A Review

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Different techniques for soil moisture measurement

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ABSTRACT

A review of some of the techniques available for the determination of soil moisture content as a tension or a volume is offered. The method of determining soil moisture content by the different techniques is described with attention given to the neutron probe (NP), time-domain reflectometry (TDR) and frequency domain (Capacitance) techniques in particular. The choice of instrumentation for soil moisture determination will depend on the consideration of factors such as physical limitations of different techniques, the level of information required (either an absolute or relative moisture measurement), the amount of data needed to objectively decide upon an irrigation regime (with consideration to spatial and temporal problems), the initial cost of the instrument and sampling; the reliability of the instrument and the collected data, and, the ease of use of the instrument in the field.

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Moisture content of the soil is a major factor determining plant growth (Allison *et al.*, 1983), especially in irrigated systems. Currently there are many and varied methods for determining soil water content on a volume basis (q_v, m^3m^{-3}) or a tension basis (kPa or bar) (Gardener, 1986).

The basic objective of irrigation scheduling is to minimize water stress of the plant, that of over irrigation, and under irrigation. The manager aims to manipulate the biological process of cell elongation and cell reproduction for improved plant yield (Cull, 1992) and maximum use of available effluent.

Sensors for soil moisture monitoring have been used in various natural resource management practices, such as research on crop yield, watershed management, environmental monitoring, precision agriculture and irrigation scheduling. One such application, which forms the focus of this research, is the role of electrical sensors in irrigation scheduling in commercial crop and horticultural production. By knowing the soil moisture content (è), agricultural producers can make timely decisions of when to start and when to stop water application, so as to optimize water use and produce a good quality crop (Hanson and Peters, 2000). Furthermore, scheduling irrigation is important for environmental quality by reducing chemical percolation and nutrient loss in the soil, and in achieving crop-specific water requirements, which would help the irrigators (Leib *et al.*, 2002).

In advanced agriculture, many instruments and methods have been used to monitor and measure soil moisture. Tensiometers, resistance blocks, gravimetric methods, and granular matrix sensors have been commonly used for many decades and will continue to be widely applied in irrigation scheduling (Gardner, 1986; Leib *et al.*, 2002). These irrigation management techniques and instruments vary with respect to their accuracy, labour intensity, cost and simplicity of use. Previously, many studies have been conducted, to evaluate soil water devices both qualitatively and quantitatively in

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