

### HOW TO PROMOTE DEEPER ROOTING ACTIVITY AND INCREASE WATER EXTRACTION RATES

Broadly speaking, the intent of the Mackay Irrigation Project is to meet crop demand for water, thereby increasing yields and improving nitrogen use efficiency (NUE). Increasing crop nitrogen uptake reduces nitrogen losses from runoff and drainage, creating a win-win situation increasing productivity and delivering environmental benefits.

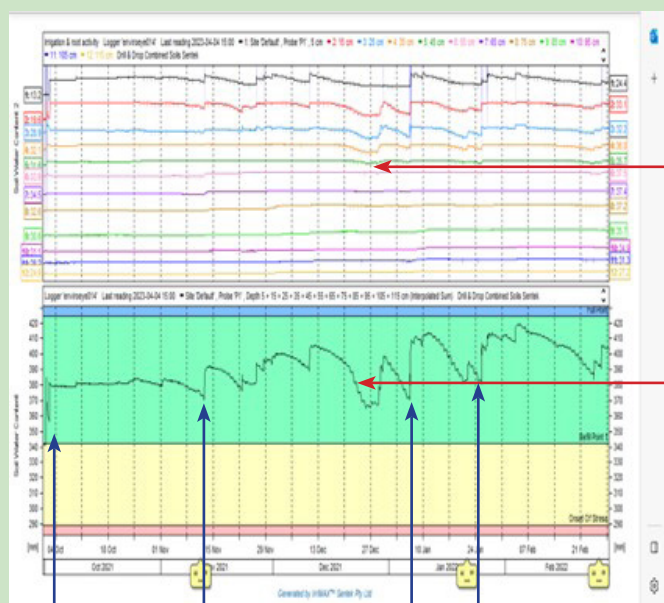
This factsheet focuses on some practical outcomes as a result of chart interrogation, and should be read in conjunction with Factsheet 2.

It is no secret that there is a direct relationship between crop water use (CWU) and yield. Training the plant to extract water from the soil faster (at a higher extraction rate) and deeper (increased root activity) within the soil profile will increase CWU.

At the same time this will increase nutrient extraction, which will reduce nutrient losses, more specifically nitrogen (N) due to its solubility.

Figure 1 (below) considers the performance of the same block of cane under two different irrigation strategies over two seasons, highlighting the difference.

### PREVIOUS IRRIGATION STRATEGY:



Irrigated 40 mm but profile not filled  
 Irrigated 25 mm  
 Irrigated 40 mm  
 Irrigated 25 mm

FIGURE 1

Root activity restricted to 50 cm.

Maximum extraction rate 6 mm/day in December.

Figure 1 shows that continuous light irrigations and rainfall restricted CWU, extraction rates and rooting depth, reducing crop growth.

CWU was 355 mm over the 5 month peak growing period (1/10/21 to 30/2/21).



Mackay Irrigation Project is showing that: *providing the right amount of water to the plant at the right time is crucial to increasing productivity, and minimising environmental nitrogen losses.*



## AN IMPROVED IRRIGATION STRATEGY

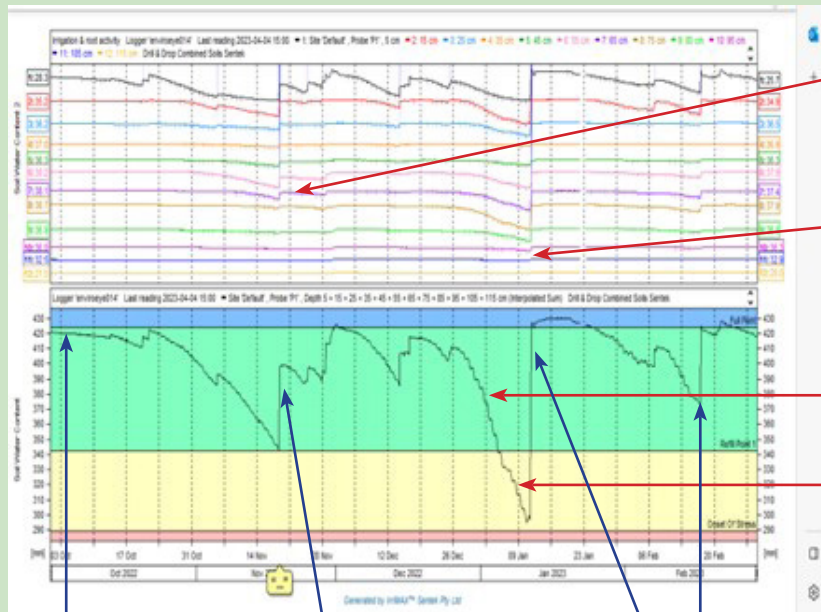


FIGURE 2



Irrigated to top up profile after harvest  
Irrigated 40 mm, plus rain, and topped up the profile  
Rainfall events

Effective rooting depth reached 80 cm during the first irrigation cycle.

And 110 cm during the second irrigation cycle.

Extraction rates of water reached a maximum of 12 mm/day and only slightly slowed down to 10 mm/day after the refill point.

Crop Water Use (CWU) increased to 480 mm over the five month period

In the following season 2022, and taking a snapshot again from October to February, the profile was filled soon after harvest and the plant allowed to drawdown water to the refill point. Rooting depth was increased.

The profile was filled again and allowed to drawdown until there was a slow-down in daily extraction rates. This slow-down did not happen to the same extent as would normally occur, with extraction rates of 12 mm/day above the refill point, and dropping to only 10 mm/day below the refill readily available water (RAW) point.

CWU was increased from 355 mm to 480 mm over this period: an increase from the previous year of 125 mm over 5 months. This would translate under normal circumstances to an approximate yield increase of 12.5 tonnes/ha. This increase is for only 5 months of growth.

The recipe in general is to fill the profile as soon after harvest as possible. *(Note: be aware of soil temperature and soil type).*

- Allow the roots to re-establish themselves as far down the profile as possible (until the sum chart changes angle or daily extraction rates become noticeably smaller).
- A top up to full point is required to ensure all of the profile has available water and allow

drawdown until the plant begins to stress (not a visible stress: stress indicator is based on a slow-down in extraction rates). This may require a couple of repetitions before the full benefit is achieved. Of course, rainfall events could kaibosh the plan, although they did not have a huge impact in the example shown in Figure 2, only delayed drawdown.

- To be safe rather than sorry, fill up at the refill point especially when using models. The RAW is determined from soil physical and chemical characteristics or it can be determined from using a soil moisture probe. In this case it was a combination of both.

In plant cane the recipe is slightly different:

- Maintain soil moisture to the sett. The sett roots provide nutrients and water to the sett. These roots are small and fragile. The sett then provides food and water for primary shoots, followed by leaf development and shoot internodes that produce new roots from the node buds. This process takes 30-35 days. Frequent light watering may be required.
- Once the new roots are established then irrigations should maintain moisture to below root activity until full effective rooting depths are achieved. Thereafter follow the regimen as per ratoons.

**In general, fill the profile as soon after harvest as possible.**

**Allow the roots to re-establish themselves as far down the profile as possible.**