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BOOK REVIEW

Field Estimation of Soil Water Content: A review

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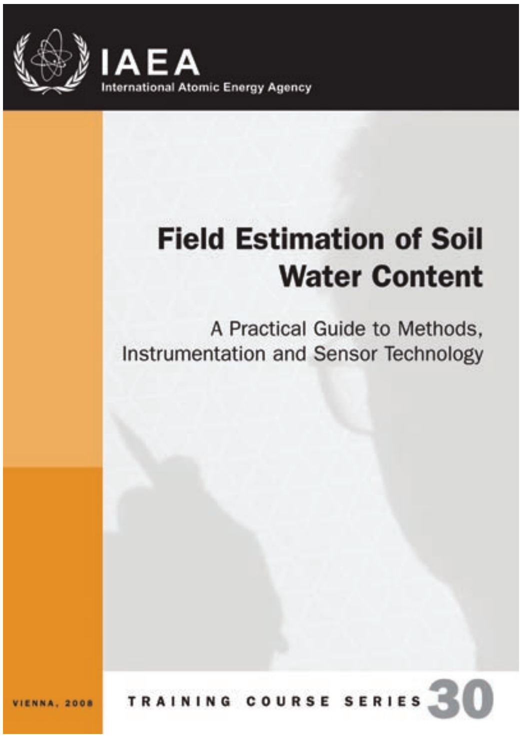

Field Estimation of Soil Water Content: A Practical Guide to Methods, Instrumentation and Sensor Technology

Steve Evett
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Field Estimation of Soil Water Content delves into the workings of a number of devices that measure soil water content (generally volumetric). Though the authors realize that instruments are often purchased based on convenience or economics, they aimed the book as a guide to help readers find the soil water measuring devices that perform best under given circumstances and to give readers information on how to use the devices. The most accurate, although destructive, form of measurement is physical sampling. Using that as the baseline, the authors listed several conclusions about less invasive measurement techniques. Their conclusions can be briefly listed as follows: all sensors must be field calibrated (with the possible exception of time domain reflectrometry [TDR]); the field-calibrated neutron moisture meter (NMM) is the most accurate and precise indirect form of measurement; electromagnetic sensors are too sensitive to nonwater related variability in the field; all sensors are too inaccurate, too costly, or too difficult to use for on-farm scheduling (with the possible exception of tensiometers or granular matrix resistance sensors); NMM, TDR, and physical measurements are the only methods accurate enough for research; and more research is needed to overcome device limitations.

Though the conclusions above seem definitive, the book goes on to describe measurement devices in detail, which makes the book a good current reference or teaching tool. Book chapters treat classes of measurement or individual sensors/methods. Most chapters focus on measurement of soil water balance to determine crop water use and water use efficiency; this is done by measuring water contents within and below the root zone.

Chapters include sections on equipment description, installation (if appropriate), and measurement. Sections or subsections include "Hints and tricks" to help readers more easily use the instruments. Chapters cover the following topics: Gravimetric and Volumetric Direct Measurements; Neutron Moisture Meters; Conventional TDR Systems; Capacitance Sensors for Use in Access Tubes; Trime® Fm3 Moisture Meter and T3 Access Tube Probe; CS616 (CS615) Water Content Reflectometer; Tensiometers; and Electrical Resistance Sensors for Soil Water Tension Estimates. Because water sensors are continually being developed and improved, the book could not include all sensors.

The book focuses on measuring and controlling soil water content for irrigation as a way to prevent plant stress. Although stress could also be an indicator of water needs, preventing it is a way to promote productivity. To control water content, several measurements are needed, such as rooting depth, soil water content, and soil "refill point" (the water content at which plants begin to stress). Refill points vary with soil, crop, management, and environmental conditions. Beyond their description, refill point calculations are considered beyond the scope of the book, though irrigation remains prominent in many chapters.

Problems measuring soil water content can arise when devices do not accurately or consistently measure it. For example, when devices measure water in a small volume, their inaccuracy or inconsistency may show up as small-scale field variation. To avoid this, the authors recommend that the devices measure a minimum soil sample volume, called the representative elemental volume (REV). REV is the volume over which most small-scale variation is averaged out. As with the refill point, REV varies for soil types and properties, including water content; it also varies for the property to be measured. Because it cannot be calculated simply, it is only briefly described in the book.

Overall, the book provides an up-to-date look at soil water content measuring devices aimed mainly at preventing plant water stress. It presents the methods in enough detail to make it a useful reference or text.

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