

Studentship Project: Annual Progress Report 27/09/2021 to 27/09/2022

Student Name:	Vongai Chekanai	AHDB Project Number:	
Project Title:	UTILIZATION OF SINGLE AND MULTIPLE SPECIES COVER CROPS FOR THE SUPPRESSION OF SOIL-BORNE NEMATODES OF <i>NARCISSUS</i>		
Lead Partner:	Harper Adams University		
Supervisor:	Dr. Matthew Back		
Start Date:	27/09/2021	End Date:	27/09/2024

1. Project aims and objectives

- To assess the sensitivity of *Pratylenchus* spp. to isothiocyanates via *in-vitro* experiments.
- To examine the susceptibility of different cover crop species to *Ditylenchus dipsaci* (stem and bulb nematode) and *Pratylenchus* spp. (root lesion nematode) in greenhouse host status experiments.
- To determine the suppressiveness of cover crops on *D. dipsaci* and *Pratylenchus* populations in narcissi fields.
- To investigate the effect of cover crops on non-target organisms and other nematodes.
- To determine the PCN population densities before and after cover crop treatments in the field

2. Key messages emerging from the project

- Brassica isothiocyanates (Allyl, Benzyl and 2-Phenylethyl) cause mortality of *Pratylenchus penetrans* nematodes.
- Green house host status experiments showed that Japanese oats and phacelia are maintenance hosts to *P. penetrans*. Forage chicory, spider flower, French marigold, oilseed radish, Indian mustard, alfalfa, lupin, African nightshade, oilseed rape are poor hosts to *P. penetrans*.
- Field experiment sites are mainly infested with *Pratylenchus* spp. Monitoring is ongoing and aims to determine the effect of selected cover crops on nematode population dynamics.

The results described in this summary report are interim and relate to one year. In all cases, the reports refer to projects that extend over a number of years.

While the Agriculture and Horticulture Development Board seeks to ensure that the information contained within this document is accurate at the time of printing, no warranty is given in respect thereof and, to the maximum extent permitted by law, the Agriculture and Horticulture Development Board accepts no liability for loss, damage or injury howsoever caused (including that caused by negligence) or suffered directly or indirectly in relation to information and opinions contained in or omitted from this document. Reference herein to trade names and proprietary products without stating that they are protected does not imply that they may be regarded as unprotected and thus free for general use. No endorsement of named products is intended, nor is any criticism implied of other alternative, but unnamed, products.

3. Summary of results from the reporting year

ITC lab experiments

- a) Determining the toxicity of pure isothiocyanates in root lesion nematodes is important for finding the potential brassica candidates for biofumigation. Allyl, 2-Phenylethyl and Benzyl ITCs caused significant mortality effects on mixed-life stage nematodes of *P. penetrans* at 12.5, 25, 50 and 100 ppm while Sulforaphane appeared to have weak nematocidal effects. Benzyl ITC appeared to be the most toxic followed by 2-Phenylethyl, Allyl ITC was the third most toxic and lastly Sulforaphane.

Greenhouse host status experiments

- b) Greenhouse experiments were carried out to determine the host status of 13 cover crop species to *P. penetrans*. The tested cover crops were forage chicory, spider flower, French marigold, oilseed radish, Indian mustard, alfalfa, lupin, African nightshade, phacelia, Japanese oats oilseed rape. The experiments were inoculated with an initial population of 1000 mixed life stage nematodes. After 8 weeks, the final population (soil and roots) and reproduction factors (Pf/Pi) of *P. penetrans* were determined. Except for two species, phacelia and Japanese oats, all the cover crops tested were poor hosts for *P. penetrans*.

Field experiments

- c) Field experiments were established on St Mary's Island, Isles of Scilly and Montrose, Scotland (Figure 1) to evaluate the potential of selected cover crops to suppress *Pratylenchus penetrans* and *D. dipsaci*. Analysis of the initial population of nematodes revealed that the sites are mainly infested with *Pratylenchus* nematodes, *Aphelenchoides*, *Aphelenchus*, and Hoplolaimid nematodes. *D. dipsaci* was found in incredibly low numbers ranging from 0 to 100 nematodes per kg of soil. Potato cyst nematodes were not detected at the sites.



d) Figure 1. Cover crops grown in Scotland before and after incorporation

4. Key issues to be addressed in the next year

ACTIVITY	2022-2023					
	Oct- Nov	Dec -Jan	Feb - Mar	Apr- May	Jun e- July	Aug - Sep
First year report defence						
Sampling, field experiment termination and analysis						
Repeat ITC lab assays						
Nematode and Microbial community analyses at James Hutton Institute						
Annual leave						
Planting cover crops in field (Season 2)						
Cover crop removal /Incorporation and soil sampling						
Nematode extraction and quantification/Miseq						
Manuscript writing and submission year 2						

5. Outputs relating to the project

(events, press articles, conference posters or presentations, scientific papers):

Output	Detail
Poster presentation	Assessing the toxicity of isothiocyanates from Brassicas against root-lesion nematodes (<i>Pratylenchus penetrans</i>) <i>in vitro</i> . Harper Adams Research Conference, September 2022
Report	Harper Adams University, Specific Degree Report (first-year report)
Teaching	Harper Adams-Marshall Papworth Course in Sustainable Agriculture.

6. Partners (if applicable)

Scientific partners	James Hutton Institute
Industry partners	AHDB, Sottish Agronomy, Hutchinsons Ltd., Affiliation of Isle of Scilly growers, Grampian Growers
Government sponsor	