Field evaluation of cover crops

PW17001 Final report Appendix 13 Integrated pest management of nematodes in sweetpotato

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The Department of Agriculture and Fisheries proudly acknowledges all First Nations peoples (Aboriginal peoples and Torres Strait Islanders) and the Traditional Owners and Custodians of the country on which we live and work. We acknowledge their continuing connection to land, waters and culture and commit to ongoing reconciliation. We pay our respect to their Elders past, present and emerging.

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Introduction

An important output of this project is to investigate cover crops and their suitability to control plant parasitic nematodes. In some sectors of the vegetable industry, biofumigation is being promoted to reduce populations of nematodes and soilborne pathogens. Since the tissue maceration and soil pulverisation that is required to liberate the biofumigant is detrimental to the soil biology, research is required to check whether this process provides benefits from fumigation or the benefits obtained are similar to other green manure crops.

Pathogenicity screening of brassica biofumigants in this project has shown that most species are hosts of root-knot nematode. Are the glucosinolates released on maceration and incorporation of biofumigants still effective in overcoming nematode populations? Kirkegaard and Sarwar, 1998 have shown that different parts of the plant have different GSL profiles, which could in turn affect the various soilborne pathogens, including nematodes, to differing degrees. Are there enough GSL concentration in the tops to control those nematodes that can be found in the roots of the various brassica biofumigants? The report is included as Appendix 5.

A grower demonstration site was selected in Bundaberg and planted to eight different winter cover crops with a bare fallow used as a control. Cover crops from the grass (Poaceae) and Brassica families were chosen based on seasonal suitability and seed availability. The inclusion of biofumigants (Brassicas) allows investigation into claims that biofumigants can be effective in reducing soilborne pathogens. Any biofumigant effects will be investigated and glucosinolate levels determined at trial conclusion.

Materials and Methods

Prior to planting, a representative soil sample was taken from each treatment for nematode extraction. The block was planted on the 21st of May 2020. The soil was sampled at 13 weeks after planting and before and after biofumigant incorporation. A biomass assessment was conducted on the 2nd of September 2020, samples were placed into oven drying facilities at 60°C, ground then analysed for glucosinolates.

Cover crops in the demonstration trial included:

- A mix of Terranova Radish and Saia Oats
- Terranova Radish
- Saia Oats
- Genie Oats
- Nemsol (Terranova radish and Nemat)
- Fungisol (Terranova radish and Ethiopian mustard)
- Bare Fallow
- Caliente
- White French millet

Image 1 Left, Rach Langenbaker (BRF), grower collaborator Daniel Zunker measuring seed. Centre, Genie Oats and right, Nemsol.

Image 2 Left to right, cover crop trial site, biomass and flowering assessment.

Results and discussion

While the different cover crop treatments showed a reduction of RKN between sampling periods, the results must be looked at with caution. This was an observation trial and not replicated, so cannot be interpreted by a statistician. There is a possibility that sampling variation could be a source of the lower counts, as nematode numbers are often patchy across a field or along a row. Cooler winter temperatures may also have had an effect on lowering the nematode numbers.

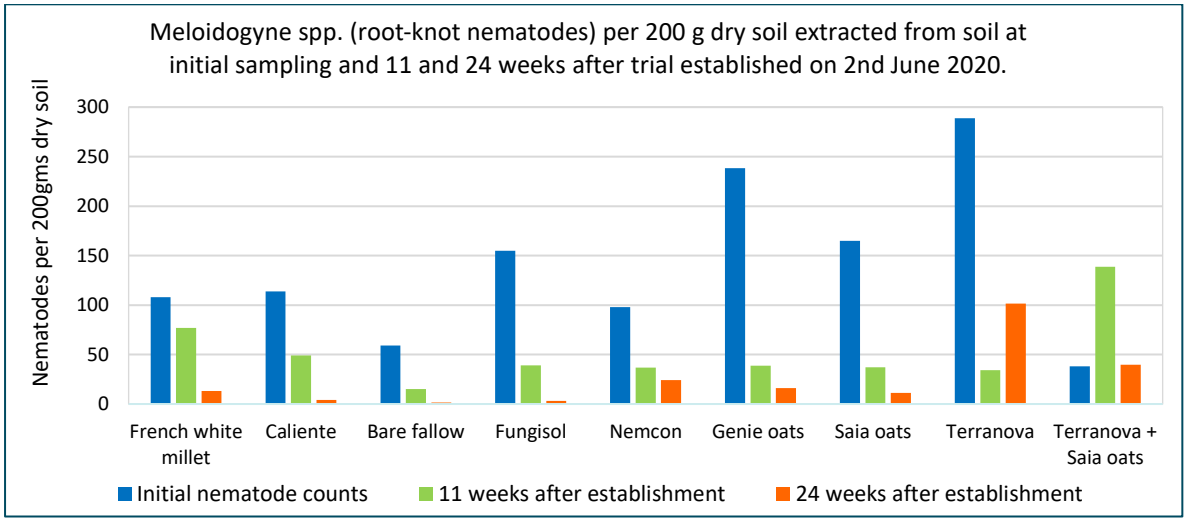

Figure 1 Cover crop trial RKN counts preplant, 11- and 24-weeks post planting.

The Brassica cover crop species attracted large populations of various insect pests and required more water than other rotation crops making them less attractive for some growers. Considering the nematode reduction trend, a replicated field trial may be worth pursuing, however inclusion of Brassica species into the crop rotation would depend upon grower interest and the viability of growing this crop considering water availability and the requirement for pesticide application.

Five glucosinolates (GSLs) were tested with key differences showing up between the Caliente and the other biofumigant types. Sinigrin was the most pronounced within Caliente, whilst other biofumigant types had very little Sinigrin present. Glucoraphanin and Gluconapin were abundant in the Terranova radish, Nemsol and Fungisol. Different brassica biofumigants and therefore GSLs, have been shown to perform differently against different soilborne pathogens (Kirkegaard, 2009, Matthiessen and Kirkegaard, 2006).

Glucosinolate profiles

Four brassica biofumigants were trialed, 3 of which contained either a radish as the sole species (Terranova radish) or as part of a mixture (Nemsol and Fungisol). Caliente was the only Indian mustard type trialed. Five glucosinolates were tested, with key differences showing up between the Caliente and the other biofumigant types. Glucosinolate Sinigrin was the most pronounced in the variety Caliente. Glucoraphanin and Gluconapin were abundant in the Terranova radish, Nemsol and Fungisol. Different brassica biofumigants and therefore glucosinolates (GSLs), have been shown to perform differently against different soilborne pathogens (Kirkegaard, 2009, Matthiessen and Kirkegaard, 2006).

Biofumigants grown at different times of the year have also been shown to produce different levels of GSLs making the selection of one brassica biofumigant over another difficult. As most brassica biofumigants have been shown to be good hosts of RKN, selection of suitable cover crops becomes very important. Even though they may be hosts of nematodes that attack the root, what happens once the tops are macerated and incorporated into the ground (Kirkegaard and Sarwar, 1998) have shown that different parts of the plant have different GSL profiles which could in turn affect the various soilborne pathogens, including nematodes, to differing degrees.

While the different cover crop treatments showed a reduction of RKN between sampling periods, the results must be looked at with caution. This was an observation trial and not replicated, so cannot be interpreted by a statistician. There is a possibility that sampling variation could be a source of the lower counts, as nematode numbers are often patchy across a field or along a row. Cooler winter temperatures may also have had an effect on lowering the nematode numbers.

Considering the nematode reduction trend, a replicated field trial may be worth pursuing, however inclusion of Brassica species into the crop rotation would depend upon grower interest and the viability of growing this crop considering water availability and the requirement for pesticide application.

Pot trials were undertaken in an attempt to determine the effect of each of the 5 glucosinolate compounds on RKN or whether total glucosinolate levels are effective for RKN control.

Table 1 Glucosinolate analysis.

Sample ID	Glucoberin (µmole/g) DW	Progoitrin (µmole/g) DW	Sinigrin (µmole/g) DW	Glucoraphanin (µmole/g) DW	Gluconapin (µmole/g) DW	Total GSL (µmole/g) DW
Terranova radish *Raphanus sativus*	1.64	0.55	0.09	2.69	3.13	8.10
Nemsol *Raphanus sativus* + *Eruca sativa*	1.66	0.22	0.09	7.55	4.70	14.22
Fungisol *Raphanus sativus* + *Brassica carinata*	0.38	0.25	0.36	5.04	2.66	8.68
Caliente B2 *Brassica juncea*	0.50	0.51	15.50	0.00	0.56	17.08

References

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