SoilWealth
NURTURING CROPS

Integrated
Crop Protection
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VG15010 Demonstration Report

Soilborne disease management in greenhouse capsicums

North Adelaide Plains, Virginia, South Australia

Tom Lioulous; Steven Coventry , EE Muir & Sons; Doris Blaesing, RMCG, August 2017

RMCG

ahr applied horticultural research

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VG 15010 A multi-faceted approach to soilborne disease management

'A multi-faceted approach to soilborne disease management' (Project VG15010) *is a three-year project (2015-2018) providing Australian vegetable growers with the tools and resources they need to manage the risk of crop losses due to soil-borne diseases.*

VG15010 delivers new information and resources about soilborne diseases to the vegetable industry through the established Soil Wealth and Integrated Crop Protection framework.

This project is a strategic levy investment under the Hort Innovation Vegetable Fund.

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Summary and conclusions

A simple on-farm demonstration trial was set up for a preliminary assessment of the effect of dry Caliente pellets (BioFence) on root health and crop growth of greenhouse capsicums in the Northern Adelaide Plains.

Preliminary findings suggest that BioFence at 200 g/m^2 on its own, applied once, pre-planting to a soil with high root knot nematode (*Meloidogyne*) levels cannot provide adequate nematode control for a capsicum crop over a nine-month growing period.

Further work is required to understand the most beneficial and economically viable use of this soil amendment. BioFence may have to be used at higher rates, different timing, repeatedly or in combination with other practices. BioFence may assist in suppressing soilborne diseases, if used when inoculum levels still low.

Introduction

BioFence, a pelletised organic soil amendment made from the brassica biofumigation plant Caliente, was used in an on-farm demonstration trial in the Northern Adelaide Plains, Virginia, South Australia. The main target organisms were root knot nematodes (*Meloidogyne* spp.*)* The grower, Tom Lioulous, was also interested in reducing the risk posed by damping off fungi such as *Pythium* spp. and *Rhizoctonia* spp.

The trial was as an initial screening of BioFence in a greenhouse capsicum production system, typical for the region. In the Northern Adelaide Plains, intensive greenhouse production of vegetables has a long history. Therefore, soil borne diseases, and especially nematodes, have become a significant problem. Metham Sodium (MS) fumigation has been used for many years to manage nematodes and other soilborne diseases. However, growers are increasingly interested in replacing the chemical. It appears that Metham Sodium no longer has the desired effect. Many growers are also concerned about its effect on soil health as well as the wellbeing of their families and those who work for them.

Conversations with numerous growers and agronomists in the Virginia area suggest that enhanced biodegradation of Metham Sodium may occur in the Adelaide Plains. Currently, a testing service for enhanced biodegradation of MS is not available in Australia. Detailed information about Metham Sodium use and alternatives that can be tried in the vegetable industry can be found in the following report VG 13045 - Identification of Potential Alternatives to Metham Sodium.

Site, trial details and methods

This section summarises information about the demo site, treatments and assessments.

TRIAL NAME	BIOFENCE USE IN CAPSICUMS (PROTECTED CROPPING)
Site and management information	
Site location	Virginia, South Australia
Producers	Tom Lioulous and family
Agronomist	Steve Coventry, EE Muir & Sons
Soil-borne Disease Project contact	Doris Blaesing, RMCG
Crop	Capsicum (yellow)
Soil texture	Loam
Soil condition (structure, fertility)	No obvious root zone restrictions
Irrigation	Drip delivering uneven amount of water along the length of the line i.e. the slight slope of houses / gravity lead to more water being applied to the lower lying section of beds and the end of lines; all beds are affected; the differences in water application have not been assessed.
Relevant management inputs	Chicken manure composts used regularly
Rotation	Capsicums, several months fallow, capsicums
Trial details	
Situation	Continuous cropping in plastic tunnels has led to a build-up of nematodes, identified via root damage symptoms; and fungal pathogens, identified via damping off issues
Trial Objectives	Investigate the effect of BioFence, a Caliente based mustard meal extract (Appendix 1), on levels of nematodes and soil borne fungi as well as disease incidence and severity. Establish whether BioFence can be used as a replacement for fumigation
Target Pathogen(s)	Nematodes, damping-off fungi; refer to preplant DNA test results (Table 2)
Trial site dimensions	Greenhouse tunnel group size: 350 m^2 x 8 houses = 2,800 m^2 for the group

TRIAL NAME	BIOFENCE USE IN CAPSICUMS (PROTECTED CROPPING)
Trial details (continued)	
Treatments	Control – no BioFence, Treated – BioFence pellets at 200 g/m^2 (refer to Appendix 1 for product information and image)
Planting Date	30/8/16
Termination	May 2017
Crop management	Standard fertiliser and irrigation management across all houses
Design and plot size	Replicated strips Control: two houses (# 4, 8) by 350 m^2 each - no treatment Treated: six houses by 350 m^2 each - (# 1, 2, 3, 5, 6, 7) treated with BioFence (sample taken with Predicta soil probe across all the treated houses prior to treatment)
Data collection	**DNA soil testing** a week after planting and after crop establishment (October 16) Sampling using Predicta probe and methodology, 1 sample bulked across control houses plus 1 across treated houses **Plant assessment** visually during site visits 31/10/16, 23 & 25/11/16 (observations recorded, and photos taken by Steve Coventry) **Plant height measurements and root health assessments** were conducted 18/1/17 and 17/2/17; average plant height within a row was measured at 22 positions in treated and untreated beds and photos taken at each position. Root health was assessed using a scale of 1-5 with 1 indicating a healthy root system and 5 a root system heavily infested with root knot nematodes and lacking new root growth. **Harvest assessments** given the long period of time the crop was harvested and the available resources, a yield assessment was not done.
Statistical analysis	Not possible; this was a demo trial to evaluate whether BioFence should be included in replicated trials
Harvest Period	End October 2016 to end May 2017

Findings and discussion

Observations and measurements

Visual assessment made during crop visits 31/10/16, 23 & 25/11/16 showed differences between the treated beds and the control. The main differences were a slightly lighter leaf colour in control beds and a larger number of poorly growing plants than in treated beds as show in below images.

31-10-16 control bed

31-10-16 treated beds

At the time of crop assessments 18/1/17 (5% yellow fruit) and 17/2/17 (harvest commenced), differences in the appearance of surviving plants in treated and untreated (control) rows had largely disappeared. At the time of the second assessment (17/2/17) plants in untreated and treated beds did not show noticeable height differences (refer to Table 1 and above images).

Root health assessments (1 = good, 5 = poor) produced no difference in overall ratings between treated and untreated (control) beds at both visual assessment dates. However, some of the plants in treated plots had less nodules and more fine roots than others, and more than those in control plots. Images on the following 2 pages show examples of plant and root assessments.

Table 1 – Plant height and root health assessments

DATE	CONTROL - HOUSES 4 & 8		TREATED - HOUSES 1-3, 6 & 7	
	Average plant height (cm)	Root health rating	Average plant height (cm)	Root health rating
18/1/17	62	4.2	70	4.2
17/2/17	84	4.3	85	4.3

DNA tests for root knot nematodes shown in Table 2 suggest that in December 2016 nematode levels in treated beds were much higher than in untreated beds; a difference which is difficult to explain from the information collected.

18-1-17 control bed

18-1-17 treated bed

17-2-17 control bed

17-2-17 treated bed

Predicta soil DNA test results

Michael Rettke, South Australian Research and Development Institute (SARDI), conducted the DNA soil tests as part of project VG15009. He suggested that the main clade I *Pythium* species is most likely *P. ultimum*. It is a cooler temperature pathogen, which can cause root rot. *P. ultimum* does not produce zoospores so the population does not change quickly. It is difficult to interpret the detected *Pythium* DNA level in terms of significance for disease risk. Some isolates can be very aggressive while others are not.

Rhizoctonia levels were low and the potential effect on the crop is not clear. *Colletotrichum coccodes* (fruit anthracnose) was found, which causes a black dot root rot on tomatoes. This disease has not been reported on capsicums.

BioFence reduced total *Meloidogyne incognita* levels in the first two months after treatment, compared to the control. However, levels were still high. By December, nematode levels found in soil from the treated areas where higher than in untreated areas. This suggests that BioFence at 200 g/m^2 on its own, applied once, pre-planting to a soil with high root knot nematode (*Meloidogyne*) levels, cannot provide adequate nematode control for a capsicum crop with some 9 months of growing and no further treatment.

Table 2 – Predicta soil DNA test results prior to planting and in-crop

Sampling date	Houses	*Pythium* clade I (pgDNA/g Sample)	*Pythium* clade f (pgDNA/g Sample)	*Rhizoctonia solani* AG2.1 (pgDNA/g Sample)	*Rhizoctonia solani* AG4 (pgDNA/g Sample)	*Colletotrichum coccodes* (Anthracnose) (pgDNA/g Sample)	*Macrophomina phaseolina* (Charcoal Rot) (copies/g soil)	*Meloidogyne javanica / incognita / arenaria* (pgDNA/g Sample)	*Meloidogyne incognita* (pgDNA/g Sample)
Pre-planting **25/08/16**	**4 & 8 Control**	**43**	**0**	**1**	**0**	**80**	**0**	**1382**	**3176**
	1,2,3,5,6,7	**45**	**0**	**3**	**0**	**79**	**0**	**1406**	**5251**
Post crop establishment 6/10/16	**4 & 8 Control**	**31**	**0**	**0**	**1**	**57**	**0**	**482**	**1645**
	1,2,3,5,6,7	**43**	**0**	**0**	**0**	**113**	**0**	**466**	**1230**
19/12/16	**4 & 8 Control**	**31**	**0**	**1**	**0**	**144**	**233**	**2050**	**Not analysed**
	1,2,3,5,6,7	**31**	**2**	**4**	**0**	**101**	**368**	**4004**	**Not analysed**

Appendix 1: BioFence information

For details visit http://www.headlandamenity.com/SDS_2011/Biofence_SDS_110124_DT.pdf

headland AMENITY PRODUCTS

PRODUCT SAFETY DATA SHEET

BIOFENCE

1. Identification of the substance/mixture and of the company/undertaking:

1.1 Product identifier:

BIOFENCE

1.2 Relevant identified uses of the substance or mixture and uses advised against:

Organic Soil Amendment

1.3 Details of the supplier of the safety data sheet:

Headland Amenity Ltd,
1010 Cambourne Business Park,
Cambourne
Cambridgeshire
CB23 6DP
Tel : +44 (0) 1223 597834
Fax - +44 (0) 1223 598052
e-mail info@headlandamenity.com

1.4 Emergency telephone number:

Tel : +44 (0) 1223 597834 during office hours (9am – 5pm, Monday – Friday)

2. Hazards Identification:

2.1 Classification of the substance or mixture;

This mixture is not classified as harmful to humans or the environment according to Directive 1999/45/EC and statutory instrument No.716 2009 Chemicals (Hazard Information and Packaging) regulation)

2.2 Label elements:

There are no statutory labelling requirements under Directive 1999/45/EC as the mixture is not classified as harmful to humans or the environment

2.3 Other hazards:
None Known

Date of MSDS completion: 24-01-2011
Version: 2
Supersedes MSDS dated: 05-2009

Appendix 1: [cont.]

BioFence application