METER
ENVIRONMENT

HOW TO MEASURE WATER CONTENT OF COMPOST SUCCESSFULLY

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It is well known that correct moisture management is the key to successful composting. If the moisture in the compost is too low, microbial processes are slowed, and compost doesn't reach its optimum temperature. If it is too high, processes become anaerobic, and the compost pile becomes an air-pollution hazard. However, the suggestions in published literature for compost moisture-monitoring methods typically are not very helpful.

MOST METHODS HAVE POOR ACCURACY

Oven drying is the only sure method for measuring compost water content, but even with this method, there are potential pitfalls. Drying the compost at too high a temperature or trying to dry it in a microwave oven to speed up the process can cause the sample to lose organic material or combust. The literature lacks reports of suitable in situ moisture measurement methods. A squeeze test has been recommended for a rough moisture measure. When the compost is at the right moisture level, water can be squeezed out with some effort, like a moist sponge. Several electronic probes have been tried, but these were described as being rough measures with poor absolute accuracy. Tensiometers have also been used to measure water potential of compost with varying success.

STATING A PERCENTAGE IS NOT ENOUGH

One reason for the poor accuracy of some of the measurements may be confusion over the moisture content units convention for compost. Publications generally agree on a moisture content range of 45 to 65% with 50 to 60% being optimal. They never say, though, whether this is volume- or mass-basis moisture or whether it is wet or dry basis. This is not a trivial matter. Gravimetric soil moisture is, by convention, reported on a dry basis (mass of water divided by mass of oven-dry soil). If a compost sample had a dry-basis gravimetric water content of 50%, its wet-basis water content would be 33%, and its volumetric water content would be 13%. It should be obvious that merely stating a percentage is not enough. One has to specify volume or mass and wet or dry basis for the number to mean anything. Though the basis for the calculation is not specified in composting literature, example calculations indicate that the numbers given for guidelines are wet-basis gravimetric water contents (mass of water divided by mass of wet compost). The basis for compost moisture reporting is therefore not the same as for soil water content.

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The only direct measurement of gravimetric water content is made with a balance and an oven. Probes, like the TEROS 10 soil moisture sensor, measure volumetric water content. To convert from volumetric to gravimetric water content, we need to know the wet density of the compost.

An example of a calculation one might do to determine the water content of compost with a TEROS 10 probe follows. Assume we inserted the soil moisture sensor into the compost and obtained a volumetric water content reading of 21%. We fill a bucket level full with the compost at its normal density (the density in the pile) and find the weight of the compost in the bucket to be 1500 grams. The same volume of water weighs 4,000 grams. The ratio of water density to compost density is, therefore, the water mass divided by the mass of an equal volume of compost, or 4000/1500 = 2.7. The gravimetric water content of the compost is therefore

$$W_{wet} = 2.7 \times 21\% = 57\%$$

It is clear that density has a significant effect on volumetric water content. Since density changes during the composting process, one would want to make density measurements more than once to do the conversions.