DIGIFARM PROJECT: Use of capacitance probes in dryland cropping

Background

Cropping in Australia is limited by moisture supply and in northern cropping areas stored soil moisture is of particular importance. Measuring soil moisture assists decision making in cropping. A grower may decide to spread extra nitrogen on a paddock if the level of stored soil moisture is favourable towards the end of tillering and seasonal outlook is favourable.

Push probes are low cost and can be used to make multiple estimates of depth of wet soil but lack accuracy. Soil sampling has higher accuracy but has a high cost in labour. Capacitance (C) probes have been used in irrigation for some time now and offer remote real time access to soil moisture levels and are used to schedule irrigation. A SIM card enables the user to access data remotely from a website.

Use of capacitance probes in dryland agriculture has been limited to date partly due to cost and partly due to more limited opportunities to make decisions based on soil moisture in dryland situations.

How does it work?

Capacitance is defined as the amount of charge a substance can hold. Capacitance probes work by measuring the change in capacitance of soil related to changes in moisture content. This can be used to monitor changes in soil moisture over time. For greater value the capacitance values can be calibrated for a particular soil type by using traditional soil sampling and oven drying to determine gravimetric moisture at different soil moisture levels. We placed capacitance probes in a dryland canola crop and a fallow at Mullaley in NSW. For the probe in the fallow soil sampling for moisture was carried out in the vicinity of the probe at installation and removal.

Pros/cons

- The lower labour input involved (installation and maintenance is usually carried out by a service provider) and remote access to data is appealing to growers.
- As with other forms of soil moisture measurement the volume of soil with which the probe interacts is quite small meaning the placement of the probe is important.
- To understand variation in soil moisture across an area multiple probes at

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increased cost are required and cost is still a deterrent to wider application.

At Mullaley the change in soil moisture in mm measured by soil coring near the probe reflected the change in soil moisture measured by the C probe giving confidence that probes accurately reflected changes in soil moisture.

Farmer/advisor experience using the technology

At Mullaley growers found it useful to be able to monitor moisture use by the canola crop and on the farm in question it enabled the grower to determine the depth of rooting by the crop and the extent of any moisture left over after harvest. “It enabled us to gain some insight into the pattern of moisture use by canola”. Monitoring of fallows as well as giving growers a more accurate estimate of soil moisture improves understanding of the process of moisture accumulation in vertosols.

What’s next?

Greater use of capacitance probes in dryland crops and fallows will depend upon reductions in cost particularly if the industry is to move towards spatial management of water.

Management of moisture in the future may well involve using a greater range of data sources such as satellite NDVI, terrestrial weather stations in conjunction with moisture sensors to model soil water.

This technology may become linked to crop growth models that provide real time estimations of potential yield and this may provide the incentive to use C probes more widely in dryland crops.

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