



Agriculture & Horticulture
DEVELOPMENT BOARD



Grower Summary

FV 349

Brassicas: Further development of infield tests for resting spores of clubroot and the development of clubroot control based on detection

Final 2013

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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: FV 349

Project Title: Brassicas: Further development of infield tests for resting spores of clubroot and the development of clubroot control based on detection

Project Leader: Professor Roy Kennedy

Contractor: University of Worcester

Industry Representative: Alistair Ewen, East of Scotland Growers Ltd

Report: Final Report 2013

Publication Date: September 2013

Previous report/(s): Annual Report 2012

Start Date: 01 April 2009

End Date: 31 May 2013

Project Cost: £82,458

Headline

Progress has been made towards an in-field clubroot test for Brassica growers.

Background

Brassica crops are of high economic importance in the United Kingdom. One of the main diseases affecting Brassica crops is clubroot, caused by the soil-borne organism *Plasmodiophora brassicae*. Mild clubroot infections lead to slowed growth and delayed harvesting. Severe infections result in total crop failure. Infection is easily recognisable by swelling of root tissue causing galls and club shaped structures. Clubroot resting spores are capable of inducing disease in vegetable Brassica crops years after initial infestation of the soil.

Once soil has been contaminated, clubroot spores remain viable for up to 18 years. Information on the presence or absence of clubroot in soils has been difficult to obtain because traditional methods cannot detect low levels of clubroot in soils. These methods were based on using the reaction of bait plants, however, large numbers of plants are required in these tests if small amounts of clubroot are to be detected. With the development of new detection methods based on molecular approaches the presence or absence of clubroot can be determined in most soil samples. These tests are laboratory based but require a high degree of precision by the operator. However, a competitive lateral flow device (lab on a stick) has been developed and evaluated for use in UK commercial soils for the detection of clubroot resting spores. The device was able to detect clubroot spores at close to epidemiological significant levels (10000 spores/gram of soil) in artificially infested soils.

The lateral flow device has the potential to be used in soil by field growers and in water based systems such as reservoirs and irrigation lines (for vegetable Brassica propagators). A quantitative measurement of clubroot resting spore infestation can be made using the lateral flow test device when used in conjunction with a lateral flow reader and standard curve data. This means that a prediction on whether the crop is at risk may be determined and, at what level ie low, medium or high risk.

Determining the clubroot resting spore number in soils using either a molecular or lateral flow test is an essential component in the development of an integrated disease management programme. Currently only two chemicals (cyazofamid – Ranman and fluazinam – Shirlan) approved for control of disease in potato crops have been demonstrated to have any potential for controlling clubroot in the field. However both these chemicals do not hold

approval for clubroot control in vegetable Brassicas as their efficacy against clubroot has not yet been demonstrated. Alternative control measures are still urgently needed. Limex, a by-product of the British sugar industry (www.limex.co.uk) was found in trials carried out over three consecutive years of the project to reduce the effect of clubroot infestation in soils on Brassica crop production. This was ahead of any other of the treatments used. An applications rate of Limex at or above 10 tons Limex ha⁻¹ was found to be optimal in reducing clubroot disease.

Summary of the project and main conclusions

A Brassica disease forecast has been under development to evaluate the potential to generate risk assessments for clubroot based on soil type, crop and clubroot resting spore numbers. In the final phase of the project the forecast has focused on three main environmental parameters: pH, calcium and magnesium. Each of which are considered significant due to their relationship in development of the disease to gall formation in the plant root. Further trials are required to establish whether the significant factors have a direct or indirect effect on clubroot disease potential. However the ability of the model to predict clubroot disease is at this point limited by the ability to predict weather patterns. Nevertheless, the model is likely to be applicable to different soils so it will be possible to work quickly towards generating risk assessments for clubroot disease based on soil type, crop and pre-planting clubroot resting spore levels.

The deliverables from this project are:

- Better detection of clubroot in the field before planting the crop.
- Detection tests which have been used “in field” to determine the level of risk to the vegetable Brassica crop posed by clubroot.
- Investigation of alternative products for clubroot control in the field.
- Initial development of a disease risk forecast for clubroot

Conclusions

- A simple ‘lab on a stick’ detection test, developed for the detection and measurement of clubroot spores in soil, has been evaluated in UK soils for use by the industry. A restricted UK Soils testing programme for measurement of clubroot contamination risk is offered in 2013 and 2014 to HDC members.

- A Brassica disease forecast to evaluate the potential to generate risk assessments for clubroot disease based on soil type, crop and clubroot resting spore numbers has been reviewed. Findings suggest that a risk matrix based on soil pH, Calcium, Magnesium and spore concentration could provide a useful measure of clubroot disease risk to susceptible crops ahead of crop planting.
- Limex was found in each year of the conducted field trials to improve the control of clubroot in heavily infested land and maintain marketable yields of Broccoli crops. This was ahead of any other of the treatments used. An applications rate of Limex at or above 10 tons Limex ha⁻¹ was found to be optimal.

Financial Benefits

- The usage of the detection tests for risk assessment for clubroot will improve the control of this pathogen.
- Generation of a clubroot disease forecast model based on soil type, crop and soil disease level will assist knowledge on planting risk and subsequent disease management strategies.
- New information will be available on an integrated management programme for predicting disease risk and strategies for clubroot control

Action Points

Specific action points for growers at this stage in the project include:

- Growers can have their soils tested for clubroot disease inoculum concentration ahead of testing.
- Limex can be used to assist control clubroot in affected land however it will not reduce clubroot risk in subsequent seasons.
- The optimal level of Limex required for clubroot control was found to be 10 tons Limex ha⁻¹