



Where do roots take up water? A new technique to measure local flow of water into roots

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Where and how fast do roots take up water from soils? Answer to this question requires direct and in-situ measurements of local flow of water into roots of transpiring plants growing in soil. Such a measurement has been a great challenge for plant and soil scientists.

Here, we introduced a new in-situ method for direct measurement of water flow in soil and roots. We used neutron radiography to monitor the transport of deuterated water (D_2O) in soil and roots of transpiring lupins. Using image analysis tools and introducing a model of D_2O transport into roots, we measured the local radial and axial fluxes into and within different locations along the root system.

The results demonstrated significant variations of water flow into the root system of 18 to 21-day-old lupins. The radial fluxes into roots were higher in the upper zone than in the lower zone. In each root, the radial fluxes were higher in the more proximal segments and decreased towards the root tips.

In lupins, most of the water uptake occurred in lateral roots. The function of the taproot was to collect water from laterals and transport it to the shoot. To this end, the taproot was radially isolated but axially very conductive. This root architecture seems favorable to take up water from deep soil layers.