No. 6
November 2008

Canola in Depth

An update from the GRDC funded project
'The contribution of subsoil constraints to canola yield decline'.

The focus of this edition is on soil compaction and what is currently known about its impact on canola performance. We have also included a final review of the trials as harvest commences. Greenethorpe is the trial under the spotlight, with a compacted layer at approximately 15cm depth.

Soil compaction and canola

A series of dry years has highlighted the importance of crop roots being able to access subsoil moisture. Consequently, there has been renewed interest in managing subsoil compaction, which has in part contributed to the recent increase in adoption of tramlining or controlled traffic farming. However the question is often asked about the extent to which compaction really does impact on plant growth.

A canola survey conducted across soil types in southern NSW in 2004/05 showed that **37 out of 39 paddocks had compacted subsurface layers** (soil strength 2MPa or greater), with 40% greater than 3MPa. Of the paddocks south of Wagga Wagga, more than 60% showed severe root distortion (less than 10% north of Wagga), which suggested that canola was sensitive to compaction. However a recent **review of deep ripping trials in south-eastern Australia over the last 25 years** (*Kirkegaard et al, 2008**) has shown variable responses to removal of the compacted layer in both wheat and canola:

- **Yield responses to deep ripping only occurred on sodic/ clay soils in wet years** (5 out of 23 trials, 1 was canola). No yield responses were recorded on these soils in an average season. Unfortunately half the trials, the majority of which were on clay loams, were conducted in very dry years when potential yield responses were limited by moisture.
- Early **dry matter responses** to deep ripping were **most prevalent in canola** (4 out of 7 canola trials compared with just 1 out of 8 wheat trials), but these rarely persisted to yield. Although dry matter responses were greatest on the two most compacted trials (4.0 to 4.2MPa), only a few responses were recorded at sites of 2.75 to 3.5MPa and **no responses were recorded on sites of less than 2.75MPa**.

**'Ripping yarns, 25 years of variable responses to ripping clay soils in south-eastern Australia.' www.regional.org.au/au/asa/2008/concurrent/managing_subsoils/5934_kirkegaardja.htm*

The review highlights the limited information on compaction in clay loam soils in southern NSW, with the only published data restricted to sodic clay soils. Unfortunately the 2007 Canola in Depth trials, which were included in the review and involved mostly clay loams, were compromised by very dry conditions. Despite this, the review highlights a number of outcomes relating to soil compaction in south-eastern Australia:

- **The commonly accepted soil strength threshold of 2MPa (at which root growth becomes restricted) may not apply to the relatively permeable soils in south-eastern Australia.** In these instances, cracks and pores in the soil enable root penetration through the compacted layer, allowing roots to access water and nutrients in (non-sodic) subsoils.
- **There is little current evidence to suggest that deep ripping of soils in south-eastern Australia is beneficial, *except* in combination with gypsum on sodic clay soils.**
- Although the benefits of controlled traffic are numerous, **current evidence suggests its role in compaction management is not as critical on clay loam soils in south-eastern Australia.** However early adopters of controlled traffic in the region have observed noticeable improvements in soil strength and structure. This will be further investigated in the new FarmLink/CSIRO project focused on improving water use efficiency across the farming system.

Resistance?

Resistance is a measure of soil strength, typically measured using a 'cone penetrometer'. A soil with penetrometer resistance of 2MPa or greater has generally been considered compacted and restrictive to root growth. However a recent review of research in south-eastern Australia suggests that roots may still be able to penetrate the compacted layer of the region's relatively permeable soils through structural cracks and pores.

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Funded By:
GRDC Grains Research & Development Corporation

Project Update

In summary, there were no significant dry matter responses to deep ripping or lime/gypsum applications at any of the sites. The only dry matter response was from surface application of organic matter at the Wimmera site (which also had a temporary response to deep nutrient placement).

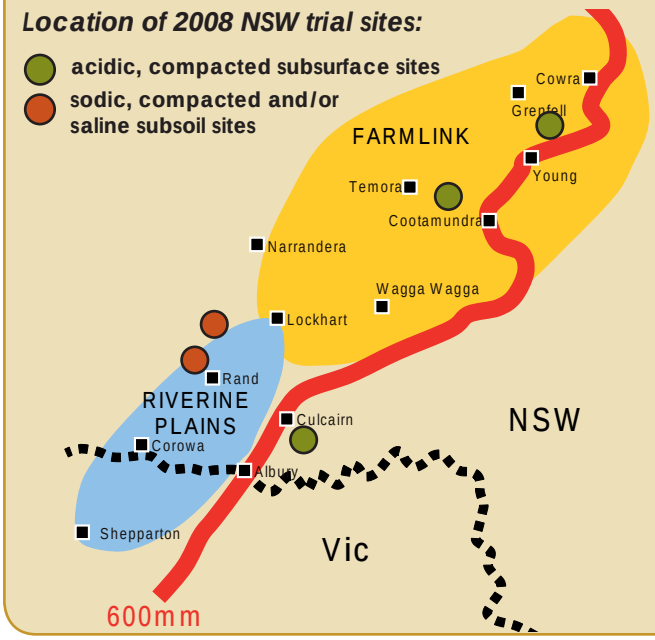
a) Acidic, compacted subsurface sites:

- **Culcairn -** Ripped & lime injected March **'08**. Beacon & Bravo sown 15th May.
  - ► Deep ripping removed compacted layer at ~5 to 25cm but made no difference to rooting depth.
  - ► A trend towards greater dry matter from ripping and/or liming, but not significant.
- **Greenethorpe -** Ripped & lime injected March **'07** (prior to wheat). Bravo sown 1st May '08.
  - ► No dry matter response to ripping and/or lime.
- **Milvale -** Ripped & lime injected March **'07** (prior to canola). Hyola 50 sown 7th May '08.
  - ► No dry matter response to ripping and/or lime.

b) Sodic, compacted and/or saline subsoil sites:

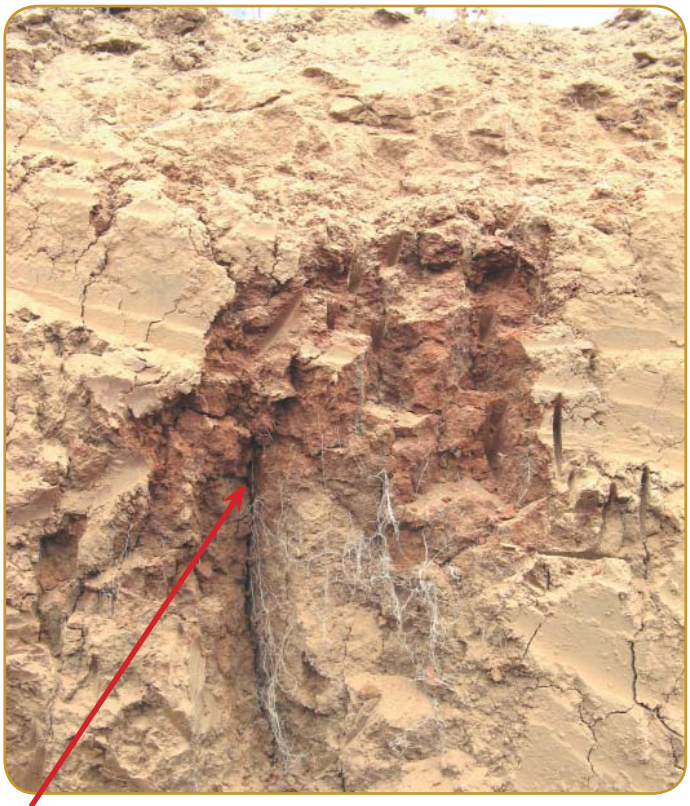
- **Rand -** Ripped & gypsum injected March **'08**. Tornado sown 24th April.
  - ► No dry matter response to ripping and/or gypsum.
- **Yuluma -** 45Y77 sown 30th April into paddock with variable salinity levels.
- **Brimpaen (Wimmera, Vic.) -** Deep ripped & treatments applied May **'08**. Marlin sown 26th May.
  - ► Application of surface organic matter resulted in 22% greater dry matter at flowering (an earlier dry matter response from deep placement of nutrients had disappeared by flowering)
  - ► No dry matter response to deep ripping (soils not sufficiently compacted at less than 2MPa)

Location of 2008 NSW trial sites:



Greenethorpe in Profile...

- Penetrometer resistance at the Greenethorpe trial (red chromosol) was 4.2 MPa at 15cm depth. Deep ripping to a depth of 35cm in March '07 removed the compacted layer, with resistance reduced to 1.4 MPa.
- As a result, canola dry matter increased by 95% and root distortion was reduced. However the very dry conditions in 2007 prevented these responses from translating into a potential yield benefit.
- A compacted paddock nearby was also ripped in March '07 and sown to canola in 2008 (wheat '07). Measurements pre-sowing this year showed the ripped area had less water to depth, presumably resulting from soil disturbance the previous year. However unlike 2007, deep ripping resulted in no dry matter response.



At a field day at the Greenethorpe site in 2007, visiting Professor Gordon Spoor noted that canola roots had been slowed by the compacted layer, but had penetrated it using the many structural cracks and pores to proliferate in the subsoil. This explains why crops grown in these soils tend to 'catch up' by the end of the season to areas where the compacted layer has been removed.

For more information...

- **Canola in Depth E-list -** If you are not a member of FarmLink but would like to receive the 'Canola in Depth' fact sheets via E-mail, please E-mail kirrily@farmlink.com.au *(previous Canola in Depth fact sheets can be downloaded from www.farmlink.com.au)*
- **'Subsoils in the FarmLink Region' -** can be downloaded from www.farmlink.com.au, or phone FarmLink on (02) 6924 4633 to receive a hard copy.
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