



Soil moisture monitoring

Viti-note Summary:

- Measurement units
- Equipment
- When to monitor
- Method
- Limitations

Other topics in this Viti-Notes series include:

- Measuring the infiltration rate of water into soil using the ring infiltrometer method
- A method for examining grapevine root systems
- *Soil moisture monitoring*
- Measuring soil porosity
- Measuring soil strength
- A method for assessing soil structure
- Taking soil samples
- Measuring soil pH
- Measuring soil salinity
- Measuring organic carbon in soil

The measurement of soil moisture is important in the evaluation and application of some vineyard management practices. Regulated deficit irrigation, partial root-zone drying, soil structure modification or mulching can be applied to improve winegrape quality or save water. Soil moisture monitoring is used to measure the effects of management practices on:

- Vine water stress;
- Vineyard evapotranspiration;
- Root system extent;
- Irrigation wetting pattern;
- Changes in soil water holding capacity;
- Rainfall infiltration.

Measurement units

Soil moisture is measured as either the soil water tension or total soil water content.

- Soil water tension - is the suction a root must exert to extract water from the soil and is sometimes referred to as suction or matric potential. Soil water tension is a good indicator of vine water stress and is measured in pressure units such as kilopascals (kPa) or centibars (cbar). Generally, when the entire root-zone soil water tension is greater than 50 kPa vines start to show symptoms of water stress.
- Soil water content - is a measure of the amount of water in the soil. Changes in soil water content are useful for estimation of the volume of water taken up by the vines and the amount of irrigation to apply. Total soil water content is measured as a percentage of a soil volume (%v/v) or as a depth of water per unit depth of soil (mm/m).

Measurement of soil water tension is recommended if the objective of the exercise is to assess vine water stress. If the objective is to determine vineyard evapotranspiration or changes in soil water holding capacity then soil water content should be measured by one of the techniques listed below. Either soil water tension or content can be used to measure root system extent, the irrigation wetting pattern or rainfall effectiveness.

Equipment

Soil water content can be measured using:

- Neutron probes;
- Capacitance probes;
- Time domain reflectometry.

Soil water tension can be measured using:

- Tensiometers (range 0-80 kPa);
- Gypsum blocks (range 30-1000 kPa);
- Watermark (range 10-200 kPa).

Some instruments can measure soil moisture automatically and feed the data directly into computerised systems and others must be measured by hand and manually recorded. Handheld meters often have the capacity to store data for later processing by computer.

When to monitor

Depending on the information sought from soil moisture monitoring, it may be necessary to measure soil moisture at regular intervals (approximately three times a week) and/or before and after irrigation (or rainfall) events.

Method

1. Install sensors at the appropriate depth and position in relation to the root-zone and wetting pattern as per manufacturer recommendations.
2. Record and store readings for comparison with other records in current and future seasons.

Limitations

One of the limitations of soil moisture monitoring is the amount of soil that is measured. Instruments only assess a small part of the total soil area so it is important to know that the sensors are buried at a depth and position that is representative of where vine root activity occurs and where wetting pattern information can be captured. Variations in soil texture can also produce very different results so it's important to know the soil texture you are operating in. Some soil moisture monitoring equipment can be costly to purchase and may be time consuming to operate.

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Further information

Nicholas, P. 2004. Soil, irrigation and nutrition. Adelaide: Winetitles.

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