50 Air Pressure Measurement

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50-1 INTRODUCTION

The flow of air which results from pressure gradients in soils is often neglected. Yet this process can play an important role in transient soil water flow and soil aeration. Measurements of the air pressure in soils are essential to improve our understanding of these phenomena. Indirectly, these measurements provide evidence of the existence of soil macrostructure.

Soil air pressures have been measured in laboratory columns and in the field. Within soil columns the air pressure ahead of a wetting front can exceed atmospheric pressure by 5 kPa (50 mbar) and occasionally as much as 11 kPa (Wilson & Luthin, 1963; Peck, 1965a, 1965b; Adrian & Franzini, 1966; McWhorter, 1971; Vachaud et al., 1973; Raj Pal & Stroossnijder, 1976). In open-bottom or otherwise ventilated columns, the air pressure increase is negligibly small. Flood irrigation or intense rainfall may raise the air pressure in field soils by approximately 1 to 3 kPa (Dixon & Linden, 1972; Linden et al., 1977). As a consequence, large pores and cracks in the soil remain air-filled and do not contribute to water movement (Dixon & Peterson, 1971; Dixon, 1975; Linden & Dixon, 1976). When air is confined between a wetting front and an air-impervious layer, the resulting pressure increase induces a lateral air flow over considerable distances and may cause a significant water table depression (Linden & Dixon, 1973, 1975). Under such conditions the hydraulic gradients and the water-conducting cross section are diminished and the tortuosity of the flow paths increased, leading to a sharp decline of the