Moisture probes boosting decision-making confidence

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Soil moisture probes were developed to help irrigators decide when to apply water. Dryland grain growers are using them to help them make crucial management decisions including when and what to plant, whether or not to top-dress in-crop nitrogen (N) and marketing.

SOIL MOISTURE PROBES LIKE THIS ONE IN A CROP OF WHEAT PROVIDE DETAILED INFORMATION ABOUT HOW MUCH MOISTURE IS PRESENT AND WHERE IT IS IN THE PROFILE, WHICH CAN HELP IMPROVE GROWER DECISION MAKING.

Grain producers are increasingly using continually-logging soil moisture probes to track what is happening with moisture levels below the surface of their paddocks.

Being able to quantify how much moisture is in a soil at a particular time can have a profound effect on the judgements grain growers have to make, and having access to measured soil moisture levels is improving grower confidence and decision making.

A probe senses soil moisture in close proximity to it, providing detailed information about how much moisture is in the soil and where it is in the profile.

Readings from individual sensors at different depths along a probe, which is usually permanently installed in a paddock, shows where moisture is located within the profile, and changes in moisture levels can show where roots are active.

Each probe logs the information it gathers. This data can be transmitted automatically to a remote computer via the 3G network.

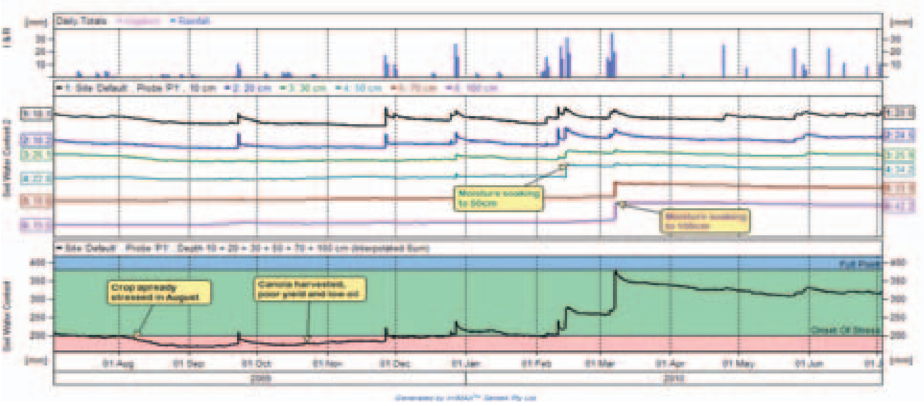
The benefits from a probe increase from year three onwards, because comparing graphs of data from multiple years with a variety of crops provides additional information that can have an immediate impact on day-to-day decision making.

Installing soil moisture probes as part of a neighbourhood network can multiply the benefits of the installation by providing participants with access to data from multiple sites with different soil types across different cropping systems and rotations for the cost of only one or two probes on each property.

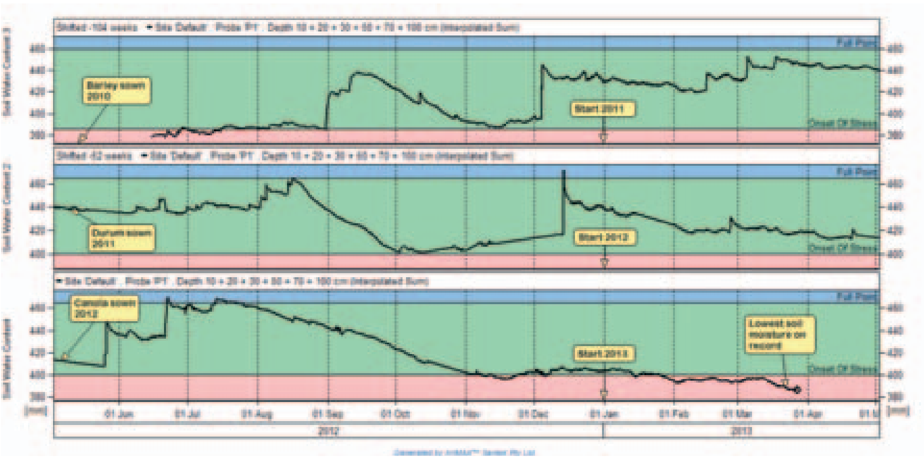
Planting

Soil moisture data logged on a continual basis can be readily graphed and turned into a visual historic data base that, with a quick glance, can show how full or empty the profile was at any point in time.

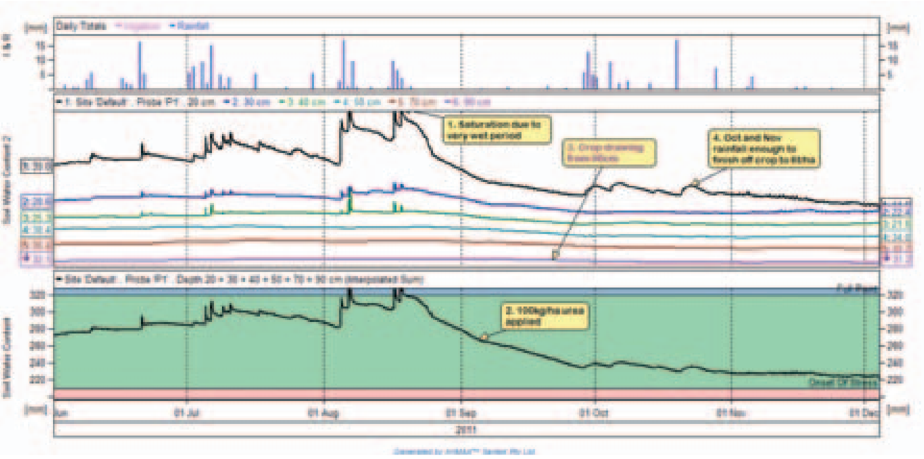
This information is particularly useful for assessing the effectiveness of summer



GRAPH 1. THE SOIL MOISTURE GRAPH FROM THE TEMORA SITE SHOWING LOW MOISTURE CONDITIONS THROUGH 2009 AND HEAVY RAINFALL EVENTS IN THE SUMMER. RAINFALL EVENTS ARE IN BLUE BARS (TOP PANEL), DATA FROM INDIVIDUAL SENSORS IN MULTICOLOURED LINES (MIDDLE PANEL) AND TOTAL MOISTURE IN THE TOP ONE-METRE PROFILE IN BLACK (BOTTOM PANEL).



GRAPH 2. THE YEAR-ON-YEAR COMPARISON RUNNING FROM JUNE 2010 SHOWS CURRENT SOIL MOISTURE LEVELS AT PASKEVILLE ARE AT RECORD LOW LEVELS. THIS INFORMATION IS MAKING GRAIN PRODUCERS CONSIDER PLANTING CROPS WITH A LOWER RISK OF FAILURE IN A DRY SEASON.



GRAPH 3. THIS GRAPH SHOWS A CLASSIC PICTURE FOR SOUTH-EASTERN AUSTRALIA, WITH THE ROOT ZONE REACHING FULL MOISTURE DURING LATE WINTER, THEN A LONG DRAW DOWN DURING SPRING AS THE WHEAT CROP EXTRACTS MOISTURE TO FILL GRAIN.

rainfall events in cropping districts with winter-dominant rainfall patterns like those in SA.

The 2012-13 summer has been relatively dry, but prior to this year, south-eastern Australia had above-average summer rainfall in several years.

At the start of the 2009 season, a soil moisture probe was installed in a paddock planted to a crop of canola south of Temora, in southern NSW. Winter growing-season rainfall in the Temora district was very low in 2009, and yields were very poor. However, a lot of rain fell between late December 2009 and April 2010. The rainfall records showed the amount of precipitation in that period, but it was the data generated by the soil moisture probe that helped shape the grower's planting decisions for the 2010 season. (Graph 1.)

The individual sensors on the soil moisture probe showed how deep moisture was soaking with each significant rainfall event of the summer. By observing these spikes in moisture moving down the profile, the grower gained confidence that moisture would be available to fill his grain at the end of the season. His poor 2009 canola yields might ordinarily have influenced him to reduce the area planted to canola, but the soil moisture probe data gave him the confidence to increase his canola plantings for 2010 and indicated that planting relatively early would be very low risk.

The picture painted by this year's soil moisture data in SA is quite different from that scenario, with very low moisture levels across much of the State. In the example below, a graph of year-on-year summed data from Paskeville, on YP, shows that current readings are the lowest on record (since June 2010 when the probe was installed). Knowing this historically low soil moisture level has been a factor in growers changing crops from those such as canola, which has a higher risk of failure in a below-average season, to those such as field peas and barley, which have a lower risk of failure in dry conditions. (Graph 2.)

In-crop nitrogen

For much of SA the 2011 and 2012 seasons saw quite good growth during winter, but spring rainfall was below average, making decisions about whether or not to apply nitrogen to crops a challenge. The good growing conditions during winter meant there were some quite bulky cereal crops that by early September looked as if they were requiring nitrogen. The use of a soil moisture probe in these conditions proved its worth many times over, as illustrated by one grower's experience at Arthurton, on YP, in 2011. The soil reached saturation point on August 18. Conditions following this were perfect for crop growth, with warm temperatures and sunny days with minimal cloud, but little rain was forecast. (Graph 3.)

With a small rainfall event forecast for September 5, the grower made a decision to apply 100 kg/ha of urea to the crop. The soil moisture graph showed that the moisture profile to 90 cm was only half empty at that time and it was apparent that there was still was moisture left in the top 10 cm of the profile, which is important to know if one is applying urea with the expectation that it will be taken up by the roots. Even though only 1mm of rain fell in the predicted rainfall event, a dense crop canopy and some moisture at ground level saw all granules dissolve within 48 hours. The crop yielded 6 t/ha of H2 wheat; an outcome due in part to the grower's increased level of confidence in his decision making based on the data from the soil moisture probe.

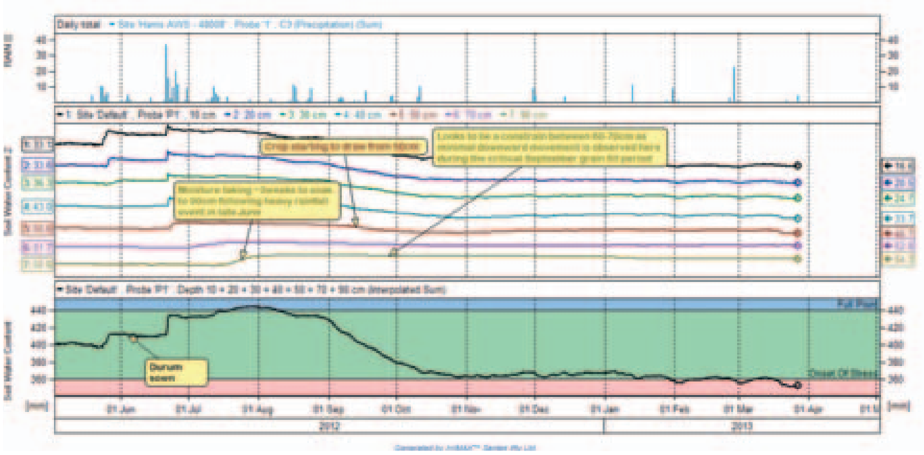
In 2012, growers in the same area used soil moisture data in making a call not to apply nitrogen during September. In this instance the crop had grown well early and produced a lot of bulk, but the data from some moisture probes showed that the crop was drawing moisture from well down the profile and it was unlikely that yields would be anything more than average at best.

Several growers used this information to help make a decision to leave the spreader in the shed; a decision that ultimately proved to be a good one.

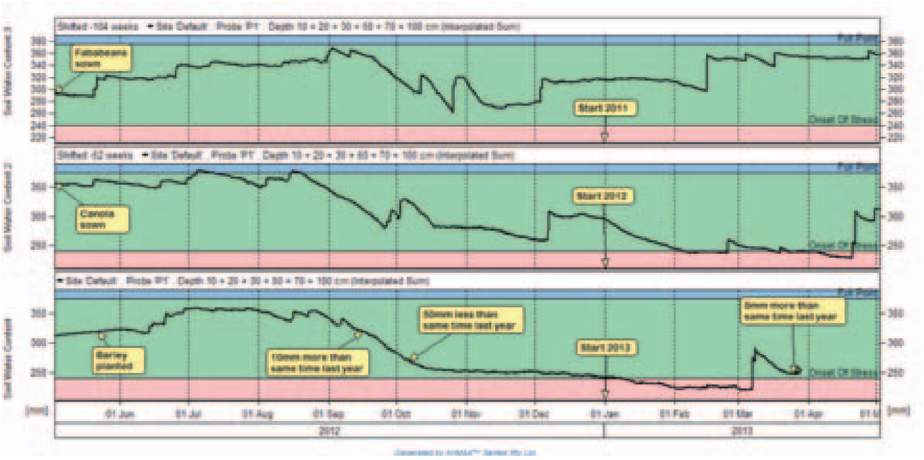
Soil constraints

The water use patterns revealed by soil moisture probe graphs have shown some growers that a soil constraint is preventing their crops from using all moisture in the theoretical rooting depth zone. The below graph from 2012 shows the soil layers below 60 cm filling up slowly from June rainfall, and this moisture remaining untouched by the crop during the September grain-fill period. The soil type at this probe site is prone to some boron toxicity issues, but in this paddock the symptoms are rarely observed in crop. These data show that, even when there are no clinical symptoms of boron toxicity, the high-boron layer can still check growth and reduce yield potential by limiting the crop's access to moisture below the boron layer in the profile. (Graph 4.)

The lack of root growth below 60 cm is a concern to the grower, but ameliorating boron toxicity at this depth is uneconomic.



GRAPH 4. THE MIDDLE PANEL SHOWING THE READINGS FROM THE INDIVIDUAL SENSORS CLEARLY ILLUSTRATES THAT THE SOIL BELOW 50 CM TAKES IN MOISTURE DURING EARLY JULY, AS INDICATED BY THE LINES MOVING UPWARDS. HOWEVER, THERE IS NO DOWNWARD MOVEMENT DURING SEPTEMBER; INDICATING NO ROOTS AT THIS LEVEL TO EXTRACT MOISTURE, SO THE MOISTURE REMAINS UNUSED.



GRAPH 5. A YEAR-ON-YEAR COMPARISON SHOWING DIFFERENT LEVELS OF MOISTURE AVAILABLE DURING THE CRUCIAL OCTOBER PERIOD.

Instead, the grower has decided to apply chicken litter with the aim of getting the most out of the top 60 cm of soil from which the crop can access moisture and nutrients.

This soil type is only part of this grower's farm, so site-specific crop management using variable rate application is the next step to increasing profitability.

Marketing

Selling grain prior to harvest can lock in good prices, but it is important to have accurate yield estimates when making decisions about whether or not to forward-sell, or how much to commit.

Soil moisture probe data can increase the level of confidence in making these decisions because they reveal exactly how much moisture is located where in the profile during the stressful and critical month of October. And a year-on-year comparison can show where soil moisture is in relation to previous seasons.

A graph of data from a probe at Yeelanna, on EP, showed that in early October last year the crop of barley in that paddock had 50 mm less moisture available than the canola crop in the same paddock at the same time the previous year. Given this information the grower decided not to forward-sell any more barley because the risk far outweighed the benefits. He would probably have made the same decision without the probe data, but having measured soil moisture levels made reaching that position less stressful and more straightforward than it would have been without the moisture data. (Graph 5.)

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