



The Precision Field Lysimeter Concept

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The understanding and interpretation of leaching processes have improved significantly during the past decades. Unlike laboratory experiments, which are mostly performed under very controlled conditions (e.g. homogeneous, uniform packing of pre-treated test material, saturated steady-state flow conditions, and controlled uniform hydraulic conditions), lysimeter experiments generally simulate actual field conditions. Lysimeters may be classified according to different criteria such as type of soil block used (monolithic or reconstructed), drainage (drainage by gravity or vacuum or a water table may be maintained), or weighing or non-weighing lysimeters. In 2004 experimental investigations have been set up to assess the impact of different farming systems on groundwater quality of the shallow floodplain aquifer of the river Mur in Wagna (Styria, Austria). The sediment is characterized by a thin layer (30 – 100 cm) of sandy Dystric Cambisol and underlying gravel and sand. Three precisely weighing equilibrium tension block lysimeters have been installed in agricultural test fields to compare water flow and solute transport under (i) organic farming, (ii) conventional low input farming and (iii) extensification by mulching grass. Specific monitoring equipment is used to reduce the well known shortcomings of lysimeter investigations:

- The lysimeter core is excavated as an undisturbed monolithic block (circular, 1 m² surface area, 2 m depth) to prevent destruction of the natural soil structure, and pore system.
- Tracing experiments have been achieved to investigate the occurrence of artificial preferential flow and transport along the walls of the lysimeters. The results show that such effects can be neglected.
- Precisely weighing load cells are used to constantly determine the weight loss of the lysimeter due to evaporation and transpiration and to measure different forms of precipitation. The accuracy of the weighing apparatus is 0.05 kg, or 0.05 mm water equivalent respectively.
- The different soil horizons in the lysimeters are equipped with sensors to measure soil temperature, water content and soil tension. Suction cups are used to get soil water samples.
- The lower boundary of the lysimeter is designed to maintain equilibrium between the suction applied to the leachate collection system and soil matrix potential thus the suction applied may vary depending on natural conditions – measured using tensiometers - in the field.
- The lysimeters are built in directly in a test area of 1000 m² with the same vegetation to prevent island effects on evapotranspiration.
- The topmost part of the lysimeter is realized as a removable ring that mechanical cultivation is possible in the same manner as at the test field.

In this presentation the concept and the implementation of the Precision Field Lysimeter is shown. First results on water and solute balances of a 4 years investigation period are discussed.