



# Southern Incentives Southern Soils



## STIRLINGS TO COAST FARMERS OVERCOMING SOIL COMPACTION TO IMPROVE PRODUCTIVITY ON STIRLINGS SANDPLAIN

### PROJECT PROFILE

**PROJECT MANAGERS:** Stirlings to Coast Farmers Inc. (SCF)  
**NAME:** Goad and Curwen families  
**LOCATION:** Chillinup Road, Kojaneerup and Bloxidge Road,  
South Stirling, WA (respectively)  
**AVERAGE ANNUAL RAINFALL:** 470 mm  
**LANDSCAPE:** Stirlings sandplain



### NUTS & BOLTS

- Soil compaction is an increasing issue in the Stirlings sandplain landscape with compaction occurring deeper than 30cm, and measured to 70cm by SCF researchers.
- Ripping below a compacted layer effectively overcomes subsoil compaction on responsive soils.
- Ripping responses can be large however, responses depend on level of compaction, soil type and other soil constraints.
- The research has thrown up many more questions: timing of the ripping, most effective equipment, residual effects and impacts of other soil constraints on the practice. Further research is required.



**Soil health** is a key focus for natural resource management groups and grower groups across the South Coast, with subsoil compaction becoming a severe soil constraint, particularly on sandy soils. Soil compaction occurs when soil particles are pressed together, reducing pore space between them. This results in reduced water infiltration, reduced drainage and inhibited plant root penetration, resulting

in poor plant growth in cropping and pasture phases. Additionally, low soil water use by plants has flow on productivity and environmental consequences. In 2016, Stirlings to Coast Farmers Incorporated (SCF) developed and implemented a collaborative research project assessing subsoil compaction at two barley cropping sites on the Stirlings sandplain landscape.

## KOJANEERUP SITE (GOAD FAMILY) ●●●

### The Site & Ripping Trial Design:

- Soil type: clayed deep sand.
- The site was ripped in 2014 with 16 alternate 700m runs of 35cm ripping and no ripping along the length of the paddock. The runs were 12m wide matching sowing and harvesting machinery. Note: there was up to 0.3 t/ha barley yield increase from this shallow ripping at the harvest following that ripping.
- In 2016 a four-treatment trial, replicated four times, was overlaid on the original 2014 shallow ripping runs, leaving 2014 ripping and no ripping as control treatments.
- In February 2016 the grower ripped full plot widths to 120cm with dozer tines at 1.1m spacing.
- In late April further plots were ripped to 75cm with a Heliripper (see Figure 1), alternate tynes at 0.5m spacing were 75 cm and 45cm deep (i.e. 75cm tine depth spaced at 1.0m).
- The paddock was sown to barley and yields were extracted from a yield map and calibrated to paddock delivered yield.



FIGURE 1: Deep ripping at Kojaneerup site with Heliripper

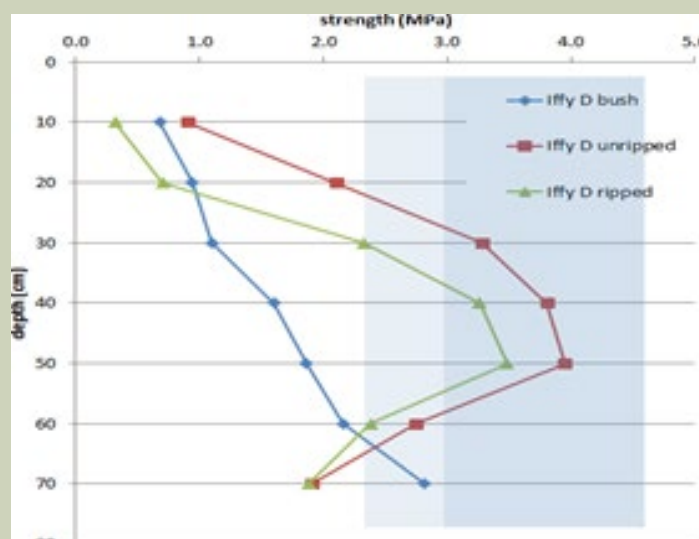


FIGURE 2: Soil strength in soil profile at Goad's in ripped, untreated and uncleared bush plots (Jeremy Lemon, DPIRD).

## FINDINGS & DISCUSSION ●●●

Of the soil profiles sampled at the Kojaneerup site and area, 75% were highly compacted, 23% moderately compacted and nil compaction in the controls (uncleared areas), as shown in Figure 2. The site is very compacted with average soil strength up to 3.5 MPa between 30 and 70cm depth as shown in figure 3. Soil pH is above target levels at most sites tested as shown in figure 4.

5 increased with 2016 deep ripping to 75cm by 0.5 to 1.1t/ha, 0.7 t/ha over the full length of plots. Yields improved a further 0.2 to 0.7 t/ha with ripping to 120cm, 0.4 t/ha over the full length of plots. While there was a yield increase on all yield zones and over the whole paddock length, the largest increase was on the poorest zone associated with sand over 1.0m depth, increasing yield above no ripping in all zones.

Grain yield data from the site as shown in Figure

There was an insignificant residual yield benefit

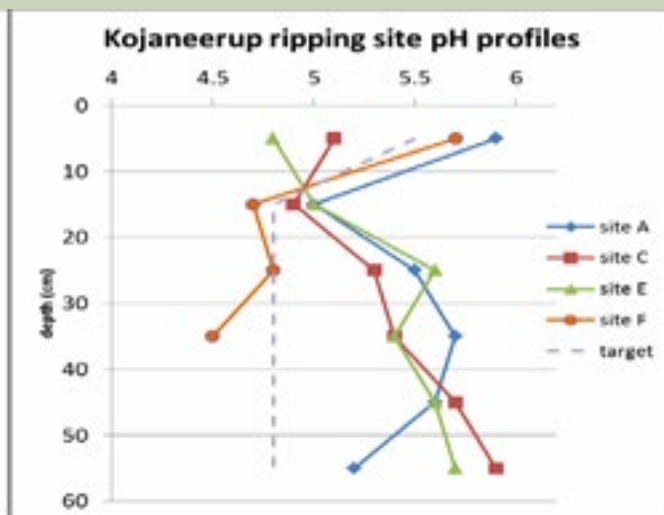
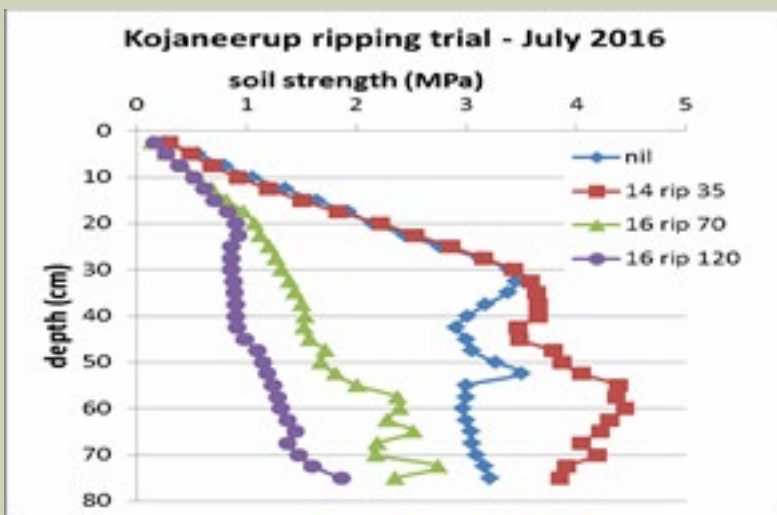


FIGURE 3: Soil moisture results from cores collected from each of the 3 pasture species strips and 2 control strips at seeding. The data presented are averages of 3 cores collected per treatment strip (Jeremy Lemon, DPIRD).

FIGURE 4: SpH profiles measured in April 2015 (Jeremy Lemon, DPIRD).

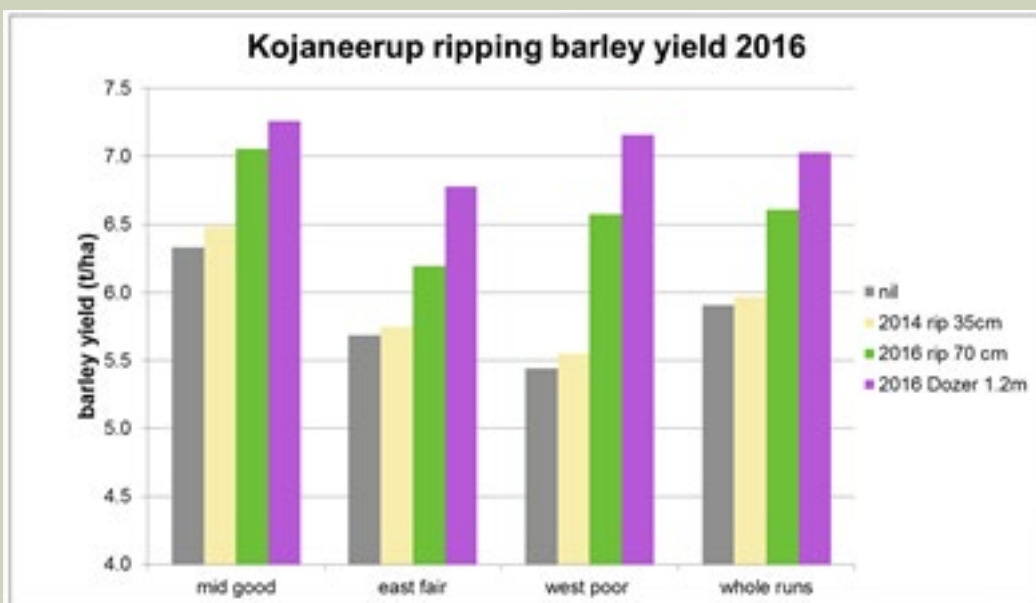


FIGURE 5: Kojaneerup site 2016 calibrated barley yields from yield zones and whole paddock plot length. (650m) (Jeremy Lemon, DPIRD).

# SOUTH STIRLING SITE (CURWEN FAMILY) • • •

## The Site & Ripping Trial Design:

- Site covers two soil types: clayed deep sand (east end) and sandy gravel over laterite.
- Site was an un-replicated demonstration due to soil type changes and machinery availability.
- Two, 24m wide Heliripper plots, one to

35cm deep and one to 75cm deep, placed between alternate un-ripped plots across both soil types.

- A weigh trailer measured header barley grain yields from each soil type separately.

## FINDINGS & DISCUSSION • • •

Penetrometer measurements (Figure 7) clearly show softer soil to depth in the 70cm rip plots but insignificant difference between 35cm ripping and no ripping. A soil pit across deeper ripped and unripped sand plots in September showed root growth past 80cm in the 1m spaced deeper ripping tyne lines. There was no root growth at this depth between the deep tynes or in the unripped plot.

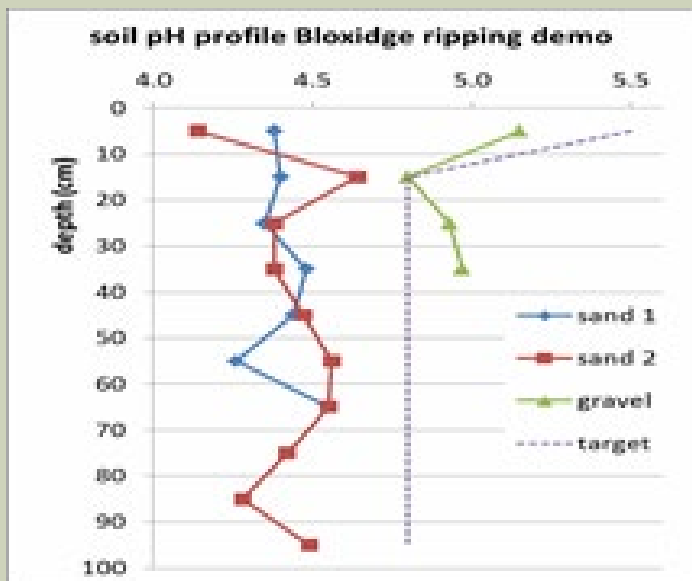


FIGURE 6: Soil pH on two soils at Bloxidge Road, South Stirling site (Jeremy Lemon, DPIRD).

Crop growth was visibly better on the ripped plots, particularly the deeper ripped sand later in the season. May to October rainfall of 350mm indicated a cereal yield potential of about 4.7t/ha, the highest plot yield approaches this with 4.46t/ha. Harvest results indicate a moderate response to both ripping depths on both soils

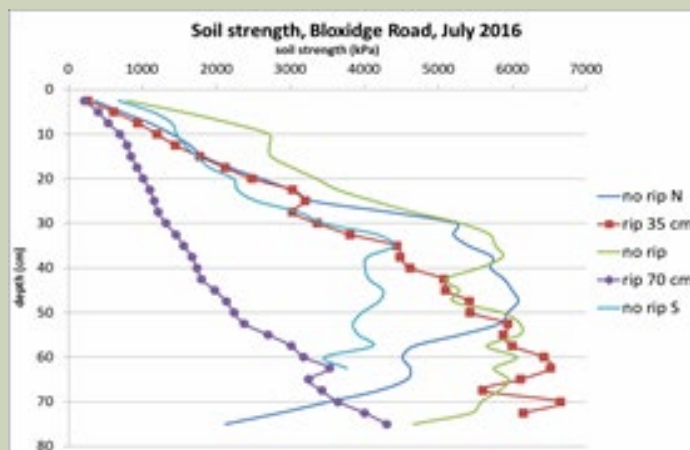


FIGURE 7: Penetrometer resistance profiles on the clayed deep sand section at Bloxidge Road, South Stirling site in July 2016 (Jeremy Lemon, DPIRD).

as shown in Figure 6. The largest yield increase was from 35cm ripping on the gravel area as shown in Figure 8. This is an unexpected result and emphasises the need for replication to verify observations. While 0.2 t/ha to 0.3 t/ha yield increases were observed from 35cm ripping, deeper ripping on such compacted sand sites often gives larger increases than the 0.34t/ha measured in this demonstration. A likely reason for the moderate result on deep sand is that the acid soil profile to depth prevented effective root function (see Figure 6). Ripping with the same machine at Kojaneerup (20 km NE) produced 0.5 t/ha to 1.1 t/ha grain yield responses in 2016.

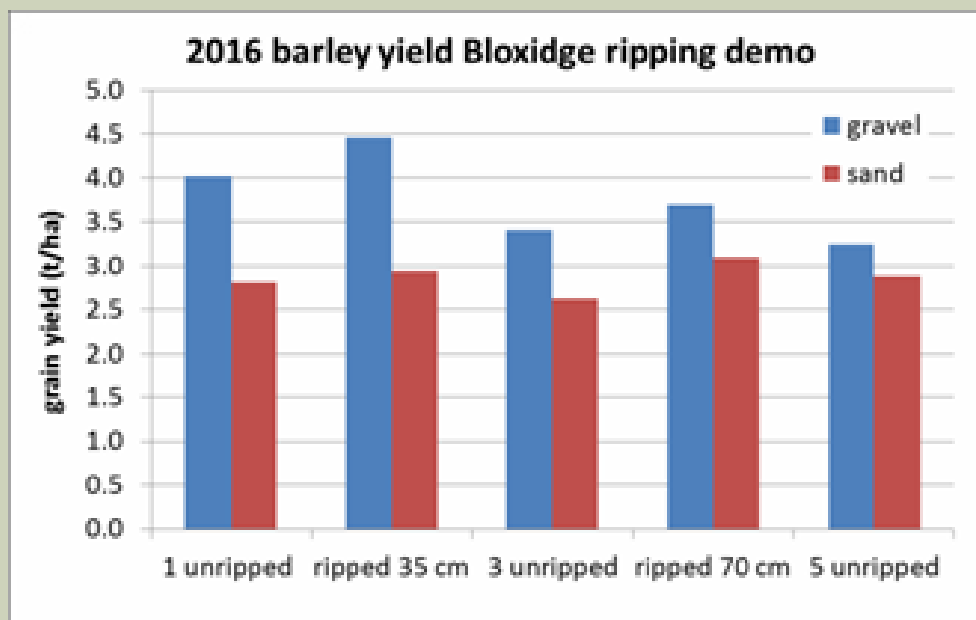


FIGURE 8: Barley grain yield from ripped and unrippd plots at Bloxidge Road, South Stirling.

## CONCLUSION ● ● ●

- Measured controls in uncleared areas confirmed that the compaction is not inherent in the original undeveloped soils.
- Ripping below a compacted layer effectively overcomes subsoil compaction on responsive soils.
- The soil survey works at both sites confirmed that almost all the deeper duplex soils, including deep sands, are developing traffic hard pans associated with the intensity of cropping.
- Ripping costs vary by machine and soil type. A 0.5 t/ha cereal yield response with grain worth \$200/t will cover costs in the first year.
- Returns from ripping will depend on longevity of the response. Factors that impact on longevity include: ability to limit compaction (i.e. possibly through controlled traffic) and the impact of other soil constraints, notably pH and associated aluminium toxicity.
- Future research into subsoil compaction could look at a wider range of machinery, different methods of measuring compaction (eg. remote sensing) and application of soil ameliorants at depth.

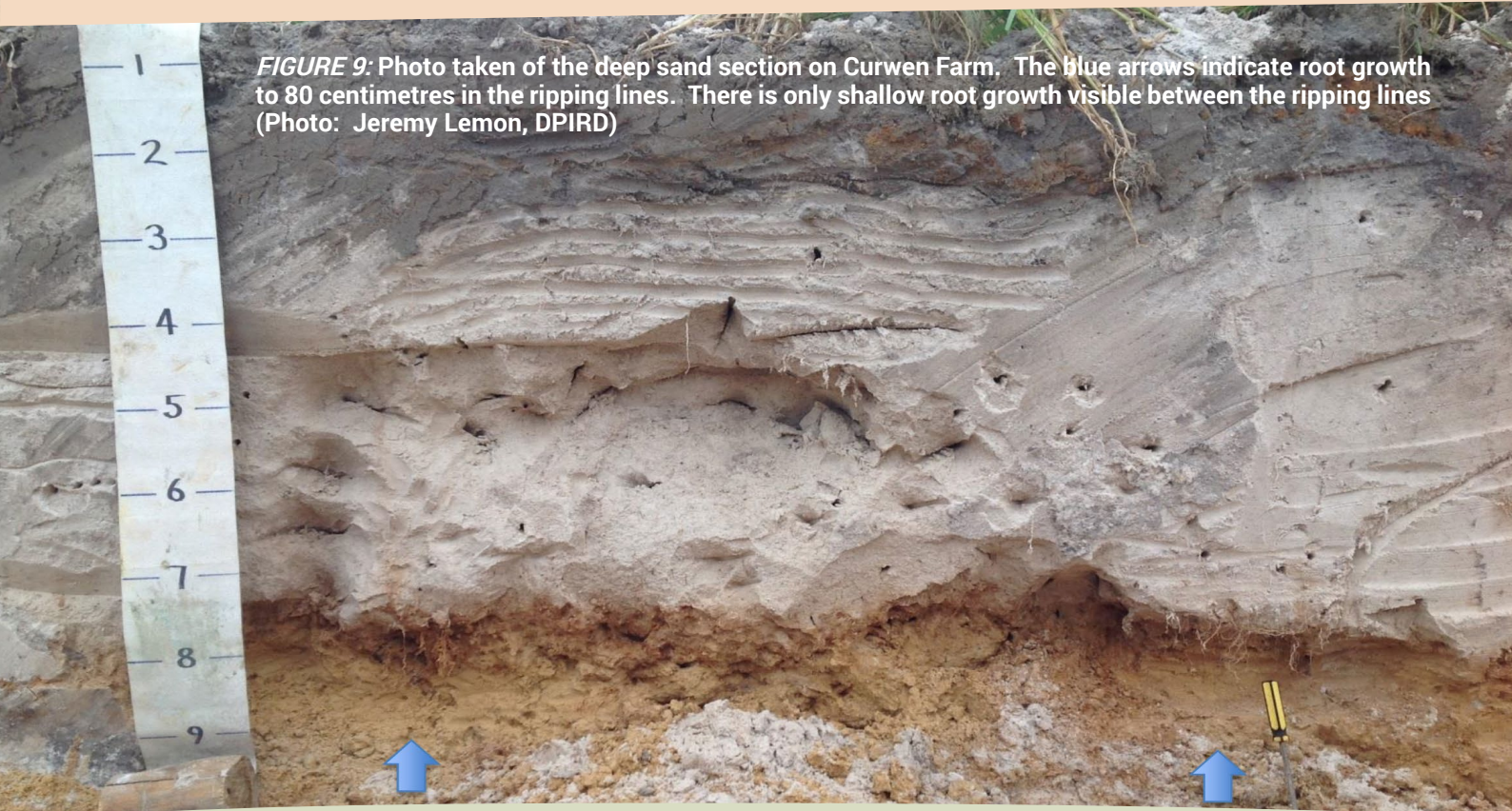
## MORE INFORMATION ● ● ●

For more information, including: further reading, references, potential future research following on from this work, or a copy of the full research report contact:

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# "Soil types respond to deep ripping to ameliorate soil compaction on the Stirlings Sandplain"



**FIGURE 9:** Photo taken of the deep sand section on Curwen Farm. The blue arrows indicate root growth to 80 centimetres in the ripping lines. There is only shallow root growth visible between the ripping lines (Photo: Jeremy Lemon, DPIRD)

South Coast NRM leads partnership arrangements for targeted public investment in protecting or improving the condition of natural resources within the South Coast NRM region of Western Australia. South Coast NRM's vision is one of resilient communities.

The Southern Incentives - Southern Soils program facilitates field trials in targeted locations across the south coast region to demonstrate sustainable practices in the key soil health areas of soil biology, soil acidity, soil erosion, water repellence and managing nutrient additions.

## ACKNOWLEDGEMENTS

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