

Using the GDot: Soil moisture sensors in sugarcane

This factsheet is designed to assist farmers and technicians with the proper placement of soil moisture sensors in order to improve sugarcane irrigation management. Installation techniques associated with particular equipment should be obtained from the manufacturer.

The use of soil moisture sensors (SMS) is one of the best and simplest ways to get feedback to improve on-farm water management decisions. However, the installation and calibration, plus interpretation of the data from soil water sensors, is often confusing.

Soil moisture monitoring devices provide useful information that can help guide and improve irrigation decisions but they should always be used in conjunction with other tools such as weather data, field observations or stalk growth monitoring.

Soil moisture sensors are used to measure moisture in the soil either as tension, percentage or relative content. Depending on the soil type, soil moisture sensor readings are an indication of the readily available water (RAW) in the root zone. Sugarcane grown in a range of soil types in Australia experience difficulties extracting water at tensions greater than -100kPa (See Crop Water Use Information Sheet IS13107). Soil moisture sensors only measure a small area of an irrigation shift and should not be the only tool used for scheduling irrigation. A much more accurate way is a combination of evapotranspiration calculations, soil moisture monitoring and plant observations.

GDots



Left:
GDot indicating that the kPa of the soil where it is installed has reached the 60-100 kPa reading.

The GDot displays soil moisture tension represented by fluorescent yellow flip dots. The more yellow dots showing, the wetter the soil is; the fewer lit yellow dots, the drier the soil.



Above: GDot indicating soil profile has reached full point or saturation as indicated by the readings of less than 10 kPa.

The GDot uses a granular matrix sensor, a type of gypsum block. Electrodes embedded into gypsum blocks are used to measure the electrical resistance between them under the presence of moisture and those signals are related to soil moisture tension, that is, how hard it is for the plant to extract water.

GDots can be used in most soil types (although not recommended for use in light sands and heavy or cracking clays) and have an operational range of 0-100 kPa.

The cable from the GDot display to the sensor can be extended allowing the sensor to be installed some distance along the cane row (recommended up to 80 m), while the display can be placed at the end of the row where it is easily accessible and visible. GDots are practical instruments but have limitations in terms of display units and ability to store data.

Location and Placement

The location should be chosen based on the soil type, the slopes of the field, and the general location avoiding wetter or drier areas than normal. Some fields have several different soil types. You should select the soil type that is the most predominant and will represent the greatest area of your field.

In furrow irrigation, the sensor should be placed in the first set to be irrigated. Unless the bottom of the field is blocked and water can pond, there is generally more water applied to the head of the field than at the bottom due to the time required for water to advance across the field. For this system, locate the sensors where water penetration is poorest, generally about 2/3 the way down the run if the bottom end is blocked or the last 1/3 if the tailwater runs freely away from the paddock.

In overhead irrigation, the sensor should be placed 10-15 metres from the start of the run in the direction of the equipment's movement. In centre pivots, avoid the inner part of a pivot circle which tends to be wetter than the rest of the circle.

Careful consideration needs to be made before placing sensors so that realistic soil water content is being measured. The location for the placement should:

- have easy access
- be placed far enough into the field to avoid edge effects
- be located in cane rows to avoid damage from field operations
- be representative of the typical irrigation of the selected soil type.



The decision of where to install the soil moisture sensor is a management one that should be based on how much of the field is represented by the chosen place. Ideally, you should have enough soil moisture monitoring sites to get representative data for your field and soil moisture sensors placed at two different depths.

Installation

The depth to monitor soil water for irrigation scheduling depends on the root depth at the stage of the crop being monitored. Recommended depth for installation in sugarcane for a single GDot sensor should be approximately 25 cm^[1] below the set (or bottom of the stool if it is installed in a ratoon crop). For more accurate readings and better control of irrigation, two soil moisture sensors are recommended.

A deep sensor is important for understanding water storage remaining in the rest of the root zone and therefore, delaying longer the next irrigation event. Particular installation procedures for the GDot and any other soil moisture sensor, should be obtained from the manufacturer or in consultation with your Productivity Services advisors.



Left: GDot installed in a corner of a block for ease of visualisation.

Calibration

It is highly recommended that stalk growth measurements are carried out to find out the number of dots lit when the block requires irrigation; in different soil types, the number of dots lit may vary.

Stalk growth measurements should be done daily at the same time and recorded. The irrigation trigger point is when the average growth reduced to below 50% of the maximum recorded for two or more days. Information sheet IS13022 discusses the procedure for stalk measurement growth monitoring. Equally important is to collect information about how much water was applied.

^[1] Sugarcane root zone can extend over 1.2 metres deep in most of the sugarcane regions in Australia.