

Improving the profitability of cropping on hostile subsoils

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Introduction

In 2004, trials were initiated at Birchip and Lubeck in Victoria to test the effects of subsoil remediation on crop water use and yield. This trial is funded by the GRDC as part of its national initiative on managing subsoil constraints, and this component of the project is a collaboration between SARDI, University of Adelaide, DPI Vic, and grower groups in both South Australia and Victoria.

At Birchip, the soil is a Calcarosol, and at Lubeck a Sodosol. At these sites conventional practice was compared with deep nutrient placement (50 kgP/ha and 15 kgZn/ha at 20 cm), deep ripping (45 cm) with liquid Ca (~7.5 t/ha gypsum), surface organic matter (20 t/ha pig bedding litter) and primer plant (sulla: *Hedysarum coronarium*). The trials were phase replicated, testing the crops wheat, canola and lentils (Table 1).

Table 1. Varieties sown and sowing dates

Crop	Variety	Rate
BIRCHIP – sowing date 1/6/2004		
Wheat	Yitpi	70kg/ha
Canola	Stubby	5kg/ha
Lentils	Nugget	55kg/ha
LUBECK – sowing date 17/6/2004		
Wheat	Yitpi	80kg/ha
Canola	Sapphire	5kg/ha
Lentils	Nugget	55kg/ha

Results

Surface application of organic matter significantly increased early growth of wheat and canola, but not lentils at Birchip (Table 2). At anthesis, no difference existed between treatments for wheat and at maturity, conventionally sown crops out yielded all other treatments. With canola, significantly greater growth occurred with the addition of organic matter and also where deep nutrients were placed. This growth did not necessarily equate to yield, as conventionally sown crops and those with deep nutrients out-yielded other treatments. The low growing season rainfall (decile 2) is likely to have driven the inverse relationship between early vigour and final yield. For lentil crops, no difference in early growth existed across treatments, however, at

anthesis, growth under deep ripping was significantly less than the other treatments. The combined sensitivity of pulse crops to salinity and the delving of saline-sodic material towards the surface due to deep ripping may have caused this comparatively poor growth. Final yields were not available for pulse crops at the time of writing.

Table 2. Birchip crop growth

Crop	Treatment (Mg/ha)	Mid-tillering straw (t/ha)	Anthesis Straw (t/ha)	Maturity Grain (t/ha)
Wheat	Control	0.76	2.59	0.50
	Deep nutrients	0.94	2.70	0.40
	Deep ripping	0.79	2.52	0.48
	Organic matter	1.00	2.85	0.38
	<i>l.s.d (P < 0.05)</i>	0.19	<i>n.s.</i>	0.09
Canola	Control	0.71	1.31	0.18
	Deep nutrients	0.67	1.63	0.15
	Deep ripping	0.48	1.13	0.10
	Organic matter	0.83	1.53	0.09
	<i>l.s.d (P < 0.05)</i>	0.14	0.21	0.07
Lentil	Control	0.32	1.09	0.02
	Deep nutrients	0.28	1.06	0.01
	Deep ripping	0.23	0.89	0.01
	Organic matter	0.33	1.11	0.02
	<i>l.s.d (P < 0.01)</i>	<i>n.s.</i>	0.09	<i>n.s.</i>

At Lubeck, early wheat growth was not affected by treatment, although at anthesis growth was significantly greater where organic matter was applied (Table 3). Early growth of canola and lentil crops was significantly less than for other treatments. An uneven seedbed due to deep ripping was the likely cause of poor establishment of small seeded crops. At anthesis, both canola and lentil crops on deep ripping showed compensatory growth, where growth of these crops was equivalent across treatments. Yield data was not available at the time of writing.

Table 3. Lubeck crop growth

Crop	Treatment (t/ha)	Mid-tillering straw (t/ha)	Anthesis straw (t/ha)
Wheat	Control	1.16	5.65
	Deep nutrients	1.41	5.19
	Deep ripping	1.11	4.75
	Organic matter	1.55	6.13
	<i>l.s.d (P < 0.01)</i>	<i>n.s.</i>	0.56
Canola	Control	0.97	3.00
	Deep nutrients	0.75	3.07
	Deep ripping	0.45	2.61
	Organic matter	0.85	3.33
	<i>l.s.d (P < 0.01)</i>	0.24	<i>n.s.</i>
Lentil	Control	0.97	1.90
	Deep nutrients	0.75	1.72
	Deep ripping	0.45	1.43
	Organic matter	0.85	2.01
	<i>l.s.d (P < 0.01)</i>	0.24	<i>n.s.</i>

Work will continue at the two sites for three years. For more information, contact James Nuttall, DPI Horsham, on (03) 5362 2111 or the BCG office on (03) 5492 2787