

## **Measuring Water Content in Organic Soils using ECH<sub>2</sub>O Probes**

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### **Introduction**

Since the introduction of the ECH<sub>2</sub>O soil moisture probe, there has been considerable interest in using them to measure volumetric water content of organic soils. Applications of this measurement include potted plant and greenhouse studies, where planting media typically have a high organic component, and seasonally flooded wetlands where water content is important to determine fire potential, among other things, during the dry season. Because of their unique makeup, soils high in organic matter have been dealt with separately from mineral soils. In this brief note, we investigate the calibration of ECH<sub>2</sub>O sensors in two organic matter samples and determine if a specialized ECH<sub>2</sub>O probe is adequately suited to this measurement.

### **Materials and Methods**

A 3:1 organic soil (Premium Potting Soil, Whitney Farms, Independence, OR) and a pure sphagnum peat moss (Sunshine) were packed around ECH<sub>2</sub>O probes in a 30 cm x 15 cm x 15 cm container. Mixing tap water with media artificially created a wide range of water contents, where actual water contents were determined using a small cylinder (16.7 cm<sup>3</sup>) that was inserted in the soil. The resulting sample was carefully weighed, dried in a microwave oven for 10 min, and weighed again.

Note that the Smart Sensor version of the ECH<sub>2</sub>O probe supplied by Onset converts the millivolt output of the probe to uncalibrated volumetric water content using the standard ECH<sub>2</sub>O linear conversion equation. The results described below in "millivolts" apply directly to the water content readings from the Onset smart sensor as well.

### **Results and Discussion**

Probe output was correlated with volumetric water content (VWC) in both media (Fig. 1, Table 1 and 2). The probe showed excellent output change (mV per unit VWC) for VWC between 0 and 0.5 m<sup>3</sup> m<sup>-3</sup> (Fig. 1) for both the sphagnum peat moss (SPM) and potting soil (PS), but showed very little change between the last two points above 0.5 m<sup>3</sup> m<sup>-3</sup> in PS.

When working in near-saturated conditions, the mV per unit VWC change in probe reading is of obvious importance. The probe showed some change near saturation. Interestingly, the probe showed considerably higher mV per unit water content change in the peat moss compared to the potting soil near saturation. This suggests that, because of the extreme saturation of the potting soil, some measurement error may have caused spurious readings in either of the last two readings. Ideally, sensor calibration would not change measurement in different media. Although the curves are similar, the output of the probe in potting soil and peat moss shows that individual calibration is required, depending on the medium being measured.

### **Summary**

Tests show that the ECH<sub>2</sub>O probes can be used to measure the volumetric water content of organic soils. Although resolution was considerably diminished in the upper water content region, the probe is sensitive over the entire water content range. These calibration curves also suggest that individual calibration curves be made for each organic medium where the probes will be placed.

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Table 1: Volumetric water content (VWC,  $\text{m}^3 \text{ m}^{-3}$ ), bulk density ( $\text{Mg m}^{-3}$ ), and probe output (mV) for the test probe in potting soil.

VWC ( $\text{m}^3 \text{ m}^{-3}$ )	Bulk Density ( $\text{Mg m}^{-3}$ )	Probe Output (mV)
0.051	0.344	216
0.114	0.357	346
0.217	0.395	546
0.376	0.382	657
0.563	0.372	737

Table 2: Volumetric water content (VWC,  $\text{m}^3 \text{ m}^{-3}$ ), bulk density ( $\text{Mg m}^{-3}$ ), and probe output (mV) for the test probe in sphagnum peat moss.

VWC ( $\text{m}^3 \text{ m}^{-3}$ )	Bulk Density ( $\text{Mg m}^{-3}$ )	Probe Output (mV)
0.143	0.131	446
0.320	0.163	706
0.434	0.184	852
0.579	0.152	930
0.671	0.143	965

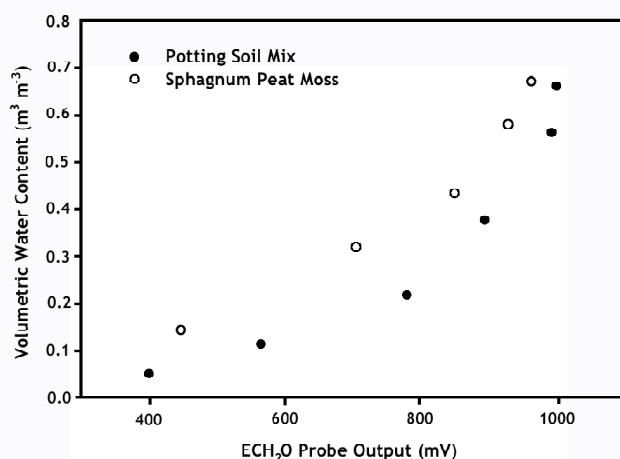


Fig. 1. Calibration curves for organic potting soil mix and sphagnum peat moss using a typical ECH<sub>2</sub>O probe