Generating a Soil Moisture Characteristic Using the WP4C

A moisture release curve, also known as a soil moisture characteristic, relates the water potential of a particular soil to its water content. This information is important for describing water storage in soil and water availability to plants, and for predicting water and contaminant transport in soil.

A moisture characteristic is obtained by measuring water potential and water content on a set of soil samples having a range of water contents. The following procedure can be used to generate a moisture characteristic using the WP4C.

The soil moisture characteristic is hysteretic. At a given water potential, samples which reached that water potential by wetting will have lower water content than those which reached it by drying. The procedure described here is for a wetting characteristic.

Procedure

1. Measure the mass of a clean stainless steel WP4C sample cup (M_c).
2. Mix an appropriate amount of soil and water to obtain the desired water content.
3. Seal the sample using one of Decagon's disposable plastic lids.
4. Perform steps 1-3 for various water contents. If the mixing is done in large quantity, the mixed soil can be used for numerous samples of the same water content.
5. Let the samples equilibrate for at least **16 hours.**
6. Measure the water potential of each sample and then immediately measure the mass of the wet soil and sample cup (M_w). This should be done quickly so that no moisture is lost to the air between the water potential measurement and weighing.
7. Place each sample with their lids off in a drying oven. Leave them in the oven for at least 16 hours at 105 degrees Celsius. When the samples are removed, immediately place the samples in a dessicator to prevent the collecting of any moisture from the air. The cups are cool after 10 -15 minutes.
8. As soon as the samples are cool, measure the mass of the dry soil and sample cup (M_d). The water content (g/g) can be calculated using the following equation:

$$(g/g) = \frac{M_w - M_d}{M_d - M_c}$$

9. The resulting data can then be plotted in a spreadsheet as shown in Figure 1.

Notes

1. Although not necessary, the equilibration of the sample can be improved if the seal on the sample cup is somewhat airtight. This can be accomplished by using a square of

Parafilm between the lid and sample cup or by sealing the perimeter of the lid with an impermeable tape.

2. The mixing of the soil is easiest if it is done in a large quantity (15 or more grams) and then added to the sample cup. The more finely the soil is mixed, the more reliable and consistent the results will be.
3. If the desired water content range is unknown, begin with an air-dry sample and increase the water content of successive samples in increments of .05 g/g or less until the soil becomes saturated.

w – (g/g)	(MPa)	w – (g/g)	(MPa)
0.027	-49.0	0.0453	-10.6
0.029	-44.0	0.056	-3.75
0.031	-40.8	0.068	-2.75
0.034	-28.8	0.0685	-1.97
0.035	-22.0	0.092	-1.05
0.0396	-15.0	0.097	-1.08
0.0419	-13.1	0.131	-0.20
0.0422	-12.7	0.17	-0.11
0.0434	-12.8	0.175	0.00

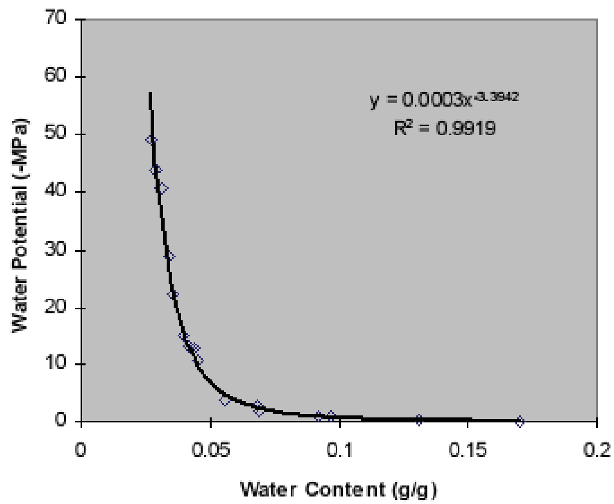

Figure 1 Sample moisture release curve for Walla Walla silt loam using the WP4C Dewpoint PotentiaMeter*

** This line is power law fit to the data.*

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