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# Canola in Depth

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

***The focus of this edition of Canola in Depth is on subsoil sodicity - how it affects the soil and what we know of its impact on canola performance. We have also included an update on trial progress, with the project team having been busy sampling over the past month to detect any early responses. The site under the spotlight in this edition is the compacted, sodic site at Rand which covers 3 soil types.***

## Soil sodicity and canola

- In Australia, a soil is considered **sodic if the exchangeable sodium percentage (ESP) is greater than 5% in the topsoil, or 15% in the subsoil**.
- Sodic soils tend to 'disperse' when wet, meaning the soil swells and disperses clay particles, blocking soil pores and resulting in a hard, dense structure when dry. This can result in reduced plant emergence due to crusting of the soil surface, as well as restricted root growth due to limited water and air movement through the soil profile.
- Applying gypsum (and/or lime if the soil is also acid) can improve the structure of sodic soils by preventing the soil from dispersing. Although this can result in improved trafficability, water infiltration and better plant growth, trials have shown that **yield responses to gypsum depend on *seasonal conditions***, particularly rainfall:
  - Under the relatively wet conditions of 2000, topdressed gypsum applied to a sodic trial site at Grogan (near Temora) resulted in canola yield increases of 0.5 to 2.0t/ha. *(ESP was 12% in the topsoil, increasing to 30% at depth.)*
  - However under the dry conditions at the same site between 2002 and 2004, no canola yield responses were recorded.
  - Trials conducted at a less sodic site nearby (Morangarell) indicated **yield responses can also depend on the *level of sodicity***. With *no topsoil sodicity* (but sodic below 10-20cm), there were no yield responses to topdressed gypsum at this site from 1999 to 2003. It was therefore concluded that responses to topdressed gypsum are unlikely if ESP in the top 10cm is less than 6%. (However it should be noted that below average rainfall fell at this site for the duration of the project).
- Unlike lime, gypsum is able to move down the soil profile relatively easily. In the trials described previously, **topdressed gypsum had reduced ESP to a depth of 30cm five years after application**. However sodicity often occurs deeper in the soil profile, affecting root growth and consequently yield.
- Treating sodic subsoils with sufficient quantities of gypsum can be costly and time consuming, with variable results. The Canola in Depth project therefore aims to quantify the impact of subsoil sodicity on canola yields, as well as measure the effects of several treatments, including combinations of deep ripping and topdressed or injected gypsum, on canola performance.

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**ESP?**

ESP (exchangeable sodium percentage) is a measure of soil sodicity. A soil is considered sodic if the ESP is greater than 5% in the topsoil or 15% in the subsoil.

***Fig. 1: FarmLink 'ripper/injector' used in the project. Modified Yeomans Plow rips to 30-40cm, placing gypsum/lime at 2 depth intervals above.***

Project Partners:
NSW Department of Primary Industries, Charles Sturt University, CSIRO, FarmLink Research, Victoria The Place To Be, The University of Melbourne
EH Graham Centre for Agricultural Innovation

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## Project Update

### a) Acidic subsurface sites:

- **Culcairn** (limed & ripped) - no obvious visual plant response to liming despite high rates. Some transient manganese toxicity symptoms. Ripping resulted in patchy germination in middle of plots.
- **Greenethorpe** (limed & ripped) - obvious plant dry matter responses to ripping but not to lime. Although not sodic, subsurface found to slump when wet, which may be contributing to ripping response.
- **Milvale** (limed & ripped) - no obvious visual plant response to liming or ripping.

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

- **Rand** (gypsum & ripped) - dry matter plant responses to ripping but not to gypsum on the 3 soil types (red, grey & brown). Emergence on grey soil affected by herbicide residues (high pH) - see below. Trial showing moisture stress.



- **Corowa** (gypsum & ripped) - obvious visual plant responses to ripping. This site is very compacted but with no sodic, saline or acid problems.
- **Lockhart** (gypsum & ripped) - site affected by resistant ryegrass. Yield monitor will be used to compare against areas of variable EM.

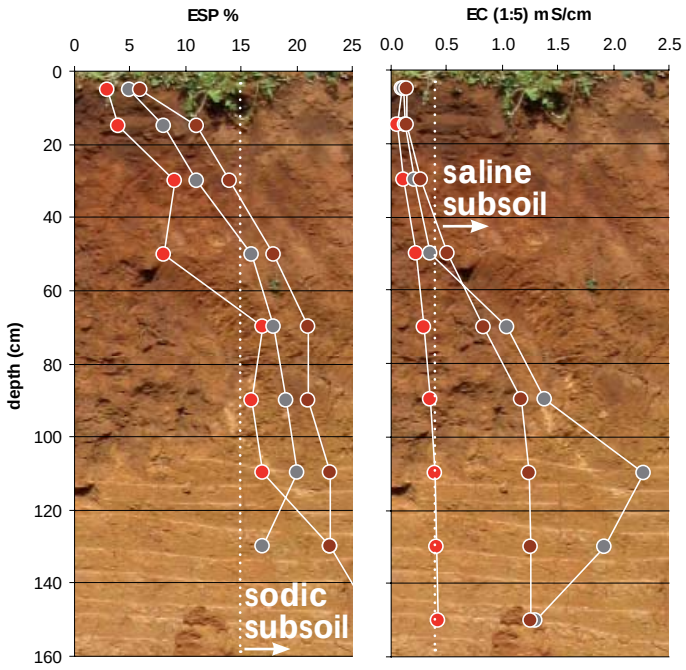
**note that herbicide residues affected the Boree Creek trial in 2007. Trial to be repeated in 2008.*

***Figure 2 - Location of 2007 trial sites:***


## Rand in Profile...

- Trial covers **3 soil types** - red, grey and brown (represented by corresponding coloured dots on graphs below):
  - ► each soil type has a **sodic subsoil** (shallowest on grey & brown soils)
  - ► grey & brown soils also have high electrical conductivity (EC > 0.4mS/cm) in the subsoil which suggests **salinity.** However the EC 'bulge' below 100cm on the grey soil is due to a high concentration of gypsum salts rather than sodium.
  - ► pH (not shown) increases with depth on all soil types to approximately $pH_{Ca}$ 8 at 80-100cm
- **1st March:** treatments applied - including deep ripping to 40cm with & without injected gypsum (3.75t/ha) & untreated
- **27th April** - trial sown to Tornado
- **30th May** - plant counts show emergence on grey soils reduced by herbicide residues (higher surface pH)
- **6th Sept** - visual plant response to ripping but not to gypsum on each soil type. Trial moisture stressed (132mm growing season rainfall to date).

***Figure 3 - Soil profiles at Rand***




## 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)*
- **Distribution of subsoil constraints -** For an overview of the distribution of subsoil constraints in the FarmLink region, download the brochure 'Subsoils in the FarmLink Region' from www.farmlink.com.au, or phone FarmLink on (02) 6924 4633 to receive a hard copy.
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