Vivonne Bay drainage trial: an update

Background

Ironstone soils have a range of limitations to crop root exploration and as a result, water use and yield. Hard gravel and impermeable clay layers below the top 15 cm can cause seasonal perched water tables and waterlogging is the result.

Following consultation with the Island's Graingrowers' Association, a demonstration site was established on the Pontifex property at Vivonne Bay in 2007 to test the ability of a range of drainage treatments to improve crop yields in soil prone to waterlogging.

What was done

Drainage Treatments

The raised beds, gravel slots and gravel mole treatments were installed in April 2007 with the conventional mole being added in April 2008 and a delved and spaded treatment in early 2009.

TABLE 1
Drainage treatment details

Drainage treatment	Spacing (metres)	Depth (cm)
Raised bed	8	50
Gravel slot	8	50
Gravel mole	8	50
Conventional mole	8	30
Delved/Spaded	2	35cm
Control	0	0

The site was sown to canola in 2009 across all treatments. Due to the severe waterlogging impacts (and poor resultant growth) on most treatments, the site was reaped as a whole and anecdotal recordings kept.

Water Monitoring

To monitor drainage over the growing season, a tipping bucket rainfall gauge was used to measure rainfall and data loggers on v-notch weirs monitored between treatments.

IMAGE 1
Data loggers and v-notch weirs used to measure water-flows

Results

Canola yields

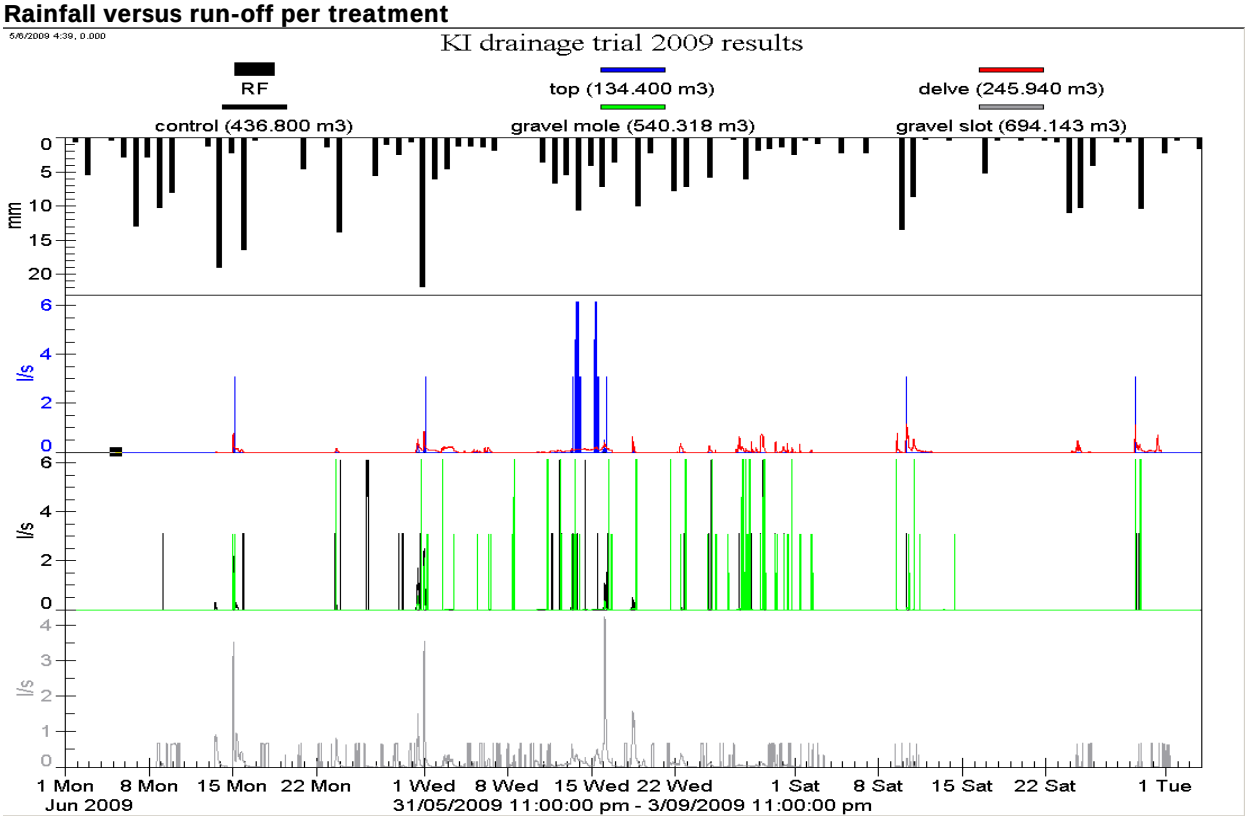
All treatments yielded more than the control in a year when waterlogging was very evident for most of the winter/early spring. The raised bed treatment was almost double the yield on all other treatments and the control had a zero yield. The gravel slots and mole treatments had noticeably high yields directly over the slots/mole runs with minimal growth between treatments.

Water Monitoring

To monitor drainage over the growing season, a tipping bucket rainfall gauge was used to measure rainfall and data loggers on v-notch weirs monitored between treatments.

Plotting rainfall against drainage per treatment (Figure 1) shows that whilst there was considerable rainfall in May, there was no run-off until the second week in June as the ground was wetting up. Then from June onwards there was more run-off from the same amount of rainfall as the soil was then saturated until it started to dry out again in spring. Note: due to a data logger error there were no separate run-off values for the control and conventional mole.

FIGURE 1
Rainfall versus run-off per treatment



Actual volumes drained per plot in Table 2 shows the maximum drainage that occurred from the gravel slots, although due to the design layout and the flatness of the site, the reading for the gravel slot treatment was probably not a true reflection of the actual drainage that occurred. Due to a data logger error, readings for the control and conventional mole were combined.

Whilst the raised bed recorded the highest crop yield it did not drain the most water. This also occurred in 2007 and 2008, indicating that the formation of the actual beds had an impact on yield in addition to the drainage impacts.

What next?

This trial has now finished. In 2010 work will focus on work from WA looking at the micro-nutrient toxicities that occur in waterlogged soils (principally iron and aluminum).

TABLE 2
Water drained with different drainage treatments

Drainage treatment	Water drained (kL)
Raised bed	53
Gravel slot	80
Gravel mole	60
Delve/spaded	64
Conventional mole*	87
Control*	

* Note: due to a data logger error there is no separate run-off values for the control and conventional mole.

IMAGE 2
Control on the left, delved/spaded treatment on the right. Both were seeded to canola. Note the lack of growth on the control due to severe waterlogging impacts.

Funding/Sponsors

- National Landcare Program through the Kangaroo Island Natural Resources Management Board
- Pontifex family

For further information contact

Lyn Dohle, Rural Solutions SA, Kingscote on 8553 4999 or email dohle.lyn@saugov.sa.gov.au

Take home messages

- In a year where waterlogging caused severe yield penalties, all treatments resulted in a yield increase compared to the control
- On flat waterlogged land, raised beds provided the best yield result but they do have some management issues
- The delved treatment drained a considerable amount of water, yielded equal to the other treatments (but less than the raised beds) and was more cost effective to install with fewer management issues
- Gravel slots and gravel moles also worked extremely well but the slots were too expensive to install to consider for broadacre use. No commercial scale gravel mole is available at present
- Conventional moles are prone to collapse with Kangaroo Island's sodic clays.