

Annual Project Report Oct 2016 to Sept 2020

Project title	Developing systems to control male fertility in wheat for hybrid breeding, enhanced pollen production and increased yield.		
Project number	21130024		
Start date	1-OCT- 2016	End date	31-SEPT-2020

Project aim and objectives

Successful reproduction is critical to grain set and crop yield in cereals. Thus optimising and enhancing fertility, alongside controlled fertilisation for breeding and hybrid development, is key to achieve high yields in a sustainable manner. Hybrid vigour increases yield, therefore developing hybrid crops offers opportunities to increase productivity. However, this is challenging due to the need to avoid self-fertilisation, therefore mechanisms that control fertility in a reversible manner are needed. There is also a requirement to ensure effective pollination; this relies on high levels of viable pollen for cross-pollination, which is distributed effectively and is resilient to abiotic stress.

This proposal will address these issues by providing greater understanding of pollen development in cereals by developing switchable systems for the control of wheat fertility, but also by identifying traits for enhanced pollen production and viability, particularly under environmental stress, which are critical for ensuring successful pollination in breeding programmes. We will also determine the environmental stability of our fertility control mechanisms in barley as well as wheat, to enable understanding of the fertility control under different temperatures and light intensities. In addition to providing tools for barley breeding, this work will be beneficial to help characterisation of the underlying mechanisms for the control of fertility. This is particularly the case due to the diploid nature of barley and the greater tools and resources available for barley genetic analysis.

Therefore, by investigating the mechanisms behind these traits and by generating tools for breeding and selection, effective breeding to increase crop productivity and resilience will be realised. In addition, the work will identify the benefit of hybrids for fertility control and the stability of these systems in elite breeding materials. This programme will be in partnership with a number of plant breeding companies to deliver key targets for wheat breeding and to ensure rapid uptake of these developments.

Key messages emerging from the project

There are conservation of the gene networks involved in pollen development. Genes have been identified from barley and wheat that are critical for pollen development. These are being targeted by mutagenesis to help characterise their function.

The results described in this summary report are interim and relate to one year. In all cases, the reports refer to projects that extend over a number of years.

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Summary of results from the reporting year

We have been identifying and characterising wheat TILLING mutants from the populations available through John Innes Centre. We have been crossing these and introgressing the orthologous mutated target genes into the same backgrounds. These are being characterised for changes in development. These are also being transferred into different genetic backgrounds to determine their impact on pollen formation.

We have been developing KASP markers for the target genes; some the markers have been working well, others there have been some issues of consistency. We have been working with LGC (the commercial company who own and supply the KASP genotyping chemistry) and the partners to address these issues.

We have been analysing the impact of environmental conditions on fertility.

Key issues to be addressed in the next year

Characterisation of the multiple mutants in the different backgrounds.

Confirm the robustness of KASP markers.

Characterise the impact of environment on fertility and the mutants under being analysed.

Analysis of barley lines showing changed fertility by expression and metabolomics analysis.

Screening of materials from the Nottingham Wheat Improvement Centre, for traits for optimal male fertility, to maximise fertility in male breeding lines.

Lead partner	Prof Zoe A Wilson; University of Nottingham
Scientific partners	-
Industry partners	KWS, LIMAGRAIN, RAGT, SECOBRA
Government sponsor	BBSRC

Has your project featured in any of the following in the last year?

Events	Press articles
N/A	N/A
Conference presentations, papers or posters	Scientific papers
N/A	N/A
Other	
Manuscripts are in preparation.	

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