Can soil management improve canola yields? – making money from muck.

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- Surface applied pig bedding litter (organic matter) boosted canola yields by 7%. Its effects may be due to a combination of additional nutrition and improved structure in the topsoil and shallow subsoil.
- Deep nutrients alone were not sufficient to increase yield, despite greater initial plant growth.
- There was no effect of deep ripping on canola yield for this soil during this below-average rainfall season.
- For this soil, salinity and the osmotic and toxic effects of sodium may be imposing the biggest constraint to root growth and water extraction.
- Wherever possible, choose a variety with a blackleg resistance rating consistent with the blackleg risk of the paddock.
- This trial comprises part of a Grains Research & Development Corporation project – "the contribution of subsoil constraints to canola yield decline".

Introduction

Canola yields in southern NSW have declined by up to 9% over the last decade (Mead *et al.,* 2005). This lagging performance may *in part* be due to the spread of canola onto less fertile soils where subsoil conditions may be reducing yield. Factors such as high sodium, hard pans and boron toxicity may all limit crop growth.

The current research aims to assess the relative contribution of subsoil constraints to canola and identify best management practices, through a range of potential subsoil remediation treatments that will increase the adaptation of canola crops to more marginal soils.

Down and dirty: DPI Soil scientist James Nuttall discussed subsoil constraints to canola growers at the Brimpaen trial site, October 2007

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2007 CANOLA & JUNCEA CANOLA TRIALS

Methods

Two sites were selected in 2007, Brimpaen in the southern Wimmera and Birchip in the southern Mallee of Victoria. The Mallee trial failed due to extreme drought, so its results are not discussed here.

Before sowing the Brimpaen site, the researchers undertook pre-sowing soil remediation treatments. The property owner sowed the plots using his own equipment.

Treatments included:

- district practice (control)
- deep ripping to 40 cm with 600 L/ha Gyplife slotted
- deep ripping alone
- organic matter as composted pig bedding straw (surface applied at 20 t/ha), and
- deep (20 cm) nutrients (25 kgP, 10 kg Zn & 50 kg N per ha).

After the pre-treatments were applied, nitrogen (55 kg N/ha) was predrilled by the grower and sown to the canola variety ATRBeacon (3.5 kg/ha). Water use and growth of canola was compared across the treatments. The impact of disease was also monitored over the growing season.

Results

The soil at Brimpaen was an alkaline duplex profile (Fig 1). The soil on average became saline (> 0.4 dS/m) by 50 cm and potentially limiting to annual crops such as canola (> 0.8 dS/m) at 80 cm. This soil also was sodic (exchangable sodium percentage, ESP > 6%) at 50 cm. Seasonal cracking was also apparent in the subsoil.

Canola establishment (average 63 plants/m^2) was even across treatments with no negative impacts of soil disruption due to deep ripping.

At rosette emergence, crops growing on composted organic matter produced 30% more biomass, and deep nutrients produced 20% more biomass compared with the control (Fig 2). Deep ripping did not affect early canola growth.

The initial effects of surface applied organic matter and deep nutrients, however, did not translate through to flowering.

Rainfall between sowing and flowering was 123 mm and from flowering to maturity was 71 mm (Growing season rainfall: 194 mm).

At harvest, canola yield averaged 2.6 t/ha. Organic matter significantly boosted yield by 7% compared with the district practice (Fig 3). Deep ripping, with or without gypsum, did not increase crop yields compared with district practice.

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Figure 1: Mean soil properties for a duplex profile at Brimpaen, Victoria. Ranges are defined by the broken lines and indicate the intra- and inter-plot variability for the canola yield decline trial site.

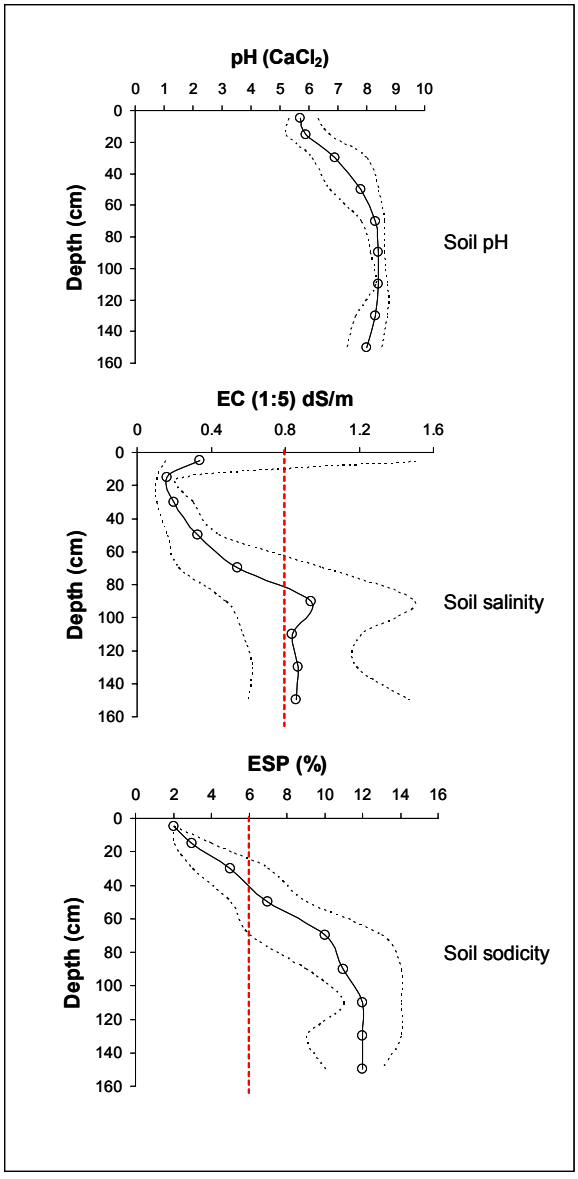


Figure 2: Canola growth at the rosette emergence stage during 2007 growing season, given the effect of 5 agronomic treatments at Brimpaen Victoria.

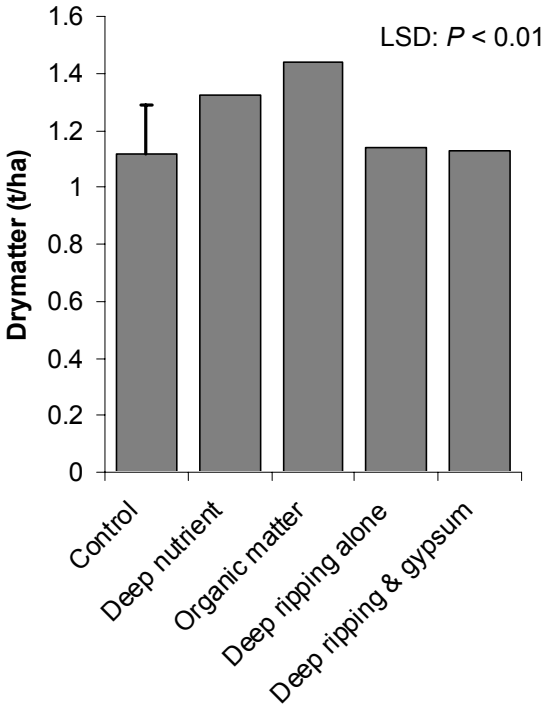
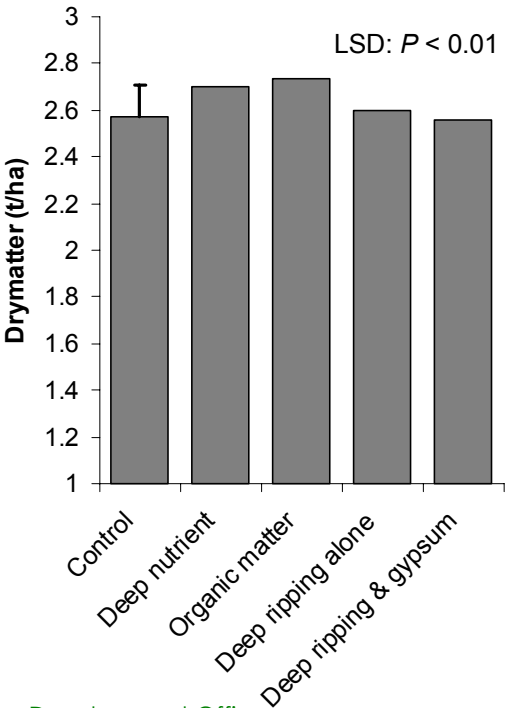


Figure 3. Canola yield for the 2007 growing season, given the effect of 5 agronomic treatments at Brimpaen Victoria.



The disease blackleg caused an estimated average of 24% yield loss across plots (Marcroft pers. comm.). As the variety, ATRBeacon has a moderately resistant blackleg rating, the choice of variety may have not been ideal for the environment. (The cultivar variety, however, was out of the control of the grower due to seed availability.)

The increase in canola yields by the composted organic matter may be due to a combined effect of improved nutrition (especially nitrogen and phosphorus) and improved structure in the topsoil and shallow subsoil.

Evidently, additional nutrients alone were not sufficient to increase yield, despite being encouraging in the early growth phase of the canola.

The soil often becomes water logged during 'average' seasons and the lack of response to deep ripping may be due to the unusually dry conditions and seasonal cracking observed within the subsoil. Evidently, advancing root tips may have been able to penetrate the subsoil where water extraction and drying initiated subsoil cracking allowing further penetration. Overall this may have negated any advantages derived from where deep ripping was imposed. Within this soil type, salinity and osmotic and toxic effect of sodium may be the greatest constraint to root growth and water extraction. Further analysis of soil water extraction may provide further insight into these results.

Commercial practice

This research provides evidence to suggest that soil structure and nutrition, as well as the disease blackleg, may be limiting canola yields in the southern Wimmera. Although the application of organic matter boosted yields, its cost-effectiveness will depend on the grower's proximity to a source of animal manure, as freight costs may be prohibitive. Growers need to also be aware that yields may be severely reduced by growing outclassed canola varieties with resistance ratings less than adequate for their location or risk level of blackleg.