chemical and biological characteristics.

The project objectives were:

- Perform a search of the scientific literature, focusing on the manipulation of microbial communities to improve both soil and hydroponic crops including salads.
- Establish an experimental trial to investigate the abilities of the selected products (stated below) to alter i) microbial biomass ii) phenotypic and iii) functional characteristics of the soil microbial community
- Investigate the effects of the products on soil chemical characteristics such as pH, organic matter, and nutrients
- Compare results obtained by the Cranfield student to those of the Soil Foodweb laboratories
- Evaluate and compare the results to determine the effectiveness of the individual products for manipulation soil microbial communities.

Both organic and conventional growers are becoming increasingly aware that soil and microbial processes and health are critical for nutrient cycling, and that a biologically diverse rooting medium may reduce disease occurrence. Management practices that maintain microbial health may thus improve crop yields. As such growers are increasingly attempting to manipulate the soil or substrate microbial community to optimise production. Along-side commercial formulations sold to alter soil microbial communities, some growers have opted to produce their own products, often known as “compost teas”. There is, however, very little empirical evidence regarding the true benefit of these products. This is unsurprising as there

is currently very little mechanistic information in peer reviewed journals. Thereby our intention was to evaluate a selection of products and their abilities of manipulating soil microbiology under a selection of cultivation techniques. The current research focused on soil with sweet peppers as the crop, however it is envisaged that results may open up opportunities to investigate the abilities of the products to maximise yields of many other soil- and substrate-grown crops.

It is intended that the information will benefit the industry by providing the grower with scientifically rigorous information regarding the usefulness of various products that are used to influence soil microbial populations to increase crop productivity. It is envisaged that the information will assist the grower in deciding which products are likely to be the most beneficial to improve yields.

Summary

The global increase of organically-managed horticultural soil has increased the use of organic amendments and proprietary products in such systems. The intention is to effect nutrient cycling and hence increase crop yields while improving soil health. In this research, it was hypothesised that such organic amendments impact on soil microbiological properties, such that they are able to, at least in part, replace the need for inorganic fertilisers. Experimental trials were established in glasshouses (Taunton, UK) with monoculture sweet-peppers (*Capsicum annuum*), grown in either a bark- or compost-amended soil. The intention was to determine the effects of adding either aerated compost tea, or two commercial products, viz. a rhizosphere inoculant referred to as 'Rhizosphere inoculant'[1], or a nutrient supplement referred to as 'Nutrient supplement'[*], compared to an unamended control. Effects on chemical (nutrient content and pH) and microbiological phenotypic structure (via the measurement of the associated soil microbial community phospholipid fatty acid (PLFA) structure), and basal and substrate (glucose) induced respiration were monitored over time.

None of the products tested resulted in statistically significant impacts on either chemical or microbiological parameters, in either the compost or bark media. However, significant variation in the properties occurred over time, whereby total C significantly decreased (irrespective of application of the test products), in both soil matrices. Total N and pH significantly decreased over time (irrespective of application of the test products) in the compost matrix. Microbiological parameters, including phenotypic (PLFA) profiles and respiration rates, also varied significantly over time. Thereby evidence that the products

[1] Trade names of the products are anonymous to protect commercial sensitivity

impacted upon soil chemical or biological properties in any functional sense is minimal. Impacts upon crop performance or disease suppression were not directly assessed in this component of the study. In conclusion, there was no evidence that the products stimulated microbial activity or nutrient cycling within the current research context, notably where soils had received high organic matter inputs.

Financial Benefits

Approximate costs of the products used in this work for a soil grown organic pepper crop:

Rhizosphere inoculant: £2100/ha per season*

Nutrient supplement: £1400/ha per season (materials) + £1500/ha per season (labour)

Compost tea: £200 one-off construction materials + approx. 2 hours labour per 'brew' (ingredient costs are negligible per brew)

*For this research labour costs of applying product were negligible as it was included in the fertigation programme.

No impact was recorded on the parameters measured, so no financial benefit can be established. Further investigations would be required to investigate effects on disease occurrence and yields, and potential long-term impact.

Action Points

- Growers should be aware that application of proprietary products to manipulate the soil microbial community for the benefit of the crop may not show an impact on the soil chemical and biological characteristics in the short term.
- For growers who already incorporate large amounts of organic matter into their soil, inoculation with proprietary mixes of microorganisms may be of limited value.
- With application costs of up to approximately £3000/ha, growers should attempt to quantify the benefits of any application, ideally by taking measurements from a well-designed commercial trial over several seasons.