

Improving water use efficiency

This trial is funded by the GRDC and conducted in collaboration with Chris Lawson and Victor Sadras, SARDI, and Glenn McDonald from the University of Adelaide.

Key findings

- The highest recorded WUE was observed at Spalding where 18.3 kg of wheat was produced per hectare for every mm of growing season rainfall.

Why do the trial?

Impressive gains in improving crop and systems water use efficiency (WUE) have been captured by Australian farmers over the past 30 years and some farmers are achieving close to their environmentally attainable yields in most seasons.

This trial will investigate the reasons for these differences in WUE by continuing with trials established at 4 sites in 2008 on different soil types and rainfall zones in selected grower paddocks. The sites established are:

Hart, 400mm annual rainfall, sandy clay loam
Condowie, 350mm, sandy loam
Spalding, 450mm, red brown earth
Saddleworth, 500mm, black cracking clay

How was it done?

Plot size 8m x 10m

Seeding date	Hart 14 th May	Fertiliser	Hart	DAP@50 kg/ha+2% Zn
	Condowie 29 th April		Condowie	DAP@35 kg/ha+2% Zn
	Spalding 6 th May		Spalding	DAP@40 kg/ha+2% Zn
	Saddleworth 7 th May		Saddleworth	DAP@80 kg/ha+2% Zn

Post emergent nitrogen
Hart, Spalding and Saddleworth
UAN@100L/ha 19th August 2011

Each trial was a randomised complete block design with 3 replicates and 4 crops.

The 4 crops include Gladius wheat, Keel barley, Kaspera peas and Tornado canola, grown in rotation to ensure weed free plots are available for wheat in each successive season.

All trials were sown with 50mm chisel points and press wheels on 225mm (9") row spacing.

All cereal grain plots were assessed for grain yield, protein, wheat screenings with a 2.0 mm screen and barley screenings with a 2.2 mm screen and retention with a 2.5mm screen.

The break crops (peas and canola) were not assessed for grain yield or quality.

Drained upper limit and crop lower limit (wheat) were measured at each site in 2008 to calculate plant available water capacity (PAWC).

WUE was calculated for the cereal crops at each site using the French & Schultz formula.

Wheat: Yield potential = (GSR-110mm)*20 kg/mm/ha

Barley: Yield potential = (GSR-90mm)*20 kg/mm/ha

Results

Growing season rainfall in 2010 ranged between 334mm (Condowie) to 486mm (Spalding). In 2010 all sites received at least 72mm more growing season rainfall than their long term average.

The wheat WUE ranged from 12.9 kg/ha/mm at Hart to 18.3 kg/ha/mm at Spalding (Table 1) producing grain yields of 3.63 t/ha and 6.73 t/ha respectively.

Table 1. Soil type, average total and average growing season rainfall (GSR), 2010 total and 2010 GSR and wheat and barley water use efficiency (WUE) for the four WUE sites in 2010.

Site	Soil type	Average total rainfall	Average GSR	2010 total rainfall	2010 GSR	Wheat WUE (kg/ha/mm)	Barley WUE (kg/ha/mm)
Condowie	sandy loam	349	252	389	334	13.0	13.7
Hart	sandy, clay loam	400	305	573	391	12.9	16.2
Spalding	red brown earth	434	322	664	486	18.3	19.8
Saddleworth	black cracking clay	497	374	536	446	13.4	16.8

Wheat grain yields ranged from 2.92 t/ha (Condowie) to 6.87 t/ha (Spalding) and barley grain yields ranged from 3.07 t/ha (Condowie) to 7.43 t/ha (Spalding) (Table 2).

Wheat protein was generally lower than in previous seasons ranging from 8.0% at Saddleworth to 10.9 % at Condowie and the barley followed similar trends.

Screenings for both crops were below 2.5% at all WUE sites in 2010.

Table 2. Grain yield (t/ha), protein (%) and screenings (%<2.0 mm for wheat and %<2.2mm for barley) at the four WUE sites in 2009.

Site	Crop	Grain yield (t/ha)	Protein (%)	Screenings (%)
Condowie	Wheat	2.92	10.9	0.8
	Barley	3.07	11.1	1.1
Hart	Wheat	3.63	9.7	1.7
	Barley	4.54	9.5	0.6
Spalding	Wheat	6.87	10.4	0.5
	Barley	7.43	10.6	0.8
Saddleworth	Wheat	4.50	8.0	0.9
	Barley	5.63	9.1	2.4

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