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Canola in Depth

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

This edition focuses on canola water use efficiency (WUE) - how to calculate it more accurately and what it means for understanding crop performance. A CSIRO study has shown canola WUE values of 15kg/ha/mm are possible where rainfall timing is optimum for crop demand, water losses are minimal and sowing is timely. Lower WUE values, however, do not necessarily reflect agronomic constraints, but may be a result of poor rainfall timing, higher water losses through runoff or evaporation, or later sowing.

Water use efficiency (WUE) of canola

► Calculating WUE

The French & Schultz method of calculating crop WUE using growing season rainfall has been widely used due to its relatively simple formula. However its simplicity also means that several important factors are not taken into account, including ***stored soil water at sowing*** and ***soil water remaining at harvest***.

Michael Robertson and John Kirkegaard from CSIRO have incorporated these factors into a refined 'French & Schultz' method for calculating WUE in canola. This method is more complex but significantly improves the accuracy of WUE calculations without the use of simulation modelling. The formula is:

WUE = yield/seasonal water supply (SWS)

where **SWS**

= in-crop rainfall[a] - 120mm (evaporation)

+ soil water at sowing[b] ☞ (fallow rainfall - 80) x 0.5[c]

- soil water at harvest ☞ (post flowering rain - 50) x 0.5[d]

[a] *in-crop rain up to 450mm (above which yield is not water limited)*

[b] *assuming a weed free fallow with stubble cover*

[c] *can vary factor according to timing of summer rain, eg. 0.6 if majority falls in March, or 0.4 if most falls in December*

[d] *can vary from 0.2 - 0.5 in drier locations, or 0.5 - 1.0 in wetter areas*

► What does it mean?

By accounting for soil water at sowing and water remaining at harvest, the ability to predict yields increases significantly. In a study of 42 canola crops in southern NSW where yield was related to different methods of measuring available water:

- *in-crop rainfall* explained 30% of yield variation
- *April to October rain* explained 48% of yield variation (better than in-crop rainfall as it accounts for rain shortly before sowing and discounts rain close to windrowing)
- ***in-crop rainfall + soil water at sowing less soil water at harvest*** explained 68% of yield variation
- *APSIM modelling* explained up to 82% of yield variation due to the ability to simulate daily soil evaporation. (NB. FarmLink is trialling commercial application of the canola APSIM model through 'Yield Prophet', producing monthly predicted yields of four canola crops in the region in the 'Weather or Not' fact sheets.)

► WUE targets?

Although each of the 42 crops studied yielded to their water limited potential (free of weeds, pests, diseases, nutrient deficiencies), ***WUE varied between upper and lower boundaries of 15 and 8kg/ha/mm*** respectively, with an average of 11kg/ha/mm. Modelling showed this variation in WUE was due to ***rainfall timing*** and ***sowing time,*** rather than other agronomic constraints:

- Crops achieving 15kg/ha/mm occurred where rainfall was well-timed to match crop demand, water losses from deep drainage, runoff and evaporation were minimal and crops were sown on time.
- Conversely, crops achieving 8kg/ha/mm were penalised by poorer rainfall timing, increased water losses and later sowing* - but not by other agronomic constraints as all crops yielded to their water limited potential.

**WUE declined, on average, by one-third between early April sowings and early July sowings.*

Source: Robertson, MJ & Kirkegaard, JA (2005) Water-use efficiency of dryland canola in an equi-seasonal rainfall environment. *AJAR* **56**, 1373-1386.

Project Partners:

EH GRAHAM CENTRE for Agricultural Innovation
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Project Update 2009

The (unfunded) 12-month extension to the project has paid off, with winter rainfall at the Culcairn, Yuluma and Rand sites allowing treatments to be assessed without moisture being the limiting factor!

a) Acidic, compacted subsurface sites:

- **Culcairn -** Garnet & Hyola 50 sown 12th May over deep ripping/liming treatments from 2007.
  - ► Canola again showed no response to injected lime (or deep ripping), suggesting these varieties are not susceptible to the levels of aluminium in the subsoil *(surface soil was limed).*
  - ► However barley (acid sensitive Hindmarsh) sown at the same site *did* show visual responses in early spring to deep ripping and injected lime.

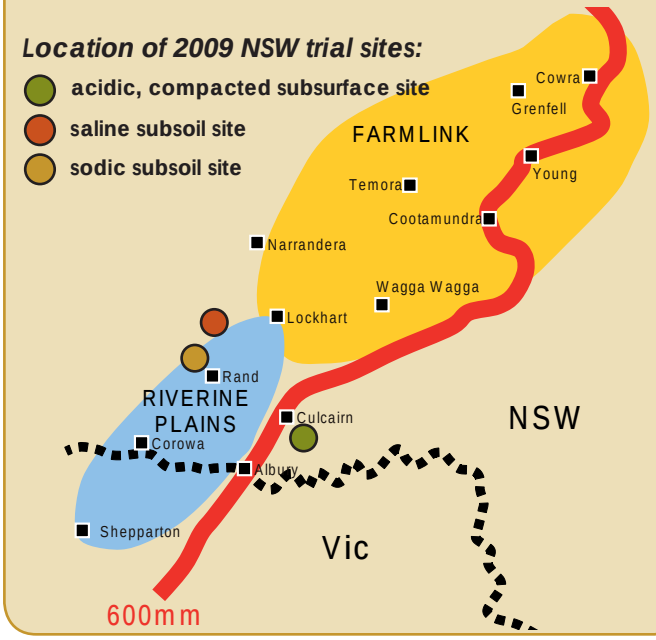
b) Sodic, compacted and/or saline subsoil sites:

- **Rand -** Canola sown over deep ripping/injected gypsum treatments from 2008.
  - ► Canola again showed no response to deep ripping or injected gypsum.

    Research to date has shown little evidence to support deep ripping in the region, except in combination with gypsum on sodic soils in wet years (>400mm rainfall).
- **Yuluma -** 45Y77 sown 17th April into paddock with variable salinity levels.
  - ► From an EM survey of the paddock in 2006, 20 areas with salinity levels ranging from 90 to 275 EC_a* were selected for monitoring in 2009.
  - ► Measurements taken in September show canola dry matter decreases as EC_a increases *(where high EC_a is due to sodium salts).*

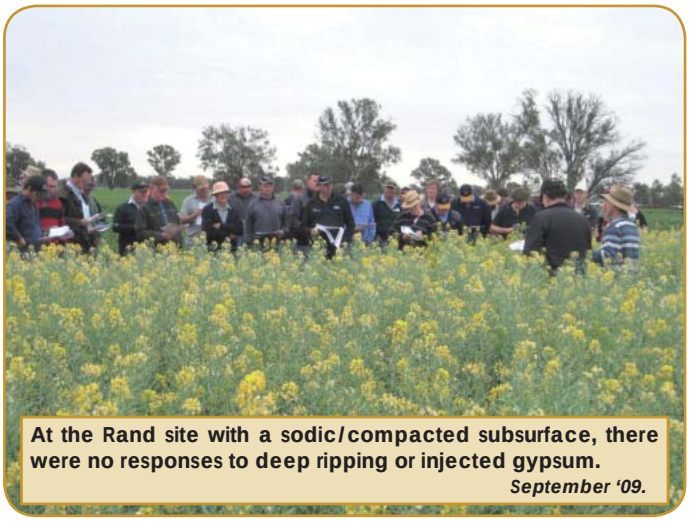
*ECa (apparent electrical conductivity) is a measure of soil salinity.

Location of 2009 NSW trial sites:



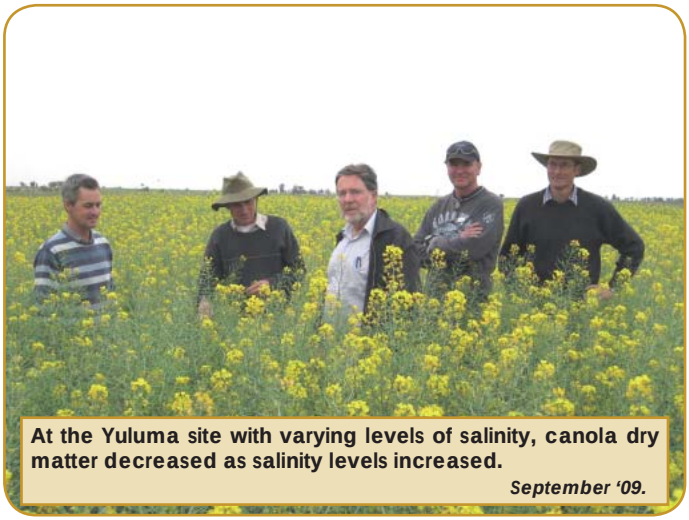
At the Culcairn site with an acid/compacted subsurface, only acid sensitive barley, not canola, showed a growth response to deep ripping and injection of lime. ***September '09.***

Photo: M. Peoples



At the Rand site with a sodic/compacted subsurface, there were no responses to deep ripping or injected gypsum. ***September '09.***

Photo: M. Peoples



At the Yuluma site with varying levels of salinity, canola dry matter decreased as salinity levels increased. ***September '09.***

Photo: M. Peoples

For more information...

- **Canola in Depth fact sheets -** past 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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