Understanding Soil Moisture Probes

Riverine Plains Soil Moisture Probe and Weather Station network

Riverine Plains hosts a network of on-farm weather stations and moisture probes across north east Victoria and south eastern NSW.

As part of a project funded by the Australian Government's Drought Communities Program, in conjunction with Federation Council, five new moisture probes were installed at Boree Creek, Urana, Daysdale, Oaklands and Rennie during 2020 (Figure 1). The installation of these probes has expanded the Riverine Plains Moisture Probe Network to a total of 30 soil moisture probes, 18 of which are also associated with on-farm weather stations.

This network of soil moisture probes and weather stations can be freely accessed through the Riverine Plains website at www.rivereineplains.org.au

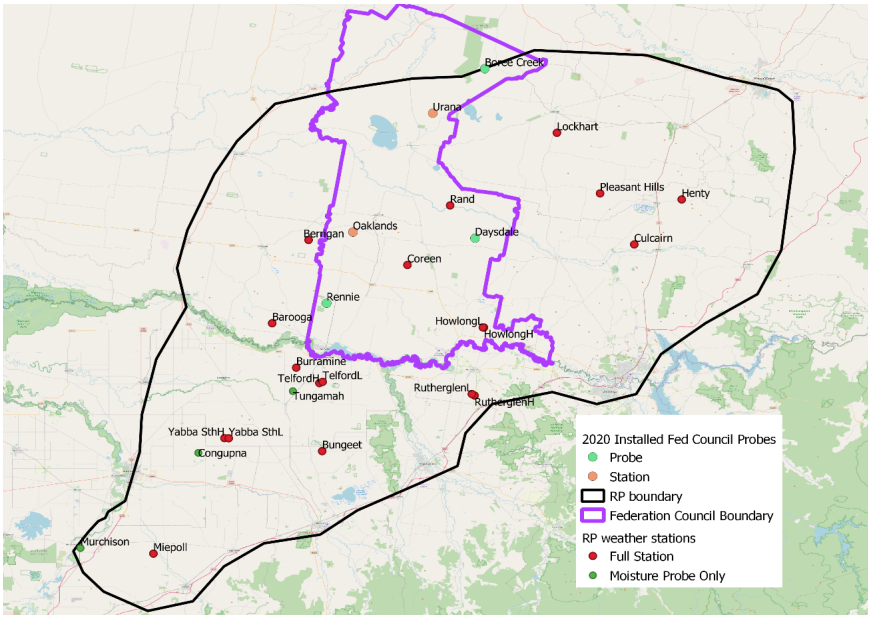

FIGURE 1 Location of Riverine Plains soil moisture probes, with those located in the Federation Council region indicated within the purple boundary.

How can moisture probes help farmers manage crops?

Understanding the capacity of different soil types in the region to store water, and the rate of water extraction by crops throughout the season, allows farmers to make more strategic management decisions regarding crop inputs. In dry seasons, this information can also help farmers decide whether to cut a crop for hay, or take the crop through to harvest if enough soil moisture is available.

The current Riverine Plains soil moisture probe network covers a variety of soil types, located in paddocks which are sown to a variety of different crops. When choosing which individual probe to reference, consider the applicability of soil type and crop, in addition to proximity to your location.

How soil moisture data is collected

The soil moisture probe (capacitance sensor) is a long tube, the top of which is placed 30cm below the soil surface. This means the probe does not measure transient surface moisture, and instead is more focussed on moisture at depth, where the roots are extracting water. Moisture measurements are taken in 10cm increments down to 140cm depth, with the sensors measuring soil moisture in an 8–10cm radius from the probe.

Interpreting soil moisture graphs

Soil moisture graphs are generally presented with annual rainfall figures to align soil moisture with rainfall events (Figure 2). Note: The black values on the left (i.e. 300.00mm water) correspond to soil moisture, while the blue values (i.e. 50.0mm) represent rainfall.

Summed graph displays

A snapshot of the total moisture content of the soil down to 140cm depth is available through the summed value display (Figure 2).

Some of these graphs also have horizontal lines which indicate the Plant Available Water content (PAW) of the soil. The Upper Limit (UL) indicates that the soil water has reached its drained upper limit (also known as Field Capacity [FC]), while the Lower Limit (LL) indicates the level below which plants cannot access soil water (also known as Permanent Wilting Point [PWP]).

The difference between the UL and LL is considered to be the PAW. Summed graphs have a limitation in that they assume soil moisture is equally available to the plant at all depths, however, for water budgeting strategies, it should be assumed that less than 50% of this water is accessible to plants.

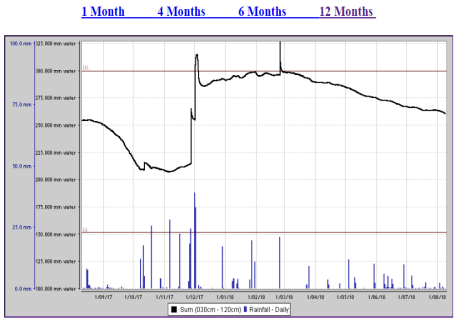

FIGURE 2 Summed value display for a soil moisture probe, where soil moisture at all sensor depths is added to give a total value for the soil profile. The horizontal lines denote the Upper Limit (UL) and Lower Limit (LL) of plant available water (PAW).

Separate Sensor Soil Moisture graph (depth increment display)

The Separate Sensor Soil Moisture Graph (with lines displayed in soil moisture level) display provides greater detail around water dynamics and root growth through the profile.

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While this type of display does appear more complex (Figure 3), soil moisture data is presented for each sensor, which makes it easier to tell how much moisture is being extracted by plant roots at a particular depth.

Soil type will affect how data from this display is interpreted. Three things to consider when reviewing this type of display for a given soil are;

1. A soil or layer containing a higher sand content will have a greater moisture content range, with most of the soil water able to be extracted by plants. While this moisture is readily available, it is also rapidly depleted and recharged.
2. A soil or layer containing a higher clay content can hold more water, however only a small proportion of this water can be accessed by plant roots, due to it being strongly held by the clay particles. Soils with increased clay contents have higher total values, but a narrower PAW range. As the moisture in clay soils is strongly held by the clay particles, it is only slowly depleted, which is of high value under drying conditions, due to its 'slow release' characteristics. This enables the soil to continue supplying water to roots for a longer period.
3. It is useful to use calendar dates, crop stages and rainfall events to pick points of the graph which correspond to significant drying and recharge events; this will help identify the UL and LL of plant-available water (PAW) for each depth. The difference between UL and LL can then be used to calculate the usable water in each depth (i.e. UL – LL = PAW; 31mm-14mm = 17 mm PAW at the 30cm depth). Note, this is a conservative approach that does not account for any additional water stored in the 0-30cm depth.

A more detailed interpretation and explanation of the factors that may affect the depth increment display is also presented in Figure 3.

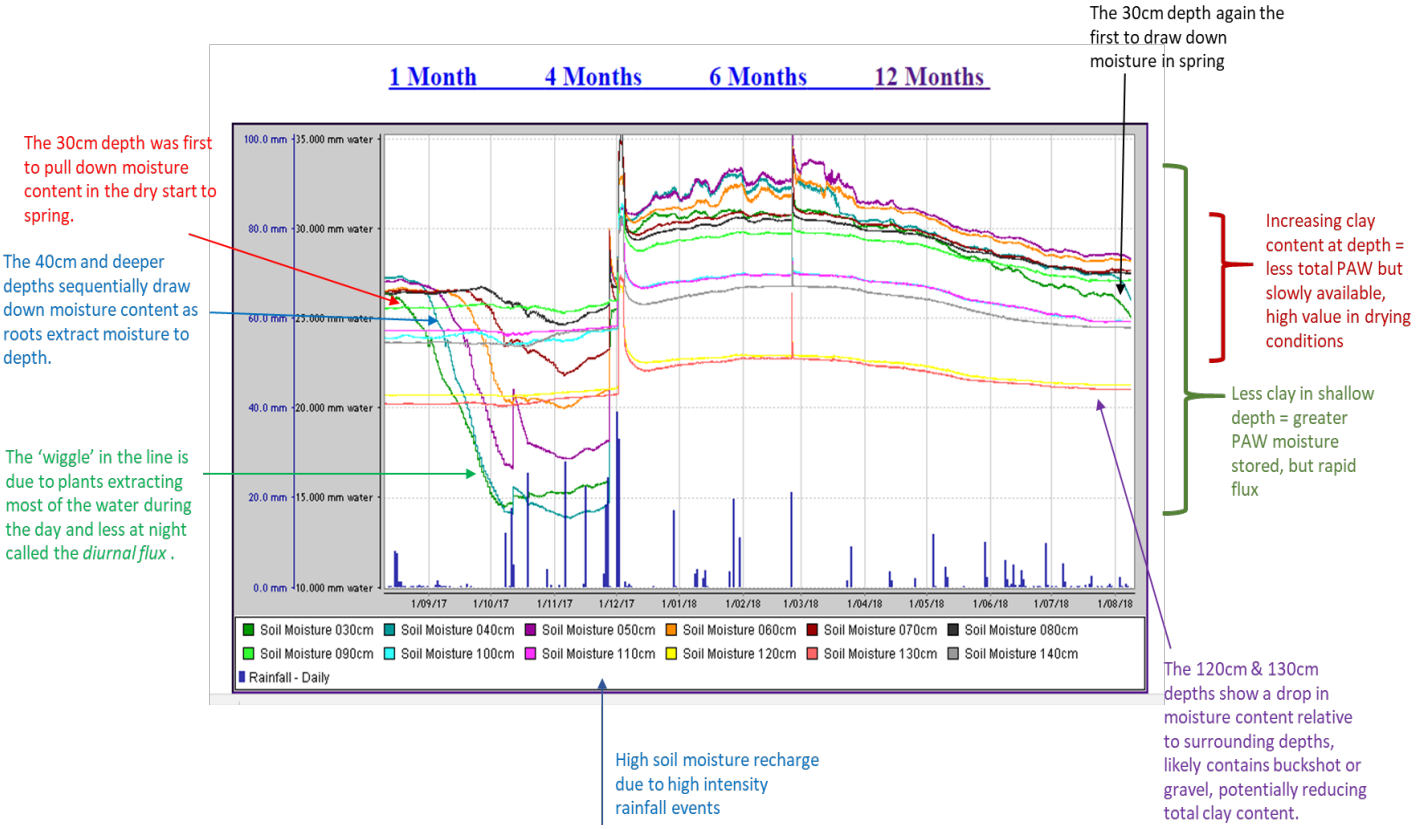

FIGURE 3 Separate Sensor Soil Moisture Graph (depth increment) with lines displayed in soil moisture level, where the recorded moisture at each depth is displayed separately. An interpretation of the display is also provided.

This information sheet and the installation of moisture probes at Boree Creek, Urana, Daysdale, Oaklands and Rennie was funded by the Australian Government's Drought Communities Program, in conjunction with Federation Council.

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