

Mouldboard plough on Wodjil soil Demonstration

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Aim

To evaluate the effects of mouldboard ploughing on yield on poor performing wodjil soil.

Background

Mouldboard ploughing involves a one-off inversion of the topsoil. The plough in this trial was able to invert the top 30cm of soil. Mouldboard ploughing can help in the control of weeds, burying water repellent topsoil, incorporating lime at depth as well as having a deep ripping effect. The cost of the operation is approximately \$100-120/ha (Davies et al, 2012).

Wodjil soils are typically yellow deep sands which are inherently strongly acidic, particularly in the subsoil. The low subsoil pH results in high aluminium concentrations that create a hostile environment for root growth and therefore reduces yields.

This site received 1.5 t/ha of lime in 2006 in an effort to increase pH. However, research has shown that surface applied lime usually takes four to seven years to treat subsurface acidity (Gazey, 2009). Mechanical incorporation is one of the methods being used to speed up this process such as by rotary spading and mouldboard ploughing, the inversion of the top layers of soil allows the higher pH soil to be buried in the subsoil.

The trial was ploughed on the 12th June using a 3 board Kvernerland plough which was 1m wide. The site received 63mm of rain in the previous 7 days, allowing the soil profile to wet down to at least 30cm, which is required for effective inversion.

Trial Details

Property	Colin & Ruth Cail, east of Wubin			
Plot size & replication	100m x 17m x 2 replications			
Soil type	Yellow wodjil sand			
Soil pH (CaCl₂)	0-10cm: 5.7	10-20cm: 4.7	20-30cm: 4.2	30-40cm: 4.1
EC	0.116 dS/m			
Sowing date	12/6/12			
Seeding rate	60 kg/ha			
Variety	Bonnie Rock			
Soil amelioration	2006: 1.5 t/ha Lime			
Fertiliser	12/6/12: 100 kg/ha Agflow, 40 L/ha Flexi-N 29/6/12: 50 kg/ha Potash			
Paddock rotation	2009 pasture, 2010 pasture, 2011 wheat			
Herbicides	Control only: 12/6/12: 1.8 L/ha Treflan, 1.3 L/ha Glyphosate 13/7/12: 1 L/ha Jaguar All plots: 8/8/12: 800 mL/ha Ester			
Growing Season Rainfall	144mm			

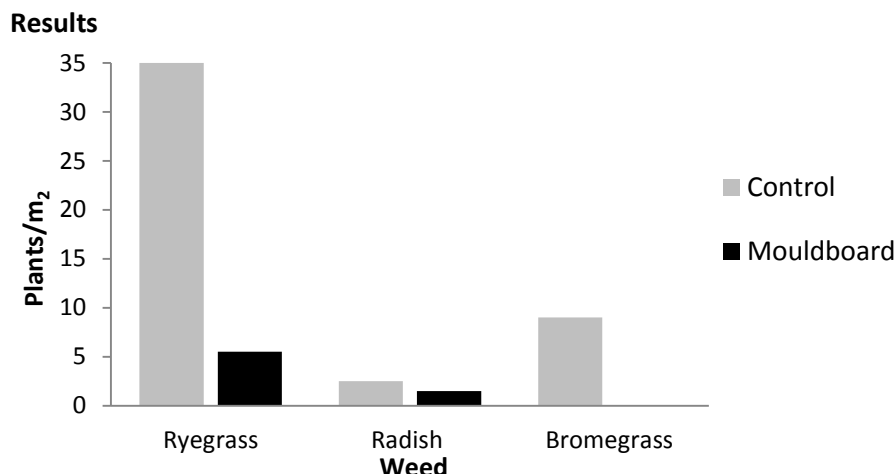


Figure 1: Average weed density measurements taken 12/7/12 at the site east of Wubin.

While not the main purpose behind the mouldboard ploughing treatment on this site, weed control is another beneficial outcome as a result of deep burial of weed seeds by inversion. As can be seen in Figure 1, weed populations in the control plots were considerably higher than in the mouldboard plough plots, which had 93% control. Weed populations in the mouldboard plots were in isolated patches where poor inversion occurred, with the remainder of the plot generally weed free. This could be due to incorrect plough set up. The use of a deeper working farm-scale mouldboard plough (8-13 furrow) rather than trial size has been shown to control greater than 95% of weeds when used correctly (Davies et al, 2012).

Table1: Yield and quality results of Bonnie Rock wheat sown east of Wubin, 2012.

Treatment	Rep	Yield (t/ha)	Protein (%)	Hectolitre (g/hL)	Screenings (%)	Grade
Mouldboard	1	0.83	13.3	80.67	1.49	H1
Mouldboard	2	1.05	11.9	81.67	2.27	H2
Control	1	1.00	11.8	81.85	1.76	H2
Control	2	0.88	13	81.53	3.43	H1

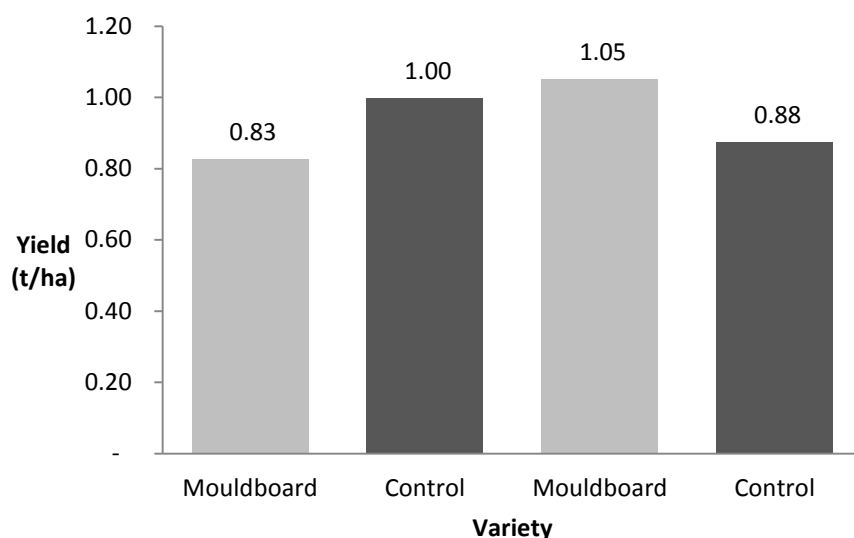


Figure 2: Wheat yields from east of Wubin varied with no significant difference between the control and mouldboard plough treatments.

Comments

Treatments did not produce statistically significant differences in yield or quality. The dry season limited grain yields and possibly negated any response. In the first year after mouldboard ploughing there can be greater evaporative losses from the soil surface given the lack of stubble and mulch cover at the soil surface after inversion. This may have been significant in a drier season.

It should also be remembered that the pH profile is only modified to the depth of ploughing and beyond this the deeper subsoil in a Wodjil-type profile remains acidic and will limit root growth, access to soil water and crop productivity. Inversion can bring to the surface quite acidic subsoils that can limit early crop growth and vigour; therefore it is likely that liming is needed to correct this subsurface acidity. In this trial it is expected that the 0-10cm of soil and 10-20cm layers (4.7-5.7pH) would have been put to depth, bringing up the 20-40cm layers to the surface and creating new topsoil with a pH of 4.1-4.2.

With a 2 t/ha lime application planned for 2013, yields are expected to improve over time as the pH is increased. It would still be advisable to grow acid tolerant crops and varieties on these soil types. As mouldboard ploughing has long-term impacts on the soil profile and changes over time this trial will be monitored again next year to discover any longer term impacts of the treatment.

Acknowledgements

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Paper reviewed by: Stephen Davies, Department of Agriculture and Food Western Australia

References

Davies, S., Blackwell, P. And Newman, P 2012. 'The role of mouldboard ploughing in cropping systems', *Spring Field Day Booklet 2012*, Liebe Group.
Gazey, C and Davies, S. 2009. *Soil acidity – A guide for WA farmers and consultants*. Bulletin 4874, Department of Agriculture, Western Australia

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