Final Project Summary

Project title	Identification of *Fusarium* resistance traits in UK oat varieties		
Project number	20083556	**Final Project Report**	SR39
Start date	23/04/2012	**End date**	30/04/2016
AHDB Cereals & Oilseeds funding	£30,000	**Total cost**	£115,500

What was the challenge/demand for the work?

The European Commission published a recommendation in 2013 to monitor the combined concentration of *Fusarium* mycotoxins, HT2 and T2 (HT2+T2) in food and feed. This is to be reviewed in near future with plans to consider new legislative limits or guidelines for the joint concentration of these toxins. In the UK, field surveys were conducted between 2002 and 2006 and results showed that 16% of UK oats exceeded the proposed indicative levels of 1000 µg/kg HT2+T2 for unprocessed oats intended for human consumption. A highly significant relationship between *Fusarium langsethiae* DNA from oat samples and the level of HT2+T2 mycotoxins in the same samples indicated that *F. langsethiae* is the main producer of these toxins on UK oats. This project aimed to understand if observed differences in HT2+T2 concentration in harvested oats between spring and winter varieties, conventional husked and naked varieties, and conventional height and dwarf varieties are due to genetic or differences in agronomy and plant morphology.

How did the project address this?

To better understand resistance to *F. langsethiae* in UK oats, a set of objectives was established:

- To conduct experiments with different sowing dates with winter and spring oat varieties
- To test naked and conventional oat varieties comparing level of HT2+T2 mycotoxins before the harvest in panicles and after the harvest in grain samples
- To test the relationship of height with *F. langsethiae* infection and HT2+T2 mycotoxin contamination
- To test a mapping population made from a cross between a dwarf (Buffalo) and a tall (Tardis) oat variety and identify QTL for resistance and mycotoxin contamination
- To test whether *Brachypodium distachyon* can be infected with *F. langsethiae* and whether HT2+T2 mycotoxins can be produced in order to investigate appropriateness of *B. distachyon* as a model species for *F. langsethiae*-cereal interaction

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What outputs has the project delivered?

The conclusion from experiments conducted was that, regardless of the sowing date, some winter varieties such as Gerald and Balado had higher levels of HT2+T2 mycotoxins when infections levels were moderate or high. In addition to this, results suggested that naked varieties are not more resistant to HT2+T2 concentration. It is rather that their loose husk, which is removed during the harvest, is the reason for the lower level of HT2+T2 when grain samples were analysed. Despite non-consistent results, there was a certain trend suggesting that shorter plants had a range of HT2+T2 values, whereas taller lines had a generally lower level of HT2+T2 with some exceptions.

This study could not distinguish between a direct effect of height and genetic linkage but the wide range of responses at specific heights indicates there are other factors involved. This project has also identified a significant number of QTLs for HT2+T2 contamination and *F. langsethiae* DNA.

The artificial inoculation with *F. langsethiae on B. distachyon* was shown to be successful. This shows that *B. distachyon* is suitable as a model species for investigating *F. langsethiae*-cereal interaction.

Who will benefit from this project and why?

The industry and society should see the benefit of developing new varieties and improvement of oats that has proven health benefits. These benefits are in having safer crops with lower levels of mycotoxins and minimising the application of fungicides in more resistant oat crops. Home-grown varieties within the EU mycotoxin limits will help the commercial sustainability of the UK oat industry. Based on results presented, it is possible to give better advice to growers, selecting for less susceptible oat varieties and recommending inclusion of spring oat varieties, as they tend to be less susceptible to *F. langsethiae* infection and subsequent HT2+T2 contamination. QTLs identified for HT2+T2 contamination and *F. langsethiae* DNA can be further tested and considered in future breeding programmes. The appropriateness of *B. distachyon* as a model species will greatly aid future experiments that aim to understand *F. langsethiae*-cereal interaction.

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

There is a need to develop an artificial inoculation method for *F. langsethiae*. This will remove the reliance on natural infection and reduce the spatial variability of *F. langsethiae* within naturally infected crops.

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How have you benefited from this studentship?
Being part of the project has helped me to develop as an independent researcher. It has provided me with an opportunity to conduct research working with experts in the area and has exposed me to the variety of contacts. My knowledge of plant pathology has expanded and I have gained a deeper understanding in a variety of other scientific skills such as statistics and plant breeding. This scholarship enabled me to enrol on a PhD programme and develop my career.

Lead partner	Prof Simon Edwards, Harper Adams University
Scientific partners	Dr Sandy Cowan, Aberystwyth University
Industry partners	Saaten Union
Government sponsor	BBSRC Defra through the Sustainable Arable LINK Programme