

Controlled traffic impacts on vetch production at Minnipa in 2017

RESEARCH

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Searching for answers



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.

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 implemented in 2015 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 sown and managed with the farmers' equipment.

Key messages

- **Vetch production in a very tough season was little affected by trafficking imposed in 2015.**
- **After three years of crop production, low levels of trafficking have had little impact on grain yield on a Minnipa soil, multiple trafficking on wet soil (in 2015) increased grain yields in the second and third crops.**
- **Ripping conducted in 2015 lifted the soil substantially but has not benefited production in any of the following three crops.**

This article summarises the first three years of crop performance after trafficking was imposed on a red calcareous sandy loam at Minnipa Agricultural Centre. A detailed summary of 2015 and 2016 results can be found in the 2015 and 2016 Eyre Peninsula Farming Systems Summaries, respectively. 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 except Swan Hill (land ownership has changed) will be maintained for at least the five years of the project.

Table 1. Performance of Volga vetch in 2017 after trafficking and ripping at Minnipa in 2015.

Treatment	Establishment (plants/m ²)	Depth of seeding (mm)	Hay biomass (kg/ha)	Maturity biomass (kg shoots/ha)	Grain yield (kg/ha)
Control	62	65	1376 ab	664	320
Single trafficking on dry soil	46	64	1242 ab	662	306
Single trafficking on wet soil	50	50	1796 b	744	372
Multi trafficking on wet soil	51	47	1938 b	843	416
Ripping	43	76	1090 a	670	333
LSD (<i>P</i> =0.05)	<i>ns</i>	10		<i>ns</i>	<i>ns</i>

Note: for hay biomass, values with the same letter are not statistically different to each other.

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 and Fathom barley in 2016. In 2017, Volga vetch was sown @50 kg/ha on 26 April with 50 kg/ha of DAP.

Crop performance was monitored at establishment, for hay production and at maturity (grain yield and biomass). Grain harvest was conducted by hand to avoid trafficking from a header on treated plots.

What happened?

Emergence of vetch was very slow and staggered in 2017 due to very dry conditions around and after seeding. However, final establishment was similar across all treatments, despite seeding depth being slightly shallower after wet trafficking and slightly deeper after ripping (see Table 1). These treatments were imposed prior to seeding in 2015, but their impact

on seeding depth has persisted into the third season on this heavy soil.

Production from the vetch was very poor due to dry conditions throughout the growing season in 2017 and hay cuts were less than 2 t/ha by early podding. Hay production after trafficking of any type was similar to the control although production after both wet trafficking treatments was better than after ripping (Table 1). Grain yields were very poor (average of 350 kg/ha for the trial) and similar for all treatments.

Trafficking on wet soil substantially increased the yield of barley in 2016. Ripping and trafficking on dry soil resulted in grain yields similar to the control.

Grain yields of wheat in 2015 were similar for all treatments, except for ripping which was lower (mostly due to low plant numbers and substantially deeper seeding).

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 ripping treatment is an attempt to remove any compaction already existing in our control areas due to historical traffic.

On this heavy Minnipa soil after three crops, trafficking has not caused any production losses, if anything less there has been an increase in production. This suggests that anybody moving into CTF on this type of soil will not see any improvements in crop productivity in the short term. We have no information about longer-term effects. Loosening up the soil by ripping has not resulted in any production increases either, a result which has been seen many times with ripping on this type of soil.

On very sandy soils where responses to deep ripping are common and often substantial, CTF is a complementary strategy which should not only increase and prolong the benefits from deep ripping operations, but also avoid trafficking issues with deeply loosened and fragile sands.

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 was severely depressed by any trafficking in the first year, but in the very wet year of 2016, production was similar across all treatments.

The benefits of improved traction and better fuel efficiency from driving on permanent traffic lanes are likely to be there, but again

with smaller gains than in other zones because trafficability is less of an issue in the LRZ and the traffic lanes are likely to be sown, reducing the benefits of permanent wheel tracks.

The often poor performance of crops after multiple heavy vehicle passes on wet sandy soils indicates that while most of our cropping paddocks are probably already quite compacted, the current generation of very heavy machinery has the potential to further increase damage into the future on sandy soils.

This trial will be continued for one more season and we will continue to monitor the impact of trafficking imposed in 2015 on subsequent crop production and soil condition.

Generally, farmers under-estimate the extent of trafficking in their paddocks. For those farmers

and advisers who would like to estimate current levels and simulate how they might change under various CTF options, there is a GRDC-supported app which walks you through the process (www.ctfcalculator.org).

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