23 Water Potential: Tensiometry

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23-1 INTRODUCTION

Soil water studies have long been conducted using soil water content measurements. The values are reported on either a weight basis or a volume basis (See chapter 21, Soil Water Content). For many studies, soil water content information is of primary interest. However, for studies involving water transport and storage in soils and soil-water-plant relationships, the energy status of the soil solution phase (soil water) and/or the energy status of the chemical species water in the soil are required.

The retention of water by soil and its relationship to the soil water energy level was discussed by Buckingham (1907), and has become known as “the potential concept of soil water”. Gardner et al. (1922) proposed that porous, ceramic-walled equipment could be used to measure the relation between soil water content and the energy status of the soil water. Porous ceramic cups connected to vacuum gauges or manometers were proposed for measuring the capillary potential of the water in a soil (Richards, 1928; Heck, 1934; Rogers, 1935). These three investigators independently reasoned that the water inside the tensiometer would equilibrate with water in the water films in the soil.

23-2 PRINCIPLES

The essential parts of a tensiometer for field use are shown in Fig. 23-1. Many modifications of this design exist. A few will be discussed in detail in section 23-3.1. Tensiometer designs for laboratory use are described in section 23-4. The porous tip or cup of the tensiometer is sealed to the barrel or connecting tube. A removable air-tight cap, which facilitates filling the tensiometer with water, is used to seal the barrel at the top. A device to measure the pressure in the water in the tensiometer...