Scheduling water application

for overhead irrigation systems

Irrigation scheduling aims to periodically replace the soil water in the crop root zone that has been either used by the crop or evaporated from the soil surface. This is collectively known as 'evapotranspiration' and varies each day based on the crop's water requirement and environmental factors at the soil surface.

How does irrigation scheduling work?

Irrigation scheduling aims to refill the profile to minimise water stress on the crop, without loss to deep drainage (beyond the root zone) and without causing waterlogging.

Estimating readily available water

To schedule irrigation effectively it is necessary to determine the amount of readily available water (RAW) that a soil can hold. This is influenced mainly by the soil texture and depth of soil available for sugarcane roots to explore. Compacted layers in the soil can impede root growth and limit water infiltration and storage.

Using the table below, if an alluvial soil in the Bundaberg area had reached the refill point (no readily available water left), an application of 90 mm of irrigation water would be needed to refill the root zone (without waterlogging the root zone).

Soil type	Texture	RAW in the root zone (mm)
Alluvial	Clay loam	90
Red volcanic	Clay loam	90
Humic clay	Silty clay loam	70
Red earth	Sandy loam	60
Red podzolic	Sandy loam	60
Yellow podzolic	Fine sandy loam Sandy loam	60 – 70 40 – 50
Gleyed podzolic	Fine sandy loam Sandy loam	60 – 70 40 – 50
Black earth	Medium clay	50 – 60
Alluvial	Sand	40

Figure 1 *Readily available water (RAW) for soils in the Bundaberg area (measured)*[1]

1 *Source: Sugar Research Australia Ltd 2014 edition of the Irrigation of Sugarcane Manual published in 1998 by BSES Limited.*

Depletion of readily available water

Ideally, irrigation will be applied before the last of the readily available water is used so that the crop is never stressed.

It is necessary to know how much water is removed from the root zone over time. This is done using monitoring devices such as soil moisture probes, tensiometers, evaporation mini-pans or by using crop growth factors and evapotranspiration rates to calculate daily water extraction from the root zone.

The Bureau of Meteorology publishes daily evapotranspiration rates. Multiply the daily evapotranspiration rate by the relevant crop factor to determine the amount of soil water extracted each day.

Crop growth stage	Crop factor
10% crop cover	0.40
75% crop cover	1.00
100% crop cover, actively growing	1.25
100% crop cover, maturing	0.70

Figure 2 *Sugarcane crop water use factor*[2]

Example calculation – Alluvial soil, Bundaberg

STEP 1

Determine RAW

RAW for this soil is 90 mm.

STEP 2

Determine the weekly ET of the actively growing crop

Daily ET figures from the BOM website* for a week in January 2021 were: 5.9, 5.4, 6.5, 5.4, 6.2, 6.6,

7.1. This gives a weekly ET of 43.1 mm.

The crop factor is 1.25 (100% cover and actively growing).

Crop water use for the week is = ET x crop factor = 43.1 x 1.25 = 53.9 mm

Since over half of the readily available water has been removed from the soil profile in 7 days, this suggest that an irrigation should be scheduled for about 5 days time, unless it rains enough before then to refill the profile.

Automated weather stations linked to soil moisture probes can do this calculation using field-specific, real-time data to give accurate predictions of when irrigation water should be applied.

Factor in the time required to deliver the necessary volume of irrigation water through the overhead irrigation system to ensure the whole block is watered before the crop becomes water stressed.

* ET figures for sites across Australia are available at:
http://www.bom.gov.au/watl/eto/

2 *Source: Sugar Research Australia Ltd 2014 edition of the Irrigation of Sugarcane Manual published in 1998 by BSES Limited.*