Generating and evaluating a novel genetic resource in wheat in diverse environments

James Welsh[1], Martin Wolfe[1], John Snape[2], Lesley Fish[2] and Bruce Pearce[1]

[1]*IOR-Elm Farm Research Centre, Hamstead Marshall, Near Newbury, Berkshire, RG20 0HR, UK*
[2]*John Innes Centre, Norwich Research Park, Colney, Norwich, NR4 7UH, UK.*

Introduction

- The potential for the adaptation of wheat to UK environments has been constrained by the framework of the pedigree selection method that has dominated plant breeding for over a century.
- Whilst this approach offers the advantages of simplicity and stability, the relatively limited number of true-breeding genotypes that are produced lack the ability to adapt to different and changing environments.
- Conventional agriculture has controlled this problem through the use of synthetic inputs, which help to overcome environmental variations. Without these inputs, however, the performance of the crop is severely constrained. Clearly, this is of major relevance to organic farming systems.
- This poster presents an overview of a recently commissioned project that will examine the potential for using population breeding as a means of rapidly overcoming a number of agronomic and environmental constraints for wheat production in organic and non-organic agriculture.

Approach

- The approach we propose is to use composite cross populations. This approach is characterised by encouraging adaptation through selection to environmental conditions relevant at a given site. Naturally, this requires the availability of genetic variation in the population, and a composite cross population is the best source of such variation.

Email: research@efrc.com

- A key element to producing a composite cross population is the selection of parent lines. The parent lines for this project were selected partly on past knowledge of successful performance in terms of yield, quality and disease resistance and partly on the basis of molecular ancestry to try to ensure as wide a range of diversity as possible.
- Following parental intercrossing in all possible combinations, progeny population samples will be exposed to a range of widely different production environments, including organic, integrated and conventional farming systems, through several seasons of largely natural selection.

- The performance, in terms of yield and grain quality, of the population samples will be compared at different stages against both the parents grown as pure stands and as physical mixtures.

Expected Benefits

- The research will deliver a unique insight into the evolution of genetically diverse wheat populations in a diverse range of environments. This will assist in elucidating the interaction between gene x environment.
- From inclusion of production environments, including organic, it should be possible to determine key characters and ideotypes that contribute to successful production under these different systems
- The population material from the project will provide a valuable genetic resource for breeders and farmers and samples will be lodged in the gene bank at the John Innes Centre.

Acknowledgements

This project is funded by the UK Department for Environment, Food and Rural Affairs (DEFRA). Project Reference: AR0914