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Utgåva 1

Markundersökningar – Bestämning av omättad konduktivitet och vattenhållande förmåga – Winds avdunstningsmetod (ISO 11275:2004, IDT)

Soil quality – Determination of unsaturated hydraulic conductivity and water-retention characteristic – Wind's evaporation method (ISO 11275:2004, IDT)

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The International Standard ISO 11275:2004 has the status of a Swedish Standard. This document contains the official English version of ISO 11275:2004.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 11275 was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 5, *Physical methods*.

Introduction

Soil water content and matric pressure are related to each other and determine the water-retention characteristics of a soil. Soil water, which is in equilibrium with free water, is at zero matric pressure (or suction) and either the soil is saturated or the gaseous phase occurs only as small bubbles. As a saturated soil dries, the matric pressure decreases (i.e. becomes more negative), and the largest pores empty of water. Progressive decreases in matric pressure will continue to empty finer pores until eventually water is held in only the finest pores. Not only is water removed from soil pores, but the films of water held around soil particles are reduced in thickness. Therefore, a decreasing matric pressure is associated with decreasing soil water content[8],[9]. Laboratory or field measurements of these two parameters can be made; and the relationship (which can be reported graphically, in tabular form, or possibly as an equation) is called the soil water-retention characteristic. The relationship extends from saturated soil to oven-dry soil (approximately 0 kPa to about -10^6 kPa matric pressure).

The soil water-retention characteristic is different for each soil type. The shape and position of the curve relative to the axes depend on soil properties such as texture, density and hysteresis associated with the wetting and drying history. Individual points on the water-retention characteristic curve may be defined for specific purposes.

The hydraulic conductivity is a measure of the rate at which liquid water can move through the soil under the influence of variations in matric pressure from point to point within the soil. The hydraulic conductivity of unsaturated soil depends on the same factors as does the soil water-retention characteristic, also showing hysteresis. As a saturated soil dries, the hydraulic conductivity decreases, and it is convenient to express the hydraulic conductivity corresponding to the soil water-retention characteristic as a function of the decreasing matrix pressure.

The results obtained using these methods can be used, for example:

— to provide an assessment of the equivalent pore-size distribution (e.g. identification of macro- and micro-pores);

— to determine indices of plant-available water in the soil and to classify soil accordingly (e.g. for irrigation purposes);

— to determine the drainable pore space (e.g. for drainage design, pollution risk assessments);

— to monitor changes in the structure of a soil (caused by e.g. tillage, compaction or addition of organic matter or synthetic soil conditioners);

— to ascertain the relationship between the negative matric pressure and other soil physical properties (e.g. hydraulic conductivity, thermal conductivity);

— to determine water content at specific negative matric pressures (e.g. for microbiological degradation studies);

— to estimate other soil physical properties.

Soil quality — Determination of unsaturated hydraulic conductivity and water-retention characteristic — Wind's evaporation method

1 Scope

This International Standard specifies a laboratory method for the simultaneous determination in soils of the unsaturated hydraulic conductivity and of the soil water-retention characteristic. It is applicable only to measurement of the drying or desorption curve. Application of the method is restricted to soil samples which are, as far as possible, homogeneous. The method is not applicable to soils which shrink in the range of matric head $h_\mathrm{m} = 0$ cm to $h_\mathrm{m} = -800$ cm.

The range of the determination of the conductivity depends on the soil type. It lies between matric heads of approximately $h_\mathrm{m} = -50$ cm and $h_\mathrm{m} = -700$ cm.

The range of the determination of the water-retention characteristic lies between matric heads of approximately $h_\mathrm{m} = 0$ cm and $h_\mathrm{m} = -800$ cm.

NOTE 1 An infiltrometer method can be used to determine hydraulic conductivities near saturation.

NOTE 2 ISO 11274 gives methods to determine the water-retention characteristic for matric heads between 0 cm and −15 000 cm.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 10381-1, *Soil quality — Sampling — Part 1: Guidance on the design of sampling programmes*

ISO 10381-4, *Soil quality — Sampling — Part 4: Guidance on the procedure for investigation of natural, near-natural and cultivated sites*

ISO 11274, *Soil quality — Determination of the water-retention characteristic — Laboratory methods*

ISO 11276, *Soil quality — Determination of pore water pressure — Tensiometer method*

ISO 11461, *Soil quality — Determination of soil water content as a volume fraction using coring sleeves — Gravimetric method*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
hydraulic conductivity
K
factor of proportionality between the soil water flux density, v, and the hydraulic gradient ∇h_h in Darcy's equation, assuming isotropic conditions, i.e.

$$v = -K \nabla h_\mathrm{h}$$

NOTE For the purposes of this document, conductivity is used synonymously for unsaturated hydraulic conductivity.

3.2
soil water-retention characteristic
retention characteristic
relation between soil water content and soil matric head of a given soil (sample)

3.3
gravitational head
amount of work that must be done in order to transport reversibly and isothermally an infinitesimal quantity of water, identical in composition to the soil water, from a pool at a specified elevation and at atmospheric pressure, to a similar pool at the elevation of the point under consideration, divided by the mass of water transported

3.4
matric head
amount of work that must be done in order to transport reversibly and isothermally an infinitesimal quantity of water, identical in composition to the soil water, from a pool at the elevation and the external gas pressure of the point under consideration, to the soil water at the point under consideration, divided by the mass of water transported

3.5
pneumatic head
amount of work that must be done in order to transport reversibly and isothermally an infinitesimal quantity of water, identical in composition to the soil water, from a pool at atmospheric pressure and at the elevation of the point under consideration, to a similar pool at the external gas pressure of the point under consideration, divided by the mass of water transported

3.6
pressure head
tensiometer head
sum of the matric and pneumatic heads

NOTE The pneumatic head is assumed to be zero for the purposes of this method. On this basis, the pressure head equals the matric head.

3.7
hydraulic head
sum of the matric, pneumatic and gravitational heads

4 Symbols

a height, in centimetres;

h_a pneumatic head, in centimetres;

h_h hydraulic head $= h_\mathrm{a} + h_\mathrm{g} + h_\mathrm{m}$, in centimetres;

h_g gravitational head, in centimetres;

h_m matric head, in centimetres;

