



## IRRIGATION RESEARCH & EXTENSION COMMITTEE

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FOR IRRIGATION CROPPERS

### **Wheat breeding, variety choice and management**

**Paper prepared by**

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## The Project

The GRDC *Irrigated Wheat Evaluation* Project for the irrigation areas in the Southern Region was conducted from 2001 to 2005. The aims were to identify under irrigation and good management wheat genotypes with high yields and to develop management packages on grain quality and profitability. Some 200 genotypes (ie released varieties and breeding lines) of bread wheat, durum and triticale were evaluated during three seasons, including a core trial at Griffith, Benerembah and Deniliquin. Additional experiments at Griffith using a range of genotypes involved sowing dates, sowing rates, nitrogen timing, growth regulators, fungicides and soil biology.

Project is described and results presented on the GRDC website under Research Updates – Irrigation, Southern Region, High Rainfall Zone and Northern Region. Progress reports have been presented in the *IREC Farmers' Newsletter Large Area* editions no. 164, 166 and 169. Pre-season and within season meetings, wheat crop workshops, farm walks and field days were organised seasonally by Irrigation Cropping Forum collaborators in the three valleys to inform farmers, advisers and researchers.

Varieties and management factors were evaluated to avoid lodging and poor grain quality. Lodging is a major factor for not achieving high target yields and returns. Lodging and disease protected H45, for example, yielded 9.6 t/ha compared to 6.0 t/ha for control, with protein from 11.2 to 11.4%, screenings 2.3% down from 6.9%, Falling Number 453 sec up from 384 sec, and test weight 83 kg/hl up from 78 kg/hl.

On-farm trials on a commercial scale in Chara paddocks were conducted during the three seasons at 10 to 18 farms across the Lachlan, Murrumbidgee and Murray valleys. Bay-length nitrogen test strips were created by collaborating farmers during fertiliser applications, for example, splitting pre-sowing strips with different topdressings to achieving similar total nitrogen fertiliser application at different timings. Strip yields were up to 9.4 t/ha (2002), 8.0 t/ha (2003) and 9.3 t/ha (2004) with gross margins well over \$1000/ha for good paddocks.

## Variety

Choice of variety was found to be the most important factor to achieving high yield in current farming systems as available management options, such as growth regulators overseas, don't guarantee prevention of lodging here. Varieties suitable to achieving consistently 8 t/ha under irrigation with efficient use of resources were identified as requiring a combination of the following traits:

- stem and anchorage strength (eg Chara)
- high sink strength (eg H45)
- restricted tillering capacity (eg H45)
- early maturity (eg H45)
- big kernels (eg Arrivato) as yield advantage with lower screenings
- green leaf area duration (eg Chara)
- not susceptible for LMAA and black point

These factors are mainly associated with yield, the main driver of financial returns. Once yield is secured, grain quality characteristics can deliver the premiums.

CIMMYT material was included in the genotype evaluations through interaction with their wheat breeding program. Lines with strong stem strength, similar to their renowned variety Seri M82, were recommended. However, these lines unlike Seri M82 failed to express anchorage strength in our environment. This demonstrated the G x E interaction for lodging risk of genotypes. Sunco backcrosses to improve stem strength were made at CIMMYT and sent to Sun Prime for evaluation; the project ceased before seed being available for evaluation in the Southern Region. Another G x E example was shown with Baviacora, recommended with good stem strength and a popular high yielder in irrigated production in Mexico, which failed in our trials because of profuse grain shattering which was unheard of in Mexico.

## Breeding

The project has actively interacted with 15 breeders with exchange of genotypes and information, and visits to the trials. Most have become aware of the required variety traits for high yields under irrigation but cater for dryland market. Current varieties have been bred for dryland production and have been tested under irrigation. Evaluation of high-yielding high-rainfall zone milling wheat under irrigation seems sensible as there are varieties suited to both environments.

To achieving high yields consistently it is important in breeding to make crosses for that purpose. Such breeding lines then need to be evaluated under appropriate high-yielding irrigation management. A variety with better straw strength than current best, Chara, will then be obtainable. Recommendation to irrigation industry (IREC/ICF) has been to fund targeted wheat breeding for their needs by forming a company similar to Grain Search set up in Western Victoria for high-rainfall zone wheat.

To generate resource efficient high-yielding varieties it is important to be working across the breeding - selection - variety release - agronomy - farm adoption scales. Genotypes need to be selected as best performing under both low and high yielding conditions, reflecting season and water-availability variability.

Hence, genotypes need to be evaluated from early in the breeding program using full irrigation next to limited-water treatments to facilitate early determination of sensitivities in yield and quality to water availability, lodging, sink strength, screenings, test weight, Falling Number and black point. Such an approach needs to be part of multi-site evaluation and connected with NVT. It could include a CIMMYT-GRDC Spring Wheat Nursery evaluation, currently conducted in Queensland, for local breeders to obtaining first-hand knowledge of performance under dry and wet of CIMMYT lines within our Southern Region wheat belt environment.

In breeder evaluation trials for high-yielding wheat under irrigation the project demonstrated the difference between use of 6, 8 and 10 row plots. Outside rows are always stronger, may have up to twice the grain yield and usually stand longer. Lodging occurrence therefore has less impact on yields of 6 row plots. This is especially so when harvesting the whole plot and having the wide inter-plot paths of an 8-row-plot seeder. For example, hybrids in current trials were performing at average compared to well above average in NSW DPI evaluation, which employs the wide 6-row plot configuration