REDUCTION OF PERFORMANCE TIME FOR MICROBIAL RESPIRATION IN THE CONTEXT OF ON-SITE ANALYSIS

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Introduction

The microbial respiration activity in soil can be used as an indicator for the presence of toxic substances and easily degradable carbon sources. If standardized methods are applied, the preparation of samples (sieving, determination of maximum water holding capacity, determination and adjustment of water content) and the subsequent measurement of respiration requires about one week.

In the context of on-site analysis it is important to obtain results quickly and with minimal effort. This especially applies to the monitoring of remediation processes. We therefore tried to improve the preparation and measurement of samples to reduce the time needed for respirometric determinations required for on-site analyses.

Three measuring devices suitable to determine the respiration activity were applied, which differed in their grade of automation and principle of measurement. For all investigations several soils with different physiochemical properties and differing microbial activity were used.

Material & Methods

Determination of the water content:

Samples were dried in a halogen oven within maximally 1 hour. The procedure was compared with the conventional method using a drying oven over night.

Adjustment of the water content of the soil:

A method originally developed to adjust the water content of compost to 40 – 60 % of its maximum water holding capacity ("Faustprobe") was applied to the soil samples and compared with the conventional method using a drying oven over night.

Devices applied for respiration measurement:

Sapromat: measurement through changes in air pressure, subsequent automatic oxygen supply;

Sensomat: measurement through changes in air pressure;

RspM: measurement of oxygen content, periodic air exchange.

Correlation of dry mass

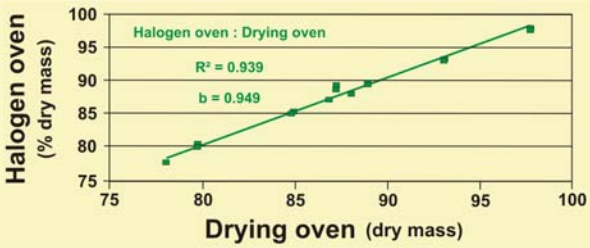

Fig.1: Linear regression of the dry mass determined by using the halogen oven compared to the drying oven. N = 15.

Estimated percent of WHC_{max}

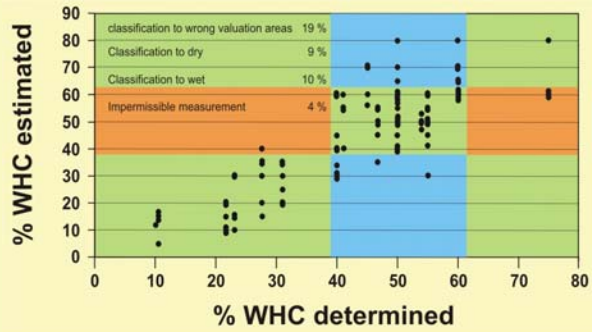

Fig.2: Comparison of the water content estimated by using the „Faustprobe" and the drying oven, respectively. The soils were associated to the classes < 40 %, 40 – 60 % or > 60 % of their WHC_{max}. N = 100.

Correlation of Respiration

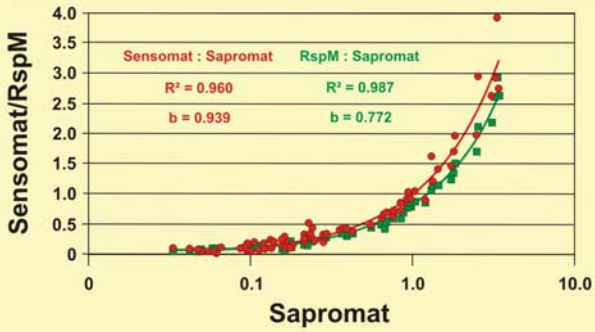

Fig.3: Linear regression of the respiration activity measured with the three measurment devices in use. N = 47.

Results

- Dry mass and percent of WHC_{max} determined by means of halogen oven and the "Faustprobe" are comparable to the conventional method using a drying oven.
- Time required for sample preparation is reduced to 1 d.
- All measurement devices yielded strongly correlated results.
- Time required for respiration measurement is reduced to 1 d.

Conclusions

The results demonstrate that the application of an adequately sensitive but robust measuring device allows to obtain sufficiently precise data for on-site analyses in not more than two days. This even applies to soils with a very low microbial respiration activity.

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