Manure Dominates Nitrate Leaching from Raspberry Field

The Abbotsford-Sumas Aquifer, located on the border of British Columbia, Canada and Washington State, USA, supplies drinking water to more than 100,000 people but has a long history of nitrate contamination. Raspberry production has been implicated as a source of nitrate, but direct measurements of nitrate losses from the raspberry root zone are lacking.

In a new Vadose Zone Journal article, researchers report 30 months of nitrate leaching measured under a commercial raspberry field using passive capillary samplers installed directly below the root zone.

The nitrate leached in a year under typical mineral fertilizer nitrogen practices was the equivalent of about 80% of the fertilizer applied. In comparison, the nitrate leached was about three times greater in a year when poultry manure was applied prior to planting the raspberry crop. While fertilizer and irrigation were applied only to the raspberry row, more than half of the nitrate was leached from the alley between rows. In addition, irrigation with high nitrate concentration groundwater supplied a surprising amount of nitrogen to the crop.

Key strategies identified to protect drinking water supplies in the Abbotsford-Sumas Aquifer include improved fertilizer nitrogen management, improved alley management, and in particular, reducing or eliminating manure application prior to raspberry planting.

Adapted from Loo, S.E., B.J. Zebarth, M.C. Ryan, T.A. Forge, and E.E. Cey. 2019. Quantifying nitrate leaching under commercial red raspberry using passive capillary wick samplers. Vadose Zone J. 18. View the full open access article online at http://dx.doi.org/doi:10.2136/vzj2018.08.0152

Enhanced Technique in Soil Column Flood Simulations

Intact soil column studies have been widely used as lab simulations in determining the effects of long-term inundation on nutrient flux in soils. However, after applying documented “flooding procedures” to short-term simulations, large initial spikes of nutrients resulted from physical disturbance of the soil surface directly following the addition of water to the soil columns, resulting in an overestimation of nutrients than what may naturally occur.

In an article recently published in Agricultural & Environmental Letters, researchers developed an enhanced laboratory protocol that significantly improved the accuracy of nutrient flux measurements following short-term inundation. By adapting the Collins-filter barrier technique, nutrient flux related to physical disturbance of soil is significantly minimized while still allowing for a natural chemical nutrient flux through the barrier and into the water column.

As sea levels continue to rise, it remains imperative to monitor the long-term effects of inundation on soils. In addition to sea level rise, however, studies predict an increased frequency in short-term coastal flooding events, substantiating the importance of accurately predicting the real-world nutrient flux response of soils to short-term inundation.


Left: Shallow soil profile over underlying sand and gravel at the experimental site. Right: Access tubes to the passive capillary samplers visible within the raspberry stand. Photos courtesy of Bernie Zebarth.

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