

FIELD SCALE PESTICIDE TRANSPORT TO GROUND AND SURFACE WATER. R.M. Allen-King¹, C.Kent Keller¹, J.L. Smith², T. Van Biersal¹, and J. Schaumlöffel³, ¹Washington State University (WSU), Dept. of Geology, Pullman, WA 99164, email: allenkng@wsu.edu, ²WSU, Dept. of Crop and Soil Sciences, Pullman, WA 99164, ³University of Massachusetts Dartmouth, 285 Old Westport Road, Chemistry and Biochemistry Dept. II-310, North Dartmouth, MA 02747

Introduction: The goal of this project is to observe and quantify the contributions of subsurface and surface patterns of agricultural chemical loss at the field-scale and to use these to understand basin-scale loading to aquifers and rivers. The initial project phase, presented here, analyzed triallate [S-(2,3,3-trichloroallyl) diisopropylthiocarbamate], nitrate and environmental tracer concentrations (¹⁸O and SiO₂) in surface runoff and soil solution for a single, topographically-constrained agricultural field (7.5 ha). A multiple tracer approach was applied to discern temporally varying chemical transport pathways within the semi-arid dry-land agricultural watershed near Pullman, WA.

Methods: Samples were collected at approximately 10-day intervals from an array of capillary wick lysimeters located in the subsurface and an ephemeral stream at the hydrologic outlet of the field. Triallate, applied as the herbicide FarGo® (Monsanto), was incorporated in the soil in the fall 1999 in a granular form (0.73 kg/ha). Triallate analysis used solid-phase microextraction (SPME) and gas chromatography with electron capture detection.

Results: Detections of triallate were sporadic and occurred in lysimeters from all three sampled depths during December and January [18, 84 and 112-cm below ground surface (bgs)] (Fig. 1a). Following the early spring ground thaw at the beginning of February, consistently low triallate concentrations (<~0.01 µg/L) were observed in middle and deep lysimeter water while elevated concentrations (Fig. 1a, ~0.1-1.0 µg/L) occurred in pore water from shallow lysimeters (exceeding the Canadian water quality standard of 0.2 µg/L). Contemporaneous with the ground thaw, nitrate (Fig. 1b), silica and EC concentrations soil pore waters exhibited a relatively sudden decline that may reflect an influx of precipitation and snowmelt to the subsurface. Steadily recovering pore water nitrate and tracer concentrations after March were due either to a progressive exchange and weathering, or to mixing and gradual displacement of the earlier influx by up-slope pore waters. Correlations between EC, silica and nitrate concentrations are consistent with the latter. The pattern of pore water triallate occurrence suggests a change from non-equilibrium preferential vertical transport (before February) to saturated, predominantly horizontal transport along soil horizons.

The triallate concentration in the ephemeral stream was consistently greater than the water quality standard. It declined steadily from >20µg/L in December until the stream ceased to flow in April (Fig. 1a).

Figure 1. Triallate (a) and nitrate (b) concentrations in soil pore water and ephemeral stream. Error bars indicate one standard deviation between replicate samplers at a particular depth, and therefore, spatial variability.

