MAJOR GRANT TO FUND RESEARCH INTO GENOMIC SELECTION.

Prof Brian Cullis and Associate Professor Alison Smith from NIASRA and Dr Haydn Kutchel, from the industry partner, Australian Grain Technologies, have been awarded and Australian Research Council Linkage grant for their project entitled “Genomic selection: a new frontier for higher rates of genetic gain in wheat”.

Genetic improvement in wheat yields is estimated between 0.75% and 1% per annum. Though this is impressive, with an increasing demand for food and a real reduction in the availability of arable land there needs to be a shift-step in the rate of genetic progress in wheat. We believe that genomic selection (GS) is the most likely candidate tool that is capable of delivering this. There are, however, major impediments to the successful implementation of GS in wheat breeding. This project addresses these issues by creation of a training population dataset unprecedented in wheat within a commercial Australian-based wheat breeding company along with the necessary statistical tools allowing GS (to wheat breeding) to be accurately evaluated.

With the current rates of population growth and rise of affluence in populous countries such as China and India, the demand for food will double by the year 2050. With a concurrent decline in arable land, the world is likely to face its largest food crises yet. As the single largest contributor to human nutrition, the historical rates of genetic gain in wheat production are not sufficient to meet this challenge. More effective selection systems are required that allow wheat breeding to provide the improvements in grain yield needed to feed the world. We believe that genomic selection (GS) is the most likely candidate tool that is capable of delivering the genetic gain required by future demands for food. GS is a form of marker assisted selection applied on a genome-wide scale using high density marker genotyping.

There are, however several major impediments to the successful implementation of GS in wheat breeding. This project aims to address these issues by creation of a training population data-set unprecedented in wheat within a large and successful commercial Australian-based wheat breeding company. The scope of the data-set in terms of density of markers, numbers and relevance of genotypes and phenotype will allow the application of GS to wheat breeding to be accurately evaluated. The major issues and aims that the project will address include:

1. Determination and optimisation of a breeding strategy for wheat improvement based on next generation selection
2. Develop novel and efficient phenotyping protocols using innovative experiment design methodology

3. Develop statistical methodologies that extend those currently in use for GS in animal breeding which respect the genetic structure of in-bred crops and specifically address incorporation of complex phenotyping and modelling of genotype x environment interactions