



# How high can we go with winter cereals on irrigation?

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## in a nutshell

- A series of trial sites was established and planted to wheat, durum, barley and triticale in May 2007 as part of a new ICF project, supported by GRDC, to identify varieties to lift irrigated winter cereal yields
- The trials will be managed for a target yield of 10 t/ha
- Field days will be held in late October and early November 2007, subject to water availability

***This is a short introduction article to a new ICF project 'High yielding genotypes of winter cereals for irrigated regions of south eastern Australia'. The project will run for three growing seasons – 2007, 2008 and 2009. The crop species being evaluated are wheat (bread wheats), durum, barley and triticale. This project will build on the knowledge gained from Dr Maarten Stapper's work and examine a much larger number of potential varieties from breeding programs across Australia and overseas.***

For irrigation farmers to remain sustainable in the future, the yields of winter cereals need to improve. We know that wheat grown under ideal conditions in other countries has been reported to achieve yields close to 20 t/ha. However, the Australian winter cereal crop is grown under less perfect conditions and faces many challenges such as high temperatures during grain filling, pre and post flowering moisture stress, and frost – just to name a few. Thus the challenge for breeders is to capture as much of the genetic potential for yield as possible under these constraints.

## Finding the room to move

This new project will attempt to set out a framework for the breeding programs of winter cereals in Australia to achieve the challenge of lifting yields for the irrigated regions of south eastern Australia.

We are focusing on three main questions in the project.

- Can varieties be selected that will produce yields consistently of 10 t/ha or greater under irrigation in south eastern Australia?
- What traits and genetic backgrounds are important to improve yields of irrigated winter cereals?
- With respect to variety performance, how variable are the irrigated areas of south eastern Australia?

Cereal breeding programs in Australia have focussed mainly on the performance of varieties in dryland environments.

This focus has been driven by the limited resources available to produce varieties, and thus larger dryland production areas have been the focal point for breeders. In our quest for better varieties for irrigated environments we can benefit from this experience of variety selection for the harsh Australian environment.

## High performing germplasm

The breeding process aims to find the individuals from a series of crosses of varieties that have the traits which allow them to perform in the target environment. Our target environment is the irrigated areas of south eastern Australia. Within this region there are static and dynamic environmental factors which will affect the performance of any given variety across sites and years such as soil type and temperature during grain filling. We are aiming to identify those varieties which can produce high yield consistently across sites and years.

The power of the current project comes from the diversity of germplasm included in the breeding cycle and when we are evaluating the lines. The breeding of varieties is a long-term process that can take 12 years from crossing to farmers' paddocks. We are trying to shorten this cycle for the irrigated growers by not attempting to become another breeding program, but by harnessing the combined forces of all the winter cereal breeding programs in Australia (see list of contributors in the next section).

## Extra road testing for the southern region

Unlike the National Variety Trials (NVT) which have varieties which will be released in the next two years, the irrigation project is looking at potential varieties up to five years from release. To be able to examine earlier stages in the breeding programs a much larger number of potential varieties are being evaluated. For example the number of wheat varieties is 10 times more than NVT trials or Dr. Stapper's work. The number of varieties being evaluated for each crop are: wheat 1000 lines, barley 150, durum 100 and triticale 50.



The significance of this larger number is that greater diversity exists at earlier stages in breeding programs and thus, there is greater potential to identify varieties which have traits that give increased yield when irrigated.

In order for the breeding programs to make progress on improving varieties for irrigation regions, they require clear direction about what traits and varieties (genetic backgrounds) give advantages in the target environments. The project will follow the '8 tonne club' formulae, developed by John Lacy NSW DPI, which is being adapted for a target of 10 t/ha. We expect many of the varieties we are testing will fail to perform under these conditions but those that do will provide significant insight into the direction that future breeding for the region should follow.

### Comprehensive industry effort

The trial locations were selected to provide a cross section of the soil types and rotations that the varieties will have to perform in if they are to be successful in lifting yields across the region. Trial locations are at Yanco Agricultural Research Institute (NSW DPI), Mayrung (Harry Kooloos' property) and Kerang (DPI Vic). The number of sites for the first stage of this project is constrained by the resources available and the high number of genotypes we wish to evaluate.

Varieties are being contributed by:

- Australian Grain Technologies
- Barley Breeding Australia
- CYMMIT

- Department of Agriculture and Food Western Australian
- Department of Primary Industries Victoria
- Enterprise Grains Australia (NSWDPI & QDPI)
- HRZ wheats (CSIRO & NZ Crop and Food)
- Longreach Plant Breeders
- National Durum Breeding Project, Sydney University.

The organisations and people providing expertise to the project are NSW DPI, ICF and CSIRO plus the breeders from the programs mentioned above. The individuals involved in the trials on a regular basis are Andrew Milgate, John Lacy, Barry Haskins, Rachel Whitworth, Kieran O'Keeffe, Robert Hoogers, Aaron Hutchison, Damian Jones, Bryan Clark and Rob Fisher.

In summary, there will be three key benefits we expect to deliver from the project. First is a clearer understanding of the genetic potential of available Australian germplasm to satisfy the needs of the irrigation industry. Second is the yield data on unreleased lines that may in time be released as varieties in their own right. Third, is that the new varieties will underpin the growth of the winter cereal grains production from irrigation which would encourage greater breeding focus on this environment. [☁](#)

### Further information

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**Figure 1:** Harry Kooloos (left) and Andrew Milgate, inspecting the Mayrung site. The trials have been sown on Harry's new 'V bays' in 2007, following a rice fallow.



**Figure 2:** The trials are off to a flying start at Mayrung. They were sown 10 May, and are photographed here at the end of June.