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Soils

Heavy trafficking gives Rhizoctonia a headache

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RESEARCH

Searching for answers

Location:
Minnipa Agricultural Centre, paddock S3S
Rainfall
Av. Annual: 325 mm
Av. GSR: 241 mm
2016 Total: 391 mm
2016 GSR: 268 mm
Yield
Potential: 4.0 t/ha (B)
Actual: 3.7 t/ha
Paddock History
2015: Scepter wheat
2014: Medic pasture
2013: Medic pasture
Soil Type
Calcareous red sandy loam
Plot Size
50 m x 3 m x 4 reps

Key messages

- **Trafficking on wet soil in 2015 resulted in substantially less Rhizoctonia in barley in 2016.**
- **After two years of cereal production, there is little evidence that heavy vehicle trafficking is severely depressing grain yield on a Minnipa soil.**

Why do the trial?

Adoption of Controlled Traffic Farming (CTF) in the low rainfall zone (LRZ) of the Southern Region is very low. The GRDC-funded project 'Application of controlled traffic in the low rainfall zone' is evaluating whether or not this scepticism is justified. To help LRZ growers answer the questions and uncertainties they face when thinking about CTF adoption, the project is conducting research on four sites (R sites) across dominant soil types and agro-ecological zones in the Southern Region LRZ. These trials focus on the impact of trafficking (by heavy vehicles) on crop production and soil condition as well as monitoring how quickly LRZ soils will "self- repair" if heavy trafficking is stopped. Issues of implementing CTF and managing permanent wheel tracks are being addressed in other components of the project.

This article summarises the first two years of crop performance after trafficking was imposed on a red calcareous sandy loam at Minnipa Agricultural Centre (a detailed summary of 2015 results can be found in the EPFS Summary 2015, p197). Three other trials similar in design and monitoring have also been implemented across the LRZ – on a deep sand at Loxton (SA), a brown loam near Swan Hill (Vic) and on a deep red earth at Lake Cargellico (NSW). All these trials will be maintained for at least the five year life of the project.

How was it done?

The R trials were designed and implemented to be the same at all four sites. Each trial consists of 5 treatments replicated 4 times:

1. Control (no heavy vehicle trafficking).
2. One pass of a 20 tonne vehicle prior to seeding when soil was dry.
3. One pass of a 20 tonne vehicle prior to seeding when soil was wet.
4. Three passes of a 20 tonne vehicle prior to seeding when soil was wet.
5. Deep ripping (to loosen any historical trafficking).

These passes were conducted with 50% overlap of the load bearing wheels to ensure even coverage and will not be re-imposed.

The trafficking treatments simulate the effect of compaction caused by trafficking of heavy vehicles, with three passes when the soil is moist as an extreme (soil is always softer when wet so compacts more for the same vehicle weight). A deep ripping treatment was included because we cannot be sure if there is still compaction from previous trafficking in our control areas and the ripping was designed to disrupt any of this historical compaction. Trials were located on farms with soils typical for their district and where wheel track patterns for the previous five years (at least) were the same and were identifiable. The trials are being seeded and managed with the farmers' equipment.

At Minnipa, trafficking treatments were imposed in April 2015, the wet passes and deep ripping following 30 mm of rainfall. Scepter wheat was grown in 2015.

In 2016, Fathom barley was sown on 19 May at 65 kg/ha and with 60 kg/ha of DAP 18:20:0:0 without prior cultivation into good seeding conditions. The farm's Horwood Bagshaw precision seeder (knife points) was used and 40 kg/ha of urea was top-dressed on all plots mid-season.

Crop performance was monitored at establishment, for early and late dry matter production and at maturity (grain yield, quality and yield components). Grain harvest was conducted by hand to avoid trafficking from a header on treated plots.

What happened?

Trafficking on dry soil in 2015 had little visual impact on the soil but three passes on wet soil depressed the soil surface by at least 5 cm. Ripping left the surface more cloddy than the control with the surface raised by at least 10 cm.

In 2015, performance of wheat was confounded by establishment issues: seeding depth after three trafficking passes on wet soil reduced seeding depth from 54 mm in the control to only 25 mm. Ripping resulted in seeding depth averaging 103 mm because the profile was so loose and the variability in placement was also higher.

Establishment of barley was much more even and consistent across all treatments in 2016. Ripping caused seed to be placed a little deeper than the control (56 mm vs 42 mm) and multi trafficking wet a little shallower at 34 mm (Table 1). Plant populations were the same in all treatments and averaged 99 plants/m^2.

Dry matter production was similar across all treatments for most of the season in 2016 with the exception of ripping, where dry matter was 30-40% better than the control up until flowering. As the season progressed, Rhizoctonia appeared in the trial as frequent and severe patches. Trafficking on wet soil had a marked impact on Rhizoctonia severity with multi trafficking on wet soil (in 2015) reducing Rhizoctonia from a score of 3.8 in the control to almost 1 (Table 1). A single trafficking pass on wet soil (also in 2015) also reduced Rhizoctonia substantially but trafficking on dry soil had similar disease to the control. Ripping appeared to cause a small reduction in Rhizoctonia severity.

Trafficking on wet soil in the previous year substantially increased the yield of barley in 2016 by more than 0.7 t/ha (Table 1). Ripping and trafficking on dry soil resulted in grain yields similar to the control of 2.9 t/ha. Barley produced more grain after trafficking due to more fertile heads in the crop. The number of grains per head and 1000 grain weight were similar for all treatments. Grain proteins in 2016 were all high in the trial and similar to the control except for deep ripping which was more than 2% higher than the control (13.2%), suggesting that the crop after ripping had accessed N reserves which the control had not.

Grain yields of wheat in 2015 were similar for all treatments, except ripping which was lower.

Table 1 Performance of Fathom barley in 2016 after trafficking and ripping at Minnipa in 2015

	Grain yield (kg/ha)	Depth of seeding (mm)	Rhizoctonia severity (0: none, 5: severe)	Heads per m^2	No of grains per head	1000 grain weight (g)	Grain protein (%)
Control	2923	42	3.8	353	21	39	13.2
Single trafficking on dry soil	3366	45	4.0	438	20	39	12.9
Single trafficking on wet soil	3773	42	1.8	458	21	39	12.8
Multi trafficking on wet soil	3696	34	1.3	459	21	39	13.1
Ripping	3284	56	2.3	449	19	39	15.4
LSD (P=0.05)	*562*	*9*	*1.7*	*51*	*ns*	*ns*	*1.0*

What does this mean?

We have imposed three increasing levels of trafficking in all four R sites to investigate the sensitivity of crop production to compaction caused by heavy vehicles in typical LRZ situations. The deep ripping treatment is an attempt to remove any compaction already existing in our control areas due to historical traffic.

In this trial, in the first year of crop production following implementation of these trafficking treatments, wheat produced similar yields to the untrafficked control, despite seeding depth being shallower after the most extreme trafficking which also resulted in a lower plant population. These early results suggest that wheat is relatively insensitive to the compaction caused by heavy vehicles on this red calcareous sandy loam in a low rainfall environment, compared to the existing conditions in the paddock.

In the second crop after trafficking had been imposed, growth of barley was poorest in the control and Rhizoctonia the most severe. Both forms of soil "conditioning", trafficking on wet soil and ripping, improved growth during the season and reduced Rhizoctonia. The exception was trafficking on dry soil which has been very similar to the control throughout the two years of the trial so far. Wet trafficking finished very well in 2016, producing 30% more heads than the control and more than 0.7 t/ha of extra grain. Only part of this yield increase with wet trafficking was due to reduced rhizoctonia. Ripping and dry trafficking produced grain yields similar to the control but protein levels in ripping were substantially higher than in any other treatment.

Of the other three trials, the two on lighter soils (typical of mallee environments) are also showing that little crop production is being lost with all but the most extreme trafficking treatment. However, on the heavy and deep red soil of southern NSW, crop production has been severely depressed by any trafficking.

This trial will be continued for the next two years at least and we will continue to monitor the impact of trafficking imposed in 2015 on subsequent crop production and soil condition. So far, there is little direct evidence that relieving current levels of compaction by ripping treatment will improve crop production on Minnipa soil.

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