# Grower Summary

## FV 377

Onions: improving risk assessment for free-living nematodes

Annual 2011

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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.

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| **Project Number:** | FV 377 |
| **Project Title:** | Onions: improving risk assessment for free-living nematodes |
| **Project Leader:** | Steve Ellis |
| **Contractor:** | ADAS |
| **Industry Representative:** | Nick Walker of PG Rix Ltd |
| **Report:** | Annual report, 2011 |
| **Publication Date:** | 25 January 2012 |
| **Previous report/(s):** | None |
| **Start Date:** | 1 April 2010 |
| **End Date:** | 31 March 2012 |
| **Project Cost:** | £93,820 |

## Headline

This project is re-defining the threshold levels to apply nematicides for free-living nematodes which could reduce the need to use them and ultimately save approximately £100/ha.

## Background

Free-living nematodes are important pests of onions but chemical control options are limited. Therefore it is becoming increasingly important to be able to determine where the crop can be grown without the risk of nematode damage.

The risk from free-living nematodes can be assessed by considering field history, previous cropping and representative soil sampling. However, there is little information available on those free-living nematodes that are most damaging to onions and at what level they pose a risk. In addition, there is some confusion over when is best to sample for free-living nematodes due to their potential to move up and down the soil profile.

This project aims to improve risk assessment for free-living nematodes in onions by studying the following:

1. *Infestation levels:* The first and most fundamental component of risk assessment is to understand the nematode infestation level that justifies treatment. Current guideline thresholds for onions have little scientific basis and are based on anecdotal information. Work is required to develop robust thresholds quoted as either numbers per volume or weight of soil.

2. *Historical data from soil analysis:* ADAS Pest Evaluation Services (PES) have several thousand records of free-living nematode analyses between 2000 and 2010. These data will be interrogated to indicate the relative abundance of different nematode groups, their numbers, proportion of samples over threshold and any trends in nematode numbers over a 10 year period.

3. *Soil sampling:* There is a lack of confidence in soil sampling to predict risk from nematodes as they may move up and down the soil profile in response to soil moisture and temperature. This could affect estimates of numbers depending upon when samples are taken and to what depth. Work will determine the optimum soil moisture and temperature ranges at which to sample to get the best estimate of pest numbers. In

addition the impact of soil cultivation on nematode numbers will be investigated.

4. *Alternative products*: The final aspect of the project will be the evaluation of potential alternative products for control of free-living nematodes. Alternative chemical control options such as Nemathorin are available and potential biopesticides are also worthy of investigation.

The specific objectives of this project are listed below:

1. To measure the effect of different populations of stubby root, needle, stunt/spiral and root lesion nematodes on the growth of onions, to determine which species are potentially most damaging.
2. To analyse historical sampling data to provide background information on field populations of different free-living nematode groups.
3. To monitor the vertical distribution of nematodes in relation to soil moisture, temperature and before and after cultivation in order to recommend an optimum period and depth for soil sampling.
4. To undertake pot experiments to test the effectiveness of a selection of nematicides and biopesticides on the control of free living nematodes

In future, protecting crops from free-living nematode damage will become increasingly reliant on integrated strategies that combine cultural and chemical control. Robust risk assessment will be fundamental to the success of such IPM programmes.

In year one of this project, objectives 1-3 have been started. Objective 4 will not begin until year 2

## Summary of the project and main conclusions

- Pot experiments suggest that populations of stubby root, root lesion and stunt/spiral nematodes well above current guideline thresholds have no effect on onion growth.

- Results suggest that significant savings can be made on nematicide use.

- Stunt/spiral nematodes are most commonly recovered from soil samples followed by root lesion nematodes, stubby root nematodes, needle nematodes, cyst juveniles, dagger nematodes, stem nematodes and root-knot nematodes.

- Stem nematodes and root-knot nematodes are potentially important pests of onions but were recovered on average in less than 1% of soil samples.

***Objective 1: Pot experiments to establish the most damaging nematode species to onions***

A range of populations of root lesion, stubby root and stunt/spiral nematodes were created by soil dilution. This involved mixing soil infested with nematodes with the same soil which had been sterilized by autoclaving at 121ºC for 45 minutes. For example, to achieve a target nematode population of 1000 stubby root nematodes/l of soil, 1 l of soil containing 2000 stubby root nematodes/l soil was mixed with 1 l of sterile soil. A total of 30 target populations was created for each nematode group (Table 1).

**Table 1**

| Nematode group | Provisional threshold (no./litre soil) | Target population range (no./litre soil) |
|---|---|---|
| Root lesion | 2,500 | 0 – 3,350 |
| Stubby root | 200 | 0 – 6,902 |
| Stunt/spiral | 10,000 | 0 – 11,600 |

The target populations were made up in 1.5 l pots and sown with 20 onion seeds (cv Vision). Pots were maintained in a polythene tunnel and watered as necessary.

Nematode numbers were also assessed to determine how the actual populations compared with the target populations. To assess the impact of nematode populations on onion growth seedling emergence was monitored daily and onion dry matter yield measured.

Nematode counts showed that the actual populations were very close to the target population. However, there was no obvious effect of nematode population on onion growth and yield. This result suggests that current guideline thresholds for free-living nematodes are far too conservative and that the crop can tolerate much higher populations of these pests.

Also potentially nematicide used in onions can be significantly reduced which would greatly improve crop profitability.

***Objective 2: Analysis of historic sampling data***

A total of 11,733 records for free-living nematode samples were extracted from the PES database over the period 31 October 2000 until 23 September 2010. Summaries were provided on the range of nematode groups and field populations in relation to existing guideline thresholds. The aim was to determine the most frequently recovered nematodes, their numbers, how these compared with the current guideline thresholds and whether there have been any obvious trends in nematode counts over the 10 year period.

The most frequently extracted nematodes between 2000 and 2010 were stunt/spiral nematodes followed by root lesion nematodes, stubby root nematodes, needle nematodes, cyst juveniles, dagger nematodes, stem nematodes and root-knot nematodes. Both stem nematode and root-knot nematode are both potential important pests of onions but were recovered from less than 1% of samples. There were no clear trends in nematode numbers between years and no indication that the risk from free-living nematodes is increasing or decreasing. Most nematodes were recovered least frequently in 2007 and most frequently in 2004. Stubby root nematodes were the main exception to these trends as they were least common in 2006 and most common in 2003.

The maximum nematode count was 33,975 stunt spiral nematodes/l soil. The next highest individual nematode counts were for stem nematode (20,325/l soil) and root-knot nematodes (15,750/l soil). These nematodes were rarely recovered from soil as previously discussed but when present could be found in very high numbers.

The proportion of nematode counts above threshold for individual groups gives an indication of the potential crop area likely to be treated with a nematicide. There is some evidence to suggest that guideline thresholds for stubby root nematodes are too conservative at 200/l soil (Ellis, unpublished data) and that 1000/l soil is a more realistic figure. The impact of increasing the threshold for stubby root nematodes was also considered.

Stubby root nematodes are most likely to exceed threshold levels. Between 2000 and 2010, 41.5% of samples contained numbers of stubby root nematodes above the 200/l threshold and so would have justified nematicide treatment. If the stubby root nematode threshold is increased to 1000/l soil, as suggested by previous work, then only 9.4% of samples would

have exceeded this level. For other nematode groups for which there are guideline thresholds, nematicide treatment would have been justified in 14.1% of samples with needle nematodes, 3.5% of samples with root lesion nematodes and less than 1% of samples with dagger and stunt/spiral nematodes. Therefore, stubby root nematodes are the most important nematode group in determining nematicide use, particularly if the 200/l threshold is retained. If thresholds are far too conservative, as suggested by the pot experiments undertaken as part of objective 1, then there is considerable potential to reduce nematicide treatment in the onion crop.

## Financial Benefits

Results suggest that guideline thresholds for free-living nematodes are far too conservative. If this is the case then growers can be much more confident that most land will not require a nematicide treatment unless it is infested with stem or root-knot nematodes. This could mean significant savings of approximately £100/ha and reduced environmental impact in terms of effects on non-target species and residue levels in soil.

## Action Points

- Growers should continue to sample land for free-living nematodes but specifically to assess the risk for stem nematode or root-knot nematode. These nematodes are only rarely recovered but can have a significant impact on the crop if present. With the exception of stem nematode and root-knot nematode the majority of other free-living species appear to have limited effect on onion growth. Neither stem nematode (a semi-endoparasite) nor root-knot nematode (endoparasite) are true free-living nematodes. Free-living nematodes do not invade plants.

- Growers can have increased confidence that unless numbers of most free-living species are exceptionally high they will not require nematicide treatment. This could have a significant impact on gross margins and reduce the environmental impact of pesticide use.