

Canola in

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

Depth

The focus of this edition is on subsoil salinity and what is currently known about its effects 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 is the variable saline site at Yuluma (west of Lockhart).

Subsoil salinity and canola

- A soil is generally considered saline if the electrical conductivity (EC_e) is greater than 2 dS/m, but this may depend on the type of salts present.
- For example, sodium chloride (NaCl) salt is more damaging than gypsum salt, but both salts could cause high EC readings. Chloride measurements may therefore provide a better indication of salinity, particularly in the subsoil. **Chloride is considered to be marginal at 300-600 mg/kg and toxic at greater than 600 mg/kg.**
- Subsoil salinity can substantially reduce plant growth and yield, particularly in dry seasons. **The presence of salts in the root zone result in reduced water uptake** and some salts, eg. sodium and chloride, can have a direct toxic effect on the plant.

How salt tolerant is canola?

- Subsoil salinity is best managed by growing deep rooted, salt tolerant species. Research conducted both in Australia and overseas suggests **canola is relatively salt tolerant** compared with other species:
 - ▶ A GRDC project on 'Primer Plants' in southern NSW showed that canola grown in highly saline soil (EC_e 20 dS/m) yielded 58% of the dry matter grown in low salt conditions. This was considerably higher than tall wheatgrass (20-30%), wheat (13%), lucerne (11%) and chickpeas (10%).¹
 - ▶ Research conducted in north-eastern Australia estimated the critical level (10% yield reduction) of subsoil chloride for canola was 980 mg/kg. This was slightly less than barley (1012 mg/kg), but greater than bread wheat (854 mg/kg), durum

wheat (662 mg/kg) and chickpeas (492 mg/kg).²

- ▶ Canadian research showed that under severe saline conditions (EC_e 25 dS/m), canola yielded far better than durum wheat or field peas (20%, 0.4% and 0% of non-saline controls respectively), despite better emergence by the durum.³
- ▶ American research showed that canola yields (both *B. napus* and *B. campestris*) were unaffected by soil salinity up to EC_e 11 and 9.7 dS/m respectively. For each unit increase in salinity above these thresholds, yields decreased by 13 and 14.3% respectively.⁴
- Monitoring at the Yuluma site for the Canola in Depth project will measure how **canola responds to a range of salinity levels**, allowing growers to identify paddocks where canola may not be suitable or to adjust inputs on paddocks (or parts of) according to the expected yield penalty (see over page).

Acknowledgements:

Tony Swan, John Angus, John Kirkegaard & Mark Peoples (CSIRO Plant Industry); James Nuttall & Roger Armstrong (Vic DPI).

References:

- ¹T. Swan, M. Peoples. Primer plants: a new approach to improve cropping on hostile soils (GRDC project CSP343)
- ²Y.P. Dang et al (2008). High subsoil chloride concentrations reduce soil water extraction and crop yield on Vertosols in north-eastern Australia. *Australian Journal of Agricultural Research* **59**, 321-330.
- ³H. Steppuhn et al (2001). Comparing canola, field pea, dry bean and durum wheat crops grown in saline media. *Crop Science* **41**, 1827-1833.
- ⁴L.E. Francois (1994). Growth, seed yield and oil content of canola grown under saline conditions. *Agronomy Journal* **86**, 233-237.

EC_e or $EC_{1:5}$?

EC (electrical conductivity) is a measure of soil salinity. The two methods used to measure EC are:

- ▶ saturated paste extract (EC_e or EC_{se})
- ▶ 1:5 soil water extract ($EC_{1:5}$)

Each method gives a different result so it's important to know which one has been used. To compare them, $EC_{1:5}$ needs to be adjusted for soil texture.

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Project Update

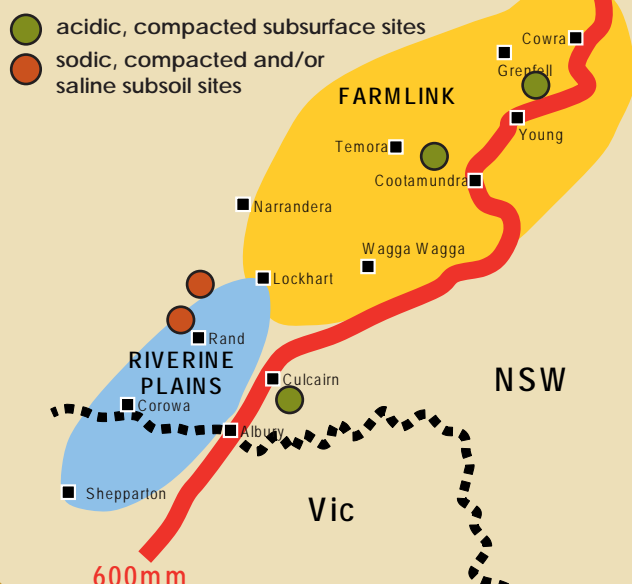
a) Acidic, compacted subsurface sites:

- **Culcairn** - Ripped & lime injected March '08. Beacon & Bravo sown 15th May.
 - ▶ No difference in emergence between treatments.
 - ▶ Less soil water at emergence in ripped plots (15% in top 15cm), compared with 17.5% in knife point incorporation treatment and 22% in uncultivated.
- **Greenethorpe** - Ripped & lime injected March '07 (prior to wheat). Bravo sown 1st May '08.
 - ▶ Less soil water to depth in ripped area pre-sowing.
 - ▶ A trend towards lower emergence in ripped areas but not significant.
- **Milvale** - Ripped & lime injected March '07 (prior to canola). Hyola 50 sown 7th May '08.
 - ▶ No differences in emergence or dry matter.

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

- **Rand** - Ripped & gypsum injected March '08. Tornado sown 24th April.
 - ▶ A trend towards lower emergence in ripped areas but not significant.
 - ▶ Variable emergence between the 3 soil types (as in '07) with poorer emergence on the black soil.
- **Yuluma** - 45Y77 sown 30th April into paddock with variable salinity levels.
 - ▶ No effect of subsoil salinity on plant emergence.
 - ▶ High EM survey readings correlated to high EC and chloride readings.
- **Brimpaen (Wimmera, Vic.)** - Deep ripped & treatments applied May '08. Marlin sown 26th May.
 - ▶ Canola dry matter to be assessed late August.
 - ▶ NB: Dry matter measurements of wheat sown over 2007 canola trial (same treatments) show organic matter treatment is 170% of control, deep nutrients 130%, but no difference in deep ripped treatments.

Location of 2008 trial sites:

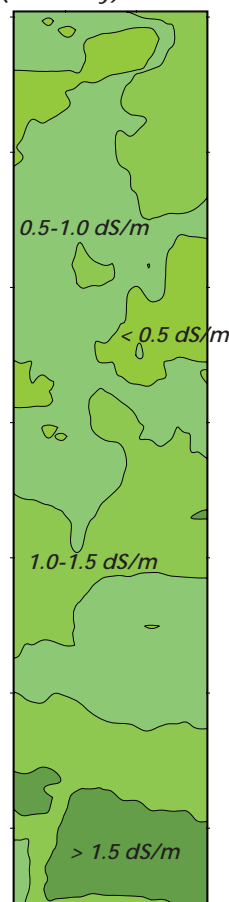


Yuluma in Profile...

- The Yuluma paddock has variable salinity levels across two main soil types, grey and red/brown vertosols.
- 45Y77 canola was sown in the paddock on 30th April. As expected, there was no effect of subsoil salinity on emergence.
- Representative areas of the paddock were selected for monitoring with an average plant population of 15 plants/m²:

- ▶ Each area was EM surveyed (Figure 1), with values ranging up to 2.5 dS/m.
- ▶ Soil cores taken from the same areas showed that where the EM reading was high, EC and chloride concentrations were also **high between 80 to 160cm** (up to 2.6 dS/m and 3250mg/kg chloride).

Figure 1 - Apparent electrical conductivity (EM survey) at Yuluma



- ▶ Where the EM reading was low, EC and chloride concentrations were also **low below 80cm**.
- ▶ If the season permits, dry matter, yield and rooting depth will be measured to determine how they correlate to the range of EC and chloride concentrations.

Figure 2 - Yuluma paddock 29th July '08; areas with high EM readings correlated to high EC and chloride measurements.



Photo: T. Swan

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 kirily@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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