

## Soil Moisture Sampling

There are many ways to measure soil moisture. The most accurate is to take a volume of soil, weigh it, (air) dry it and then weigh it again. The impracticality of this method necessarily led to the development of other techniques. The best known was the neutron probe which used a radio active source lowered into the soil by means of an aluminium access tube. Pulse bounces were counted by the device to record soil moisture very accurately. With its demise, on safety issues, and the fact that it was incapable of measuring top layers, TDR (Time Domain Reflectometry) became a safe replacement and, although accuracy was not quite as high, it is a very credible alternative.

TDR measures the 'dielectric constant' of a material to determine the moisture. The dielectric constant is a complex quantity with a real number, that characterises the moisture and with an imaginary component as a measure for energy loss and electrical conductivity. Both parts depend mainly on frequency, so that the measuring frequency of an electromagnetic technique is a decisive criterion. A few TDR systems were developed but Van Walt selected the award winning TRIME TDR which quickly established itself as a market leader.

Because TDR uses high frequencies it requires a more expensive chip and cheaper alternatives such as those based on frequency domain reflectometry came onto the market but TDR remains unquestionably the favoured tool for researchers. Very recent technology has allowed TDR moisture sensors to be manufactured (TRIME Pico) which are priced to almost match the less accurate capacitance based alternatives. Capacitive methods are now marginally lower in price than TRIME® -TDR, but they don't provide the measuring precision required for scientific work.