Mackay Irrigation Project

CANEGROWERS MACKAY

FACTSHEET 2

CROP WATER USE AND YIELD

Providing the right amount of water to the plant at the right time is crucial to increasing productivity.

This factsheet focuses on this critical aspect of irrigation and for the moment does not consider other issues such as the economics of applying more water, the efficiencies of equipment, nor their ability to meet crop demand for water.

Factsheet 3 will cover the issue of training roots down the profile.

Deeper roots mean greater extraction rates of water and nutrients, as well as better standability of the crop.

Allowing water extraction at deeper levels allows aerobic conditions down the profile which is better for soil health and reduces denitrification.

There are a myriad of variables so this factsheet will only focus on the basics.

TYPICAL SUM CHART

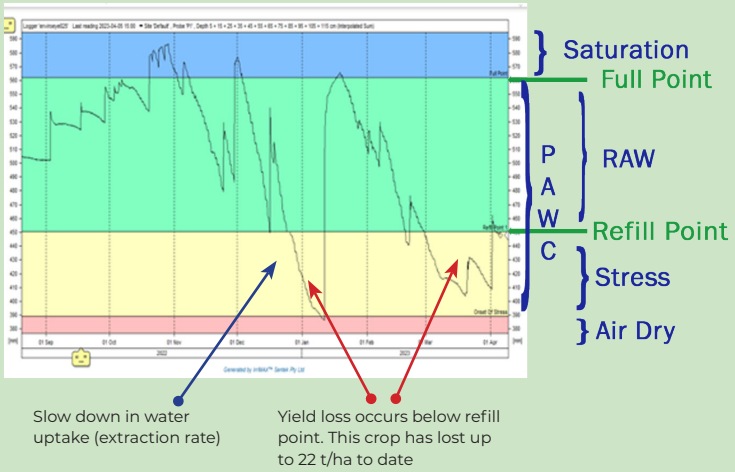

FIGURE 1

Figure 1 above is a typical "summed chart" giving the water balance in the soil as an addition of all the sensors available in the soil moisture probe.

This is sometimes only a qualitive amount unless the probe has been calibrated (can be done by just changing the scale). Some platforms can cater for this.

We can safely assume though that the amount of CWU (crop water use) has a direct relationship to the yield that will ultimately be achieved.

The intent therefore is to irrigate with the right amount of water so that water is available for all the roots to become active and maintain maximum growth.

Overwatering will induce runoff and deep drainage and reduce crop growth.

Underwatering may mean we do not activate root activity down the profile and reduce crop growth.

All soils have different water holding capacities. It is critical to know how much water your soil holds, also termed plant available water content (PAWC), and what the readily available water content (RAW) is (see Figure 1 for further explanation).

All soils have different RAW amounts and this can range from 30-70% of the PAWC. Below the RAW stage the plant starts stressing and water extraction rates slow down as does growth, until the plant can no longer extract any more (this limit is the air dry/ stress point).

Conversely if the soil remains too wet extraction rates also slow down and again and again limits growth and therefore the yield potential for the crop.

Mackay Irrigation Project is showing that:

Providing the right amount of water to the plant at the right time is crucial to increasing productivity.

This project is part of the Mackay Whitsunday Water Quality Program, funded by the partnership between the Australian Government's Reef Trust and the Great Barrier Reef Foundation.

Australian Government | REEF TRUST | Great Barrier Reef Foundation

READING SOIL MOISTURE PROBE DATA

Consider the data graphed below from a soil moisture probe with sensors 10 cm apart down to 1.2 m.

FIGURE 2

Each sensor, set at 10cm intervals, is indicated by a different colour in the data. A straight horizontal line indicates the plant is not taking up any water, while a sloped line indicates water uptake. The steeper the slope the greater the uptake.

The correct amount of irrigation was applied to replenish water to the bottom of the root zone.

Excess rain or irrigation after the first irrigation slows down extraction. If not enough water had been applied extraction would also have been slowed as the bottom layers would not have been replenished.

The plant is pumping water from all depths down to root activity.

As upper levels dry off from root water extraction, aeration increases and roots begin to extract at deeper levels. This can only occur if those deeper levels already had available water. When the plant draws water from all levels the plant is pumping at maximum efficiency using more water and nutrients.

Continuous water supply increases anaerobic conditions and root activity recedes up the profile with slower extraction rates. The plant becomes lazy and roots tend to be concentrated in the top layers if this situation continues.

The whole crux of the matter is that, by using available technologies we are able to get the right balance of soil moisture, and apply the right amounts of water at the right time.

By doing this we improve the ability of the plant to pump more water and use available nutrients to ultimately increase the yields achievable (see Figure 2).

Soil moisture monitoring equipment can be expensive but there are other ways to achieve this, such as by using modelling which would capture the predicted water balance in the soil and make available a good indicator as to when to irrigate.

A combination of modelling and probes is probably the most economic way to go.

It is advisable to use moisture probes and as a starting point to insert these in different soil types, so that you become familiar with the different nuances of your soil types.

It is also preferable to insert probes that can read soil moisture to expected effective rooting depth.

If your effective rooting depth is 1.2 m, placing a probe to 30 cm will not tell you enough about water availability down the profile and this can then lead to bad decision making.

By using available technologies we are able to get the right balance of soil moisture, and apply the right amounts of water at the right time.