INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

Soil Moisture – Selected Methods of Measuring

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Water is one of the most important ingredients in any soil. Soil formation would not be possible without water.

Water content is given on a volumetric or mass (gravimetric) units. We have different possibilities for determining of soil moisture.

Gravimetric method

The gravimetric method is the oldest and the most widely used method for determining soil moisture. The method is easy – soil sample is weighed before and after drying (oven temperature 105°C), and calculating its original moisture content. It is required for calibrating the equipment used in the others methods.

In soil-moisture sampling, it is essential that all sampling operations the transfer of samples to moisture cans and the weighing of the moist samples be done as rapidly as possible to prevent undue moisture losses. Augers or core samplers are used for soil-moisture sampling.

Electrical-resistance

This device operates on the principle that resistance to the passage of an electrical current between two electrodes buried in the soil will depend upon the moisture content of the soil. A meter at the surface measures changes in electrical resistance. The resistance is read on the meter and is converted to moisture-content values by means of a calibration chart. The accuracy of soil-moisture blocks is at best 1 percent by weight. The device responds with equal rapidity to changes in soil moisture. It is generally considered most dependable in the low-moisture-content range, below filed capacity. But salt concentration in soil moisture will materially affect results obtained by use of soil-moisture blocks.

Blocks require relatively little effort to install and can be speedily read.

Tensiometric

A tensiometer consists of a porous point or cup connected through a tube to a pressure-measuring device. The system is filled with water and the water in the point or cup comes into equilibrium with the moisture in the surrounding soil. The tension is changed with different amounts of water – greater tension is with dry soil and less tension is with wetter soil.

The tensiometer is most useful for measuring moisture content of tensions below approximately 0.9 atmospheres. Such tensions will, on the average, correspond to a range in moisture content from slightly below filed capacity to saturation. At the higher tensions found in drier soils, tensiometers become inoperative because air enters the system through the porous point.

Tensiometers are affected by temperature. The temperature gradients between the tensiometer and the soil may cause variations in the tension readings. The salt concentration seems to affect tensiometric methods less than electrical methods.

Time Domain Reflectometry (TDR)

TDR measures the apparent dielectric constant of the soil surrounding a waveguide, at microwave frequencies of MHz to GHz. The propagation velocity of an electromagnetic wave along a transmission line of L embedded in the soil is determined from the time response of the system to a pulse generated by the TDR cable tester.

TDR method have a lot of advantages: superior accuracy to within 1 or 2 percent by volume, minimal calibration requirements, excellent spatial and temporal resolution, simple to obtain continuous soil water measurements through automation and multiplexing. TDR method has the problem with highly saline conditions and the soil-specific calibration required for soils with high clay or organic matter contents.

Radioactive

This method is based on the principle of measuring the slowing of neutrons emitted into the soil from a fast-neutron source. The energy loss is much greater in neutron collisions with atoms of low atomic weight and is proportional to the number of such atoms present in the soil. The effect of such collisions is change the speed of neutrons. Hydrogen, which is the principal element of low atomic weight found in the soil, is largely contained in the molecules of the water in the soil.

The radioactive method indicates the amount of water per unit volume of soil. Most investigators have reported accuracy within 1 to 2 percent by volume. However, to obtain this accuracy, it is recommended that the probe be calibrated in the type of soil to be tested.

Salt concentration in the soil moisture and temperature do not materially affect the data obtained by the radioactive method.

The radioactive method is time consuming. The equipment is heavy and delicate and equipment failures are likely.

Fig. 1 Soil sample before drying

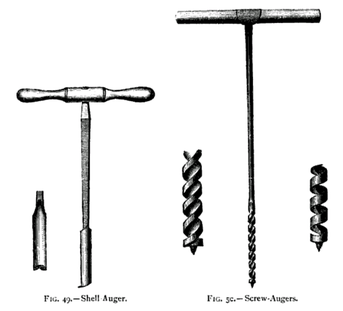

Fig. 2 Augers

Fig. 3 Soil samplers

Fig. 4 Electrical-resistance device

Fig. 5 Tensiometer

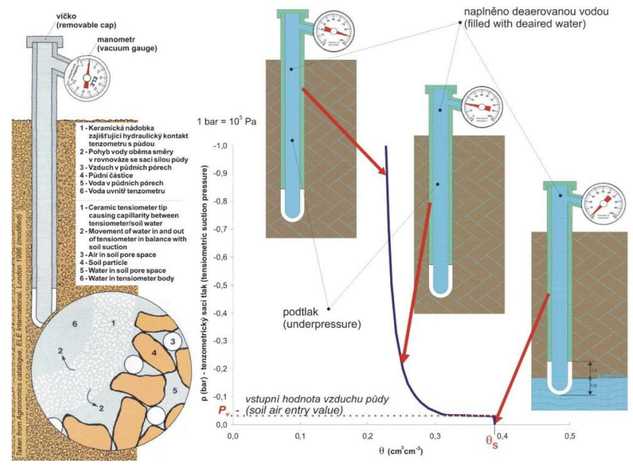

Fig. 6 Princip of tensiometric

Fig. 7 Time domain reflectometry

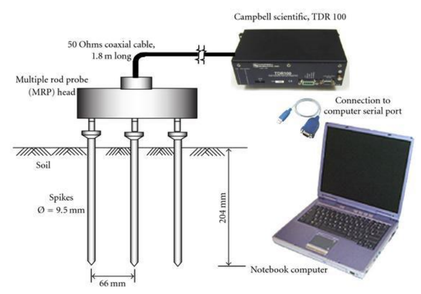

Fig. 8 Schema of a typical TDR systém.

Fig. 9 Device for radioactive

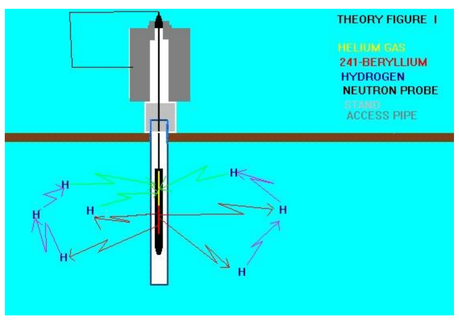

Fig 10. Princip of radioactive method

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