

Final Project Summary

Project title	Brassicas: Further development of 'in field' tests for resting spores of clubroot and the development of control based on detection		
Project number	RD-2008-3525	Final Project Reports	AHDB Cereals & Oilseeds 577 AHDB Horticulture report FV349
Start date	01/04/09	End date	30/09/16
AHDB Cereals & Oilseeds funding	£167,533	Total cost	£404,347

What was the challenge/demand for the work?

As a member of the Brassica family, oilseeds are susceptible to the soil-borne protozoan pathogen *Plasmodiophora brassicae*, which causes clubroot. Once soil has been contaminated, spores can remain viable for several years causing any subsequent oilseed or vegetable brassica crop to be at risk of infection. Growers require knowledge of clubroot risk before planting to enable them to make cultivar and other management choices. With the development of new detection methods, based on identifying *Plasmodiophora brassicae* DNA levels in soils, the presence or absence of clubroot risk can be determined; however, these are limited by the need for processing in a laboratory. The primary aim of this work was to validate a clubroot lateral flow device (LFD) for use in fields by oilseed rape growers, therefore avoiding the need for specialised laboratories.

How did the project address this?

Quantification of spores by lateral flow devices was tested against a molecular quantification method (quantitative PCR) to establish whether a commercially viable diagnostic test could be provided for growers. This was done for 137 soil samples collected from eight commercial oilseed rape fields in England and fourteen in Scotland, plus a further two fields involved in variety trials. The soil samples contained a wide range of *P. brassicae* resting spore concentrations, as quantified by qPCR. It was found that the LFDs over-estimated the number of clubroot spores in soil samples. However, qPCR proved to be a reliable assay after appropriate soil sampling.

In addition, the effect of oilseed rape cultivar on disease development was investigated through pot-based bioassays, as was the effect of *P. brassicae* resting spore density on seedling infection levels. In the pot-based bioassays, there was increased damage observed on OSR roots at higher soil spore concentrations in both a resistant and a susceptible cultivar; it was notable that galling (at very low levels) was observed during glasshouse trials on the main resistant cultivar of OSR currently used in the UK: cv. Cracker. Of other cultivars tested, a range of disease severity was observed.

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An additional objective was to study the effect of clubroot on yields of resistant and susceptible oilseed crops. In Syngenta-funded trials, there was a good relationship between the clubroot levels detected in soil and subsequent infection on plants ($r^2 = 0.726$). This indicates that clubroot quantification at sowing in soil using a diagnostic test is a good indicator of subsequent plant infection. However, this does not necessarily allow for a determination of likely yield loss for oilseed rape. Unlike vegetable brassicas, where whole marketable plant loss can result from clubroot infection, oilseed rape has a relatively high plant population per metre squared and overall yield is not as dependent on the survival of an individual plant. From observations taken in the crop and from the pot experiments reported in this project, clubroot can have an overall impact of reducing OSR plant populations. This will have an impact on yield but surviving plants may negate this effect through yield compensation. It is clear that smaller OSR plants in the canopy are more likely to be heavily impacted by clubroot compared to larger OSR plants.

What outputs has the project delivered?

- A reliable molecular test is available (and now offered commercially) which can detect clubroot level in land prior to planting with OSR
- Yield loss results from only high levels of clubroot contamination
- Cultivar Cracker (resistant) shows some level of clubroot gall formation on roots
- An in-field test is available for detection of high levels of clubroot in contaminated fields

Who will benefit from this project and why?

Oilseed rape and vegetable brassica growers can have soil tested for the presence of clubroot spores, which will help guide decision making on cultivar choice, rotation and disease management strategies.

If the challenge has not been specifically met, state why and how this could be overcome

The LFD test could be improved for detection of clubroot reliably at lower levels of soil contamination if a pre-filtering or concentration step was built into the protocol. This would require larger volumes of soil (10 g).

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Lead contractor	University of Worcester
Industry partners	Syngenta

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