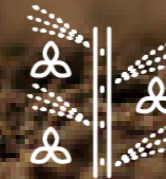


Tech time: A guide to getting soil moisture monitoring right



1. Why is soil moisture monitoring important?

Soil moisture monitoring (SMM) can provide a **real-time and predictive decision-making support tool** for growers to improve their irrigation scheduling and water use efficiency. It allows growers to **make informed decisions** on when and how much to irrigate by providing data on soil moisture content from varying depths within the soil profile.

In combination with an understanding of crop water requirements, climatic factors and soil type, growers can use SMM equipment to **accurately predict current and future water requirements** of their crops. This can support the intended objectives within a production system to maintain soils close to optimum water holding capacity for crop performance. It also avoids under- or over-watering for an extended period which can lead to plant stress and leave them more susceptible to other stressors, such as pest and disease.

2. How does it work?

SMM systems aim to measure **actual soil moisture levels (mm)** to assess how much water is available in the rootzone (mm). The difference between the measured and required amount of water (mm) can then be applied via irrigation to balance the difference (deficit).

SMM probes indicate the **current soil moisture at different depths** and can highlight when sufficient water has been applied. Soil moisture is complex and influenced by a number of soil characteristics including texture, compaction, organic matter content and subsoil constraints. These affect water movement through the soil and also effective rooting depth of the vegetable plant.

A wide range of soil moisture sensors are available to the vegetable industry (e.g. tensiometers, granular matrix, and capacitance). Some are more suitable than others.

3. How do you implement it?

Using know how

To determine soil moisture levels requires detailed knowledge of soil water status, crop water requirements, crop water stress status and potential yield reduction under water stress. This information is used to inform decisions about irrigation scheduling to optimise water use efficiency and crop performance.

Irrigation scheduling

Irrigation scheduling determines when and how much to irrigate. The following soil moisture attributes can be used to guide decisions about irrigation scheduling:

- The soil's readily available water-holding capacity
- Application rate of the irrigation system (mm/hour)
- Evenness of water distribution (DU%)
- Current water content of the soil
- Rate of crop water use.

Purpose of this guide



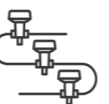
- **Outline a simple step-wise process for vegetable growers who are considering using soil moisture monitoring to inform their irrigation scheduling decisions**
- **Better understand why, what, how and when soil moisture monitoring could be appropriate for vegetable growers to use and the key issues and questions to consider.**

4. How can you apply the available tools?

There are numerous SMM tools available for vegetable growers to use to implement irrigation scheduling. The type of tool/s that will be appropriate will depend on several factors including crop growing times, soil types, technology complexity and ease of use within the farming system.

The key tools and guidance on their application are outlined in Table 1.

Table 1: Type of soil moisture tools available and their application





TOOL	DESCRIPTION	APPLICATION
 Simple models	<ul style="list-style-type: none"> • Daily spreadsheet feedback • Potential to be linked to soil moisture monitoring data where available 	Short-cycle crops – 4 to 8 weeks (e.g. lettuces)
 Probes (such as G-Dots, EasyAg)	<ul style="list-style-type: none"> • Strategically placed soil moisture probes based on blocks or patches at the same growing stage with the same soil type • Placement should be in an area that is frequented by the grower (e.g. a headland) so data can be readily accessed and used in decision making 	Longer-cycle crops – 8 to 15 weeks (e.g. melons, potatoes, onions, tomatoes)
 Simple scheduling tools (such as App-based tools)	<ul style="list-style-type: none"> • Tools with the capability to provide simple real-time data that can be used to respond immediately to the irrigation needs of crops • As technologies develop many are including links to daily emails and text messages to make data access and retrieval quick and easy 	All

5. What are some of the challenges to consider?

SMM is particularly important for vegetable growers given the susceptibility of vegetable crops to water stress due to their shallow root zones and often leafy foliage that readily loses commercial value once stressed. However, irrigation scheduling systems are not widely adopted by vegetable growers.

Some of the challenges in using SMM to assist irrigation scheduling by vegetable growers is summarised in Table 2.

Table 2: Challenges associated with soil moisture monitoring

TYPE OF CHALLENGE	DESCRIPTION
 Knowledge	Soil moisture monitoring data is not collected by growers due to perceived lack of importance and due to producers being time poor (particularly those that produce short-cycle annual crops)
 Cultural	Knowledge and opinions of other growers is highly regarded and often perceived as more credible than technical experts
 Structural	Accessibility to on-demand water, farm design, labour shortages and time pressures can limit the use of soil moisture monitoring
 Technology	The perceived complexity in using soil moisture monitoring tools and lack of support to determine which tool is the best fit for a given enterprise and how to interpret the data

Key messages

There is potential for soil moisture monitoring to benefit vegetable growers by optimising crop performance and water use efficiency.

A variety of different SMM approaches and technologies are available to provide the necessary information to guide irrigation scheduling.

Those most relevant for vegetable growers are outlined in this guide. In considering the adoption of SMM vegetable growers should:

- Understand crop water requirements, crop water stress status, and potential yield reduction under water stress
- Consider that some soil moisture monitoring technology will be more suitable in longer cycle crops (8-15 weeks) and less suitable in shorter cycle crops (4-6 weeks)
- Seek support to assist with the transition and use of irrigation scheduling and soil moisture monitoring technology.

Acknowledgement and further reading

Hort Innovation (2016) *Review of current vegetable irrigation technologies – VG14048*, report prepared by NSW Department of Primary Industries and Irrigation Australia Limited