SOIL GAS ANALYSIS

You will return to the contents of P1 SOIL by clicking the pictogram

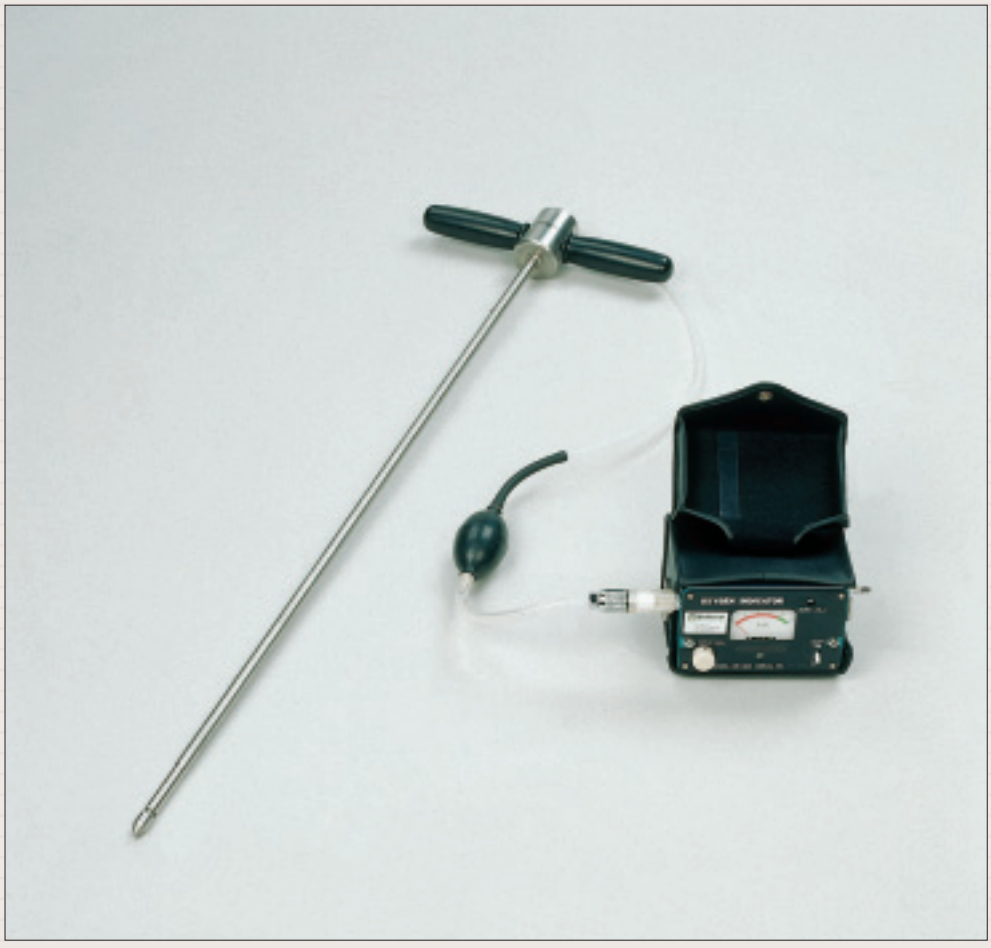
P1.66

Soil gas analysis can yield a lot of information concerning the soil environment. Using a 'piercing probe' and an oxygen content meter the growing conditions for shrubs and trees can be defined. And who would not want to be able to measure the extent of soil pollution in an area without time-consuming soil drilling?

14.35 Soil oxygen content analysis system

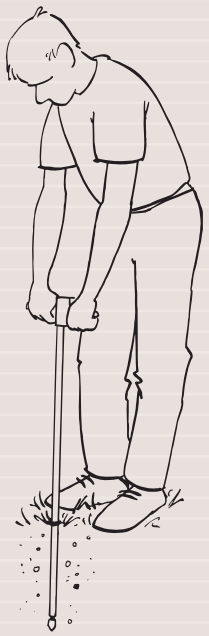
This system consists of a short soil probe and an oxygen content meter. The probe is pushed into the soil manually.

Once at the right depth the probe is lifted slightly. In this way the probe opens itself. Next, the oxygen content meter is connected to the probe and, using a bellows, soil gas is drawn through the meter and the O_2 content is measured, and with that an important growing parameter for trees and plants, can be read. The probe has a small dead volume, so that a measurement can be executed accurately within minutes. The oxygen content meter operates with an electrochemical cell. This cell has a limited service life (about 1.5 years), but can be calibrated easily with air (21%) and with a gas free of oxygen (natural gas, nitrogen).

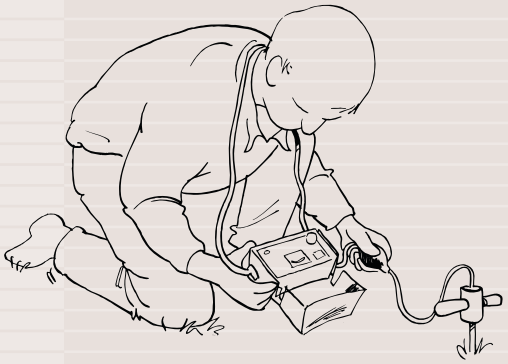


Soil oxygen content analysis system

The opening of the soil air probe.



Drawing-in and analysing the soil gas oxygen content.



BENEFITS

14.35 Soil oxygen meter

- Sturdy and very simple to operate soil probe
- Immediately shows living conditions for roots
- Meter allows measurements up till 0% O_2

Eijkelkamp Agrisearch Equipment

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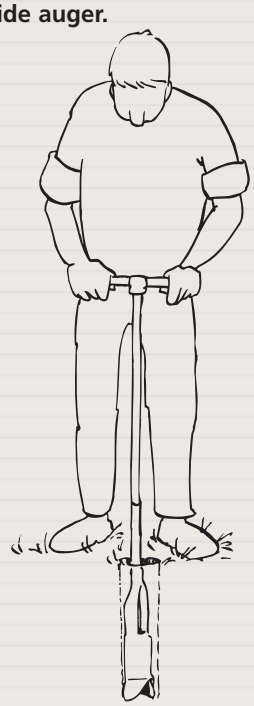
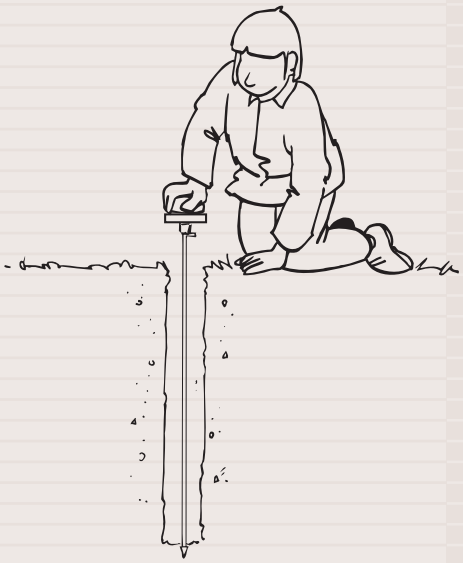
SOIL GAS ANALYSIS

To place the oxygen diffusion probe a hole is pre-drilled with a Riverside auger.



The oxygen diffusion probe is pushed into the bottom of the pre-drilled hole.



14.36 Oxygen diffusion meter

In plant cultivation it is very important that the soil has proper ventilation. The necessary oxygen supply for the roots and the discharge of the carbon dioxide gas that is formed there, in case of most cultivated growth, takes place via the soil.
Also soil chemical processes depend on the presence of oxygen in the soil.

The major part of the transport of O_2 and CO_2 is executed via the so called 'gas phase' of the soil, or via the air filled pores. The gas phase is an essential part of the soil; plant growth and soil are seriously influenced by the extend and composition of the gas phase.
The air content of the soil depends on the soil moisture content and the soil structure.
Lack of oxygen (insufficient aeration) may lead to:

- ❒ Reduction of root growth.
- ❒ Reduced availability of nutrients.
- ❒ Reduction of evaporation.
- ❒ Reduction of the rate of photosynthesis.

All of this leads to a reduction in the production of plant material.

Gas transport thus is necessary in order to get enough oxygen into the soil. The partial pressure of the oxygen in the soil air due to consumption will be less then in the atmosphere.
As a consequence the diffusion process causes a net supply of oxygen molecules into the soil and, in the other direction, a discharge of the carbon dioxide molecules from the soil. Gas diffusion in the soil almost solely takes place via the continuously air-filled pores (oxygen diffuses through water only very slowly).

Plants need air as well as water, a permanent heterogeneous pore system thus is an essential requirement. Such a pore system is enhanced by the following: activation of soil life; drainage and tillage. The process of aeration is hindered by: soil compaction; the soil being too wet; soaking; paving and adding material.

Oxygen diffusion measurement system

SOIL GAS ANALYSIS

The oxygen diffusion meter measures the mobility of oxygen in the soil. A mobility that is important for the availability of oxygen for plants.

The method: measuring the electric current required for the reduction of all oxygen present at the surface of a cylindrical Pt-electrode in the soil. The flow of oxygen through the air-filled pores and the water film on the electrode is measured until the steady state is reached.

The Oxygen Diffusion Rate (ODR) probe (Pt-electrode) should be placed in undisturbed soil. To this purpose a hole is pre-drilled to a depth of approximately 10 mm above the measuring point, after which the probe is lowered and carefully pushed into the bottom of the augerhole. It is advised to remove the electrode from the soil after a series of measurements in order to clean it.

The meter provides a stabilized voltage between the ODR-probe and the Ag-AgCl-reference electrode.

In very dry soils only part of the electrode will be covered in water. This results in a rising impedance between soil and electrode. In such a situation the meter can also be used to perform a redox-potential measurement.

The measuring system consists of a read-out unit with connecting facilities for three ODR-probes, one ODR-probe, one Ag-AgCl reference electrode, KCl-solution and a brass electrode.

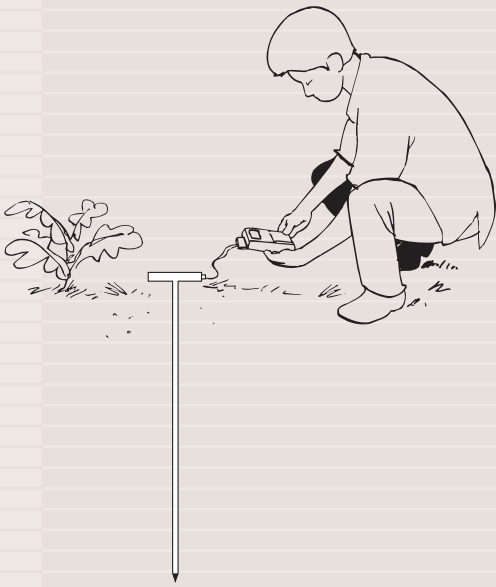
The reference electrode is used for measuring and checking the potential between the Pt-electrode and the soil.

The brass electrode is used to close the electrical circuit.

The measuring range for oxygen diffusion is 0 - 999 µA and for Redox 0 - 999 mV (resolution resp. 1 µA and 1 mV).

Accuracy +/- 3 µA and +/- 3 mV. Operating temperature between 0 and 50 °C and an air humidity between 30 - 80%. The meter is supplied in a case, incl. batteries.

The oxygen diffusion meter is read.



Oxygen diffusion probe

Oxygen diffusion meter

BENEFITS

14.36 Oxygen diffusion meter

- Will determine availability of O_2
- Only useful in growing season
- Instrument for purely scientific research

Eijkelkamp Agrisearch Equipment

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PARTS LIST

Art.no.	Description	Qty. in set
Soil gas analysis (P1.66)		
	Within the field of soil gas analysis we supply two standard sets.	
14.35	**Soil oxygen content analysis system, set, consisting of a soil probe and an oxygen content meter**	
**14.35.10	Portable oxygen indicator for soil air, measuring range 0 - 25 %, contents 3 cc only, incl. water filter and electro-chemical cell (14.35.05), in carrying bag	1
**14.35.01	Soil gas probe, contents ± 20 cc, length 80 cm	1
**12.20.97	Adjustable pinch clamp for tubes with 10 mm Ø max.	1
**10.01.14	Roll teflon tape	1
**99.70.01	Bag for tools	1
**99.53.14	Double ended socket wrench 14x15 mm	1
**99.60.05	Screw driver, 5 mm bit	1
**99.65.05	Waterpump plier 24 cm	1
**01.10.21	Steel brush (stainless)	1
	To be used optionally with 14.35 set (spare part)	
14.35.05	Oxygen cell for oxygen indicator 14.35	
14.36	**Oxygen diffusion meter for measurement of mobility of oxygen in soil + redox measurement. Standard set with read-out unit, reference electrode and brass electrode in case and 1 Pt-electrode for measurements till 70 cm depth. Compl. with Rivers. auger 7 cm**	
**14.36.01	Pt elektrode for oxygen diffusion meter (ODR), stainless steel, length 70 cm, with 2 m BNC cable. Surface platinum probe 0.226 cm^2	1
**14.36.03	Read-out unit for oxygen diffusion meter (ODR), measuring range 0-1000 muA, redox measure-ment 0-1000 mV, for connection of max. 3 Pt electrodes, with 2 m output cable for connection to writer, power supply 4x1.5 V AA battery, in synthetic case	1
**14.36.05	Reference electrode for oxygen diffusion meter (ODR), liquid electrode for KCL solution, with AG-electrode and porous ceramic cup, incl. 2 m BNC cable	1
**14.36.07	Brass electrode for oxygen diffusion meter (ODR), length 173 mm, with 2 m BNC cable	1
**18.36.12	KCL electrolyte, bottle 500 ml, concentration 3 M, for maintenance/storage of pH electrodes or reference electrode of oxygen diffusion meter (ODR)	1
**99.80.02	Battery Penlite (AA, LR6), 1.5 Volt, alkaline, low in mercury and cadmium free, blister pack of 4 pieces	1
**01.04.00.07.B	Riverside auger, bottom part, bay., Ø 7 cm	1
**01.10.17.B	Handle, normal, 60 cm, with all synthetic, detachable grip (incl. coupling sleeve), bay.	1
**01.14	Carrying bag for field equipment, with two shoulder straps (backpack model), (inside) Ø 17x150 cm	1
**18.21.30	Glassfiber pin to make the platina of the redox electrode for soil and water oxide-free	1
**18.21.32	Redox calibration set consisting of 250 ml buffer pH 4.0, 250 ml buffer pH 7.0, 5 gram Quinhydrone, spatula, 2 small mixing jars and 2 waste jars	1
	Extra accessories (max. three probes can be connected to the meter):	
14.36.01	Pt elektrode for oxygen diffusion meter (ODR), stainless steel, length 70 cm, with 2 m BNC cable. Surface platinum probe 0.226 cm^2	
	For air permeability in the field we supply a field air permeameter (see P1.88 Soil air permeability test)	