Irrigation Scheduling Toolbox

Irrigation scheduling is the process of deciding when and how much water to apply. Poor irrigation scheduling can result in under-irrigation, leading to water stress and reduced yields; or over-irrigation which leads to misuse of water and electricity resources, leaching of expensive fertilisers, erosion of the top soil and anaerobic soil conditions leading to yield reductions.

A number of tools are available to assist with irrigation scheduling. These range from direct measurement of soil water content to weather-based methods for estimating crop water use and soil water status indirectly. Herewith an overview of the most widely used irrigation scheduling tools in the sugar industry.

DIRECT MEASUREMENT OF SOIL WATER CONTENT

Continuous logging capacitance probes: Probes are permanently installed in the field and can measure up to six depths simultaneously. Automatic rain gauges record rainfall and irrigation. Depending on the manufacturer, data is downloaded via wireless communication with a roaming data logger, radio telemetry or GSM cell phone network. Data and graphics are easily accessible either through desktop software or the internet. User friendly software, ease of access to the data and the real-time nature of the data, hourly or half hourly, have made these probes very popular amongst growers.

Tensiometers: Tensiometers indicate the suction force required by plant roots to extract water and it is therefore a direct measure of the availability of soil water for plant growth. A reading of 0 kPa will indicate saturation and the higher the gauge reading, the drier the soil. A tensiometer station normally consists of tensiometers installed at 30 cm, 60 cm and 90 cm depths. The deeper instrument acts as a control to guard against over-irrigation. Tensiometers are relatively cheap, but require regular servicing to top up water and remove air bubbles.

Wetting front detectors: This instrument is a simple funnel shaped tool that is buried in the root zone. The funnel concentrates water into a chamber which triggers a mechanical float visible above ground, indicating when water has reached the desired depth. Wetting front detectors inform when to stop irrigating, but not when to start up again. Detectors should be used in pairs; the shallow detector should respond to most irrigation events and the deeper detector should respond occasionally. Wetting front detectors are inexpensive and easy to install.

Placement: Correct placement of soil water monitoring devices is critical. Devices should be placed in a representative position within a field and preferable at more than one position. For overhead irrigation, devices can be placed in close proximity to the cane row (about 15 to 30 cm). For drip irrigation, the placement in relation to the emitters is more critical. As a guide, devices should be placed a quarter of the emitter spacing away from the emitter and a third of emitter spacing away from the line. Dig a trench to look at the lateral water movement and root distribution to determine correct placement of soil water monitoring devices.

INDIRECT ESTIMATION OF SOIL WATER CONTENT

Soil water budgeting spread sheets: Soil water content can be estimated by accounting for additions or profits (rainfall and irrigation) and removal or losses (crop water use) on a daily basis using a basic spread sheet. Irrigation is scheduled once the estimated soil water content reaches a predetermined threshold level. A good example is the SASched spreadsheet.

Crop models: With the advent of automatic weather stations, crop models such as MyCanesim® and Canepro are used to automatically calculate the daily crop water use and soil water budget. These models

use weather data and basic information on the soil, crop and irrigation system to automatically keep track of the soil water balance and generate irrigation scheduling recommendations. In addition, crop models are capable of accurately predicting final cane and sucrose yields.

Remote sensing: An exciting development is the use of remotely sensed data via satellite or unmanned aerial vehicles (UAV's) to estimate crop water use (and biomass production) on a high resolution and near real-time basis. High costs and other practical limitations are, however, currently limiting the wide application of this technology.

Accuracy of irrigation scheduling depends on the accuracy with which the available amount of water in the soil can be determined. The accuracy can be increased by combining different methods, for example scheduling with a crop model such as MyCanesim® and monitoring soil water content of the same field with a capacitance probe. Knowledge of your soils and their total available water (TAW) is a key component of successfully implementing accurate irrigation scheduling. While accuracy is important, any scheduling method is better than not scheduling at all.

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