

Final Project Summary

Project title	Developing sustainable management methods for clubroot		
Project number	21140006	Final Project Report	PR608
Start date	August 2015	End date	January 2019
AHDB Cereals & Oilseeds funding	£176,832	Total cost	£196,832

What was the challenge/demand for the work?

Clubroot incidence and severity increases year on year in the UK. Varietal resistance remains the most viable and cost effective solution on infected land but efficacy has eroded in rotations where it has been deployed before. The patchy nature of clubroot in fields also makes yield loss prediction and treatment need hard to predict. This project aimed to progress sustainable and cost-effective management of clubroot, through an enhanced understanding of the diversity of UK clubroot populations, and the prevalence of varietal resistance breaking strains. Secondly, the project aimed to assess the potential for targeted treatment by mapping the severity of clubroot in affected fields.

How did the project address this?

Through soil sampling and testing with bait plants, the project elucidated the diversity of UK clubroot populations, and the prevalence of varietal resistance breaking strains. The project results have highlighted the prevalence of clubroot in the UK, the diverse nature of the pathogen population and the patchy nature of the disease in affected fields. Twenty-five fields were assessed using a standardised European Clubroot Differential Host set and 20 different pathotypes were identified, in almost equal proportion. Strains of clubroot that can overcome the 'Mendel' resistance to clubroot, which is present in resistant varieties like Chrome, Mentor and Cracker, were found to be present throughout the UK. Soils from seventy-five fields were tested in total, using the oilseed rape varieties Mendel (resistant) and Tolken (susceptible) in bioassays. Of these almost half (49%) had disease severities of more than 10% in the resistant variety as a % of what was noted in the susceptible variety and 15% of sites gave results of over 30% disease severity.

To assess the potential for targeted treatment by mapping the severity of clubroot in affected fields the project adopted and mapped infected fields. By mapping clubroot severity in commercial crops at 50m grid squares, and testing the soil and examining plants at three timings in the season, the project illustrated the patchy nature of the disease. Yield maps of these sites highlighted that the pathogen is just one cause of low yielding patches in fields. The disease mapping demonstrated the potential for the targeted management tools, such as liming or any new but costly methods that might later be developed. It would also allow for hygiene precautions to be taken around infected patches and for patches to be differentially treated when drilling susceptible crops – for example leaving bare or seeding with grass.

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Disease mapping also has potential in helping with economic decision making about fields: a field with a low level of infection distributed evenly in the field would be managed differently to a field with a single hot spot; however, they might give a similar test result under current testing systems, which would assign a single risk level for the whole field. Fields in this project were mapped using qPCR, bioassays and by visually assessing disease levels developing in the field. It was evident that soil tests, particularly molecular tests, do not correlate well with in-field disease development, so this is an area where further refinement is needed.

What outputs has the project delivered?

The practical advice arising from this project is that, because of the prevalence of clubroot in the UK and the widespread occurrence of resistance breaking strains, growers should keep accurate crop records of clubroot occurrence, location and intensity and note where varietal resistance has been deployed in fields to aid long-term planning and help prevent spread.

Resistant varieties should not be used as the sole management tool because of the high frequency of Mendel breaking strains in the UK. The use of non-susceptible crops in rotational courses is the most sustainable long-term solution, and should be used in partnership with other options, such as resistant varieties or liming. Where resistant varieties are used, crops should be monitored carefully to assess the levels of clubroot that develop so that, if levels of infection start to increase, farm strategy can be changed. Inoculum increase through volunteers and weeds is a recognised risk, so managing volunteers and susceptible weeds within and between oilseed rape crops, especially on farms with a record of clubroot and or on tight rotations, is critical. Purchasing certified seed ensures that susceptible plant numbers are minimised in a resistant variety seed batch, so resistant varieties should not be home-saved for seed.

Growers should be mindful of other susceptible crop choices when planning rotations – spring rape is susceptible and cover crop mixes often contain susceptible species. Ideally, long-term planning should be based on the long-term profitability of a field and not on a single season's predicted margin. Field mapping should be considered in order to inform management choices; around isolated patches, basic hygiene measures to reduce spread can be taken and there is potential to target available tools at infected areas. These might include liming, the use of resistant varieties or the use of fallow / grass in a patch of known infection. Since clubroot persists for up to 20 years, knowledge of patches would remain useful for several seasons after a mapping exercise.

- Keep accurate crop records of clubroot occurrence, location and intensity.
- Note where varietal resistance has been deployed in fields to aid long-term planning and help prevent spread.

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- Where resistant varieties are used, monitor the crop carefully and assess the levels of clubroot present. If levels of infection start to increase, change strategy.
- Increase the frequency and detail of testing at sites with higher frequencies of susceptible crops in a rotation. Mapping fields will identify hot spots and help management planning.
- Buying certified seed ensures that susceptible plant numbers are minimised in a resistant variety seed batch. Do not home-save resistant varieties.
- Manage volunteers and susceptible weeds, both within and between oilseed rape crops. Weeds allow clubroot populations to bulk up and should be managed as early as possible.
- Be mindful of other susceptible crop choices when planning rotations – spring rape is susceptible and cover crop mixes often contain susceptible species.
- Long-term planning should be based on the long-term profitability and sustainability of a field and not on a single season's predicted margin.

Who will benefit from this project and why?

Farmers will be the main beneficiaries through better awareness and more targeted and sustainable management methods. There are also supply chain beneficiaries, through more efficient and resilient production and greater yield stability with commensurate environmental benefits. Oilseed rape breeders will also benefit through greater knowledge of the prevalent strains in the UK, allowing more targeted breeding.

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

Lead partner	SRUC
Scientific partners	ADAS
Industry partners	KWS Soil Essentials
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