Improving water use efficiency – crop rotations

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

- At three out of the 4 sites gladius wheat sown onto a pea crop background from 2011 produced the best grain yields
- At Condowie wheat on barley (2.54t/ha average) was always better than wheat on wheat (2.10t/ha average), regardless of extra nitrogen

Why do the trial?

Throughout southern Australia traditional crop rotations are based on wheat following an oilseed or legume break crop and then followed by either wheat or barley. Generally wheat following barley is generally avoided to minimise the chances of grain contamination and downgrading at harvest, and the build up of weeds.

These trials aimed to assess the performance of wheat following either peas, wheat or barley. The trials were conducted on the previously established sites used in improving water use efficiency trials.

How was it done?

Plot size 8m x 10m

Seeding date	Hart 30th May 2012	**Fertiliser**	Hart	DAP @ 80kg/ha + 2% Zn
	Condowie 21st May		Condowie	DAP @ 65kg/ha + 2% Zn
	Spalding 17th May		Spalding	DAP @ 80kg/ha + 2% Zn
	Saddleworth 18th May		Saddleworth	DAP @ 100kg/ha + 2% Zn

Post emergent nitrogen:

The Hart site received 40kg N/ha on the 24th July and the other sites on the 13th August.

The extra nitrogen treatments received an extra 46kg N/ha on the 13th of August.

Each trial was a randomised complete block design with 3 replicates using Gladius wheat sown onto either kaspa pea, gladius wheat or commander barley stubble from 2011.

The 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 2.0mm screen and barley screenings with a 2.2mm screen and retention with a 2.5mm screen.

Results

At three out of the 4 sites gladius wheat sown onto a pea crop background from 2011 produced the best grain yields. This result is well understood and expected due to benefits from disease control, fewer weeds, more moisture and high soil nitrogen. At the Saddleworth site, which averaged 4.53t/ha, the previous crop made no significant difference to the wheat yield in 2011.

With no extra applied nitrogen the next best previous crop choice was barley, for all the sites except Hart (Table 1). Wheat after wheat was generally the lower yielding treatment. This might be due to root and leaf diseases i.e yellow leaf spot, which can carry over from year to year on the same crop types, or a soil moisture effect.

However, when extra nitrogen was applied on the 14th of August, the wheat on wheat yields improved and matched the wheat on barley yields, at 3 of the sites. At Condowie wheat on barley (2.54t/ha average) was always better than wheat on wheat (2.10t/ha average), regardless of extra nitrogen.

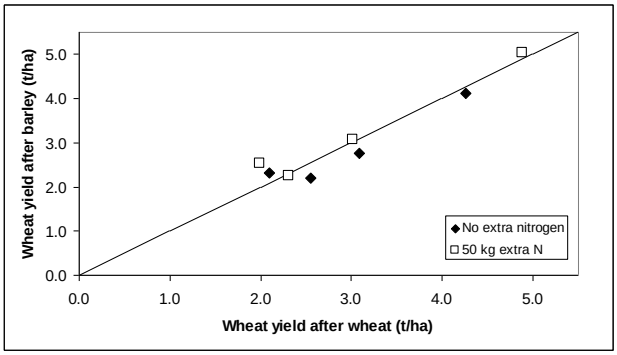
Protein generally increased with nitrogen from 10.5% with standard nitrogen to 11.3% with extra nitrogen across all the trials and treatments. The protein levels at Saddleworth were very low, averaging only 7.1%.

Table 1. Wheat grain yield for rotation and nitrogen treatments applied at Condowie, Hart, Saddleworth and Spalding in 2012.

Site	Previous crop	Nitrogen (kg N/ha)	Grain yield (t/ha)	Protein (%)
Hart	Wheat	0	2.32	12.3
		50	2.32	12.6
	Barley	0	2.09	11.2
		50	2.24	11.9
	Peas	0	2.76	11.9
		50	2.90	12.5
LSD (0.05) Prev crop, nitrogen, crop*nitrogen			0.3, ns, ns	0.6, 0.5, ns
Saddleworth	Wheat	0	4.12	7.2
		50	4.89	8.8
	Barley	0	4.26	5.5
		50	5.04	6.4
	Peas	0	4.10	6.4
		50	4.77	8.0
LSD (0.05)			ns, 0.6, ns	1.2, 1.0, ns
Condowie	Wheat	0	2.20	11.8
		50	1.99	12.4
	Barley	0	2.55	9.9
		50	2.54	11.0
	Peas	0	2.57	10.8
		50	2.77	10.7
LSD (0.05)			0.4, ns, ns	0.6, 0.5, ns
Spalding	Wheat	0	2.77	13.7
		50	3.02	14.3
	Barley	0	3.08	11.5
		50	3.06	12.5
	Peas	0	3.17	13.7
		50	3.48	14.5
LSD (0.05)			0.3, ns, ns	0.9, 0.7, ns

Using wheat after wheat as a reference the values in Figure 1 show the grain yields for wheat after barley to have a slight benefit in lower yielding environments. Figure 2 shows that wheat following peas generally outyielded wheat after wheat and again the differences were larger in lower yielding environments. When the location reached over 4t/ha, the benefit of a pea history disappeared.

These trial results have shown that the sequence of crop rotations could have an impact on water use efficiency. Advances to farming systems such as Group B tolerant crops, Harrington seed destructors or chaff carts mean that flexibility over traditional rotations is now possible, and can offer benefits.



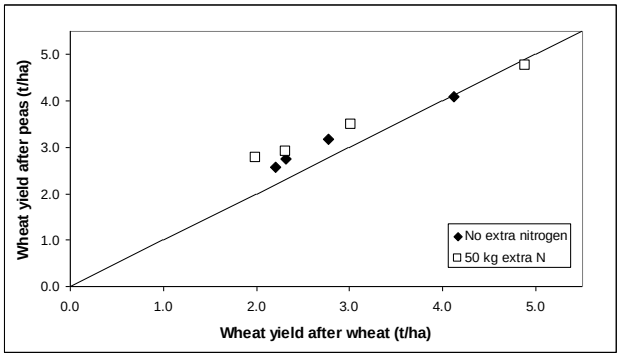


Figure 1 & 2: Wheat grain yield following barley or peas with or without extra nitrogen at Condowie, Hart, Saddleworth and Spalding in 2012. The black line is the 1:1 comparison.

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