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## Macropore/Subsurface Drain Direct Connectivity: Macropores as Rapid Transport Pathways to Subsurface Drains

Recent research indicates immediate breakthrough of contaminants in subsurface drainage by transport through directly connected macropores. This “direct connectivity” phenomenon was verified by conducting infiltration experiments in a laboratory soil column (28 cm by 50 cm cross-section and 95 cm long) with an artificial macropore placed directly above and shifted away from a subsurface drain. The experimental setup allowed open surface and buried macropore lengths to be varied from the subsurface drain to the surface without unpacking or disturbing the soil column between experiments. The column was packed with a sandy loam soil. For each experiment, a 1-cm ponded boundary condition was maintained at the soil surface. The movement of the wave front down the column was observed with pencil size tensiometers at 10, 40, and 70 cm above the drain. The longer the buried macropore length (i.e., as the macropore approached the soil surface), the more rapid response at the drain outlet in addition to an increased percentage of total drain flow through the macropore (35-40%). Breakthrough times with the surface connected macropore (approximately 8 times faster than matrix flow) decreased significantly compared to buried macropores (less than 2 times faster than matrix flow). For 55-cm surface connected macropore experiments, the average ratio of steady state macropore to matrix flow rates decreased as the distance from the drain increased: 2.4, 2.1, and 1.6 for distances of 0, 6.25, and 12.5 cm, respectively. Macropores located within 20 to 25 cm of the drain were directly connected. This research verifies the “contributing area” concept hypothesized in field and numerical modeling studies.

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