Wheat response to rotary spading of water repellent sand at Marchagee

Stephen Davies, Research Officer, DAFWA

Department of Agriculture and Food

Aim

To assess the impact of rotary spading non-wetting sandplain soil on soil properties, crop growth and productivity.

Background

The one-off use of deep cultivation on sandplain soils is being investigated as a method for medium to long-term amelioration of water repellent topsoils. Rotary spaders have deep working spades that lift wettable subsoil seams to the soil surface and these provide numerous pathways for water entry allowing the water repellent soil to wet up more quickly. The mixing action also dilutes some of the water repellent soils and buries some of the topsoil, associated nutrients and organic matter. Other one-off deep cultivation techniques include soil inversion with a mouldboard plough, which buries the water repellent layer and lifts a layer of wettable subsoil to the surface; it also buries the weed seedsw giving excellent weed control. To test these tools Michael (farmer) has conducted several on-farm trials that allow assessment of how the technique fits into the farming system and any associated risks or benefits as well as measures of changes in crop productivity.

Trial Details

Property	Michael O'Callaghan, South Marchagee
Plot size & replication	Farmer trial
Soil type	Pale deep sand
Crop Variety	Mace wheat
Sowing date	5/6/11
Seeding rate	80 kg/ha
Fertiliser	Starter: 120kg/ha Mallee (70%) & MOP (30%); Top-up N: 60 L/ha 40L/ha Flexi-N
Paddock rotation	2010 volunteer pasture; 2011 wheat
Growing Season Rainfall	324mm (May-Oct)

Results

Table 1: Growth and yield response of Mace wheat to rotary spading conducted in 2011 on strongly repellent deep sand at Marchagee in 2011. Data are the average of 4 paired harvest index hand cut samples in an area strongly exhibiting water repellence. Spading cost of $150/ha is an estimate based on contractor rates with no pre-ripping.

Treatment	Shoot DW (t/ha)	Head number (heads/m^2)	Grain Yield (t/ha)	Harvest Index	Kernel weight (mg)	Screenings (%)	Gross Return ($/ha)*	Spading Cost ($/ha)**	Gross Margin ($/ha)
Control	3.47	193	1.49	0.43	35.1	0.9	358	0	358
Spaded 2011	7.74	326	3.28	0.42	35.4	1.3	787	150	637
Difference Spaded-Control	*4.27*	*133*	*1.79*	*-0.01*	*0.3*	*0.4*	*429*	*-150*	*279*

* Based on EPR for APW2 Base Rate $240/tonne; ** Estimate of cost of spading based on contractor rates.

Comments

In the 2011 season more rainfall and some larger rainfall events meant that in general soil water repellence was less of a problem in many areas as the soil had opportunity to wet up. However, in cases of severe water repellence there was still significant reductions and delays in crop establishment. This site was a pale deep sand with severe water repellence. Spading greatly improved crop establishment with early and even germination, while in the control soil

establishment was poor with large delays to the extent that while many of the early germinated wheat plants were in ear, other late-germinating plants were still at early tillering. The hand harvest index cut samples were taken in a strongly repellent part of the paddock where treatment differences were visually large. Spading increased both total shoot dry weight and grain yield by 120%, a grain yield response of nearly 1.8 t/ha. In the 2010 season, rotary spading on a better yellow sand increased wheat grain yield by 0.8 t/ha. The higher wheat yield measured here was a result in a large improvement in plant density (Figure 1), reflected by the fact that the spaded treatment had, on average, 133 more heads per m^2 than the untreated control, a 69% increase in head number (Table 1). It should be noted that the grain yield increases reported here are for hand-cuts which can overestimate yield and they were taken from the most severely water repellent part of the paddock where the responses were greatest. Yield response across the entire paddock is likely to be lower but the results indicate that for this soil type is likely to be profitable in the first year. Minimal or negative yield responses to rotary spading have been measured in some trials, usually this is a result of seeding problems with seed being sown too deep or sandblasting of the crop after is has emerged, but it can occasionally be due to insufficient water at grain filling to finish the spaded crop which has bigger biomass and higher water use. The long term productivity benefits of rotary spading are still unclear and are currently being assessed.

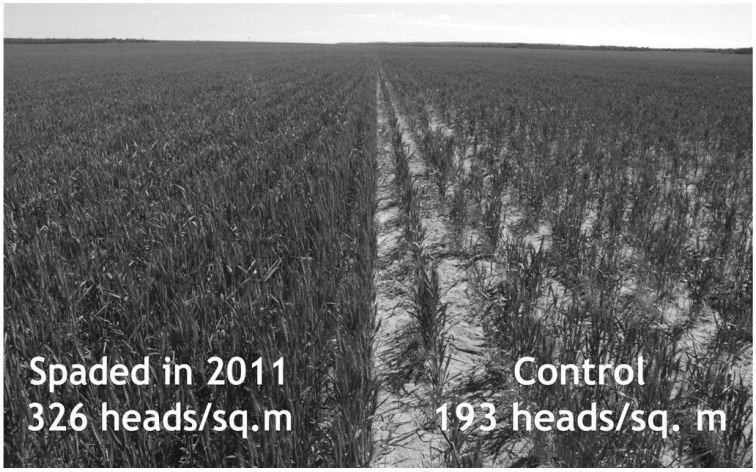

Figure 1: Image showing density of Mace wheat grown in 2011 in response to rotary spading conducted in 2011 compared with an untreated control on severely water repellent pale deep sand. Head numbers are the average of 4 paired harvest index hand cut samples taken at crop maturity.

Acknowledgements
Soil water repellence project 'Delivering agronomic strategies for water repellent soils in WA (DAW00204)' is funded by DAFWA and GRDC. Particular thanks to Michael and Julia O'Callaghan for putting in and allowing access to the trial and Nadine Hollamby (Liebe Group) and Breanne Best (DAFWA) for support and assistance.

Paper reviewed by: Nadine Hollamby, Liebe Group

Contact
Stephen Davies, DAFWA
stephen.davies@agric.gov.au
(08) 9956 8515