SOIL ECOLOGY SOCIETY
TENTH BIENNIAL
INTERNATIONAL CONFERENCE

LINKAGES IN SOIL ECOLOGY

Argonne National Laboratory
Argonne, Illinois
22-25 May 2005

KUPERMAN, R.G., CHECKAI, R.T., SIMINI, M., PHILLIPS, C.T., KOLAKOWSKI, J.E., and KURNAS, C.W. Soil characteristics and weathering-and-aging of TNT in soil affect toxicity to soil invertebrates. Edgewood Chemical Biological Center, Aberdeen Proving Ground MD.

We investigated the toxicity of 2,4,6-trinitrotoluene (TNT) to soil invertebrates in five natural soils that vary in organic matter, clay content, and pH: Sassafras sandy loam (SSL), Teller sandy loam (TSL), Richfield clay loam (RCL), Kirkland clay loam (KCL), and Webster clay loam (WCL). The qualitative "relative bioavailability scores" for organic chemicals in natural soils were considered "high" for SSL and TSL; "medium" for RCL and KCL; and relatively "low" for WCL soil, according to Eco-SSL criteria (USEPA 2003). We adapted standardized toxicity tests for the soil invertebrates *Eisenia fetida* (ISO 11268-2:1998), *Enchytraeus crypticus* (ISO/16387:2003), and *Folsomia candida* (ISO 11267:1998) to conduct TNT exposures in soils (after a 24-h moisture equilibration period) that were either freshly amended, or after amendment subjected to wetting/drying cycles (10-14 weeks) in the greenhouse. This was done to investigate the effect of weathering-and-aging of TNT in soil on the resulting toxicity. Reproduction data were analyzed using nonlinear regression models to determine TNT concentrations causing a 20% (EC_{20}) or 50% (EC_{50}) reduction in the measurement endpoints. Preliminary results showed that toxicity of TNT was both species and soil type specific. Weathering-and-aging TNT in soil significantly altered the toxicity to all species tested based on EC_{50} values at 95% confidence intervals, compared with results of freshly amended treatments. This was true for all species and soil types except for *E. fetida* in TSL, and *E. crypticus* in KCL. Toxicity to both *E. fetida* and *E. crypticus* as measured by juvenile production in freshly amended soils closely paralleled relative bioavailability scores, and for *E. crypticus* in weathered-and-aged treatments. Soil organic matter and clay contents had strongest correlation ($r > 0.8$) with effects on *E. crypticus*, based on increasing EC_{50} values for juvenile production. Toxicity for juvenile production by *F. candida* in both freshly amended and weathered-and-aged treatments, and for *E. fetida* in weathered-and-aged treatments, varied among soil types. Differential toxicity to the three soil invertebrate species in the five soils will be discussed in relation to soil physicochemical properties and weathering-and-aging effects. Toxicity benchmarks derived in these studies will be submitted to the Eco-SSL Task Group for use in developing an Eco-SSL for TNT for soil invertebrates; results of these studies will undergo quality assurance before inclusion in the Eco-SSL database.

LACHNICHT, S.L., ARCHER, D.A., JOHNSON, J., WILTS, A., BARBOUR, N., and EKLUND, J. Use of FAME to distinguish management effects in conventional and organic farming systems. USDA ARS North Central Soil Conservation Research Laboratory, Morris MN.

A large scale systems study on conventional and organic management systems was established. Two vs. four year crop rotations (corn-soybean, corn-soybean-wheat-alfalfa), inorganic vs. organic fertilizer sources, and conventional vs. strip tillage management practices were compared. Fatty acid methyl esters (FAME) were extracted from the top 10 cm of soil in spring samples collected over three years from initial plot establishment. FAME profiles were compared by principle component analysis to determine if management practices affected the microbial community.

LAWHORN, C.N.[1] and NEHER, D.A.[2] Impact of Coleopteran-active Bt corn on extracellular enzyme activities of nontarget microbial communities that inhabit soil and litter. [1]University of Toledo, Toledo, OH. and [2] Department of Plant and Soil Science, University of Vermont, Burlington, VT.

Soil microbial communities are potentially exposed to Cry3Bb1 toxins exudated from living or decaying roots of Bt corn (event MON863, YieldGard® Rootworm) targeted for corn rootworms. Our objective was to determine whether coleopteran-Bt corn affected the colonization rate and patterns of succession of microbial communities that mediate decomposition over time. Extracellular enzyme activity (EEA) was quantified in decomposing root tissue of a Bt hybrid compared to 1) a non-Bt, isogenic hybrid treated with a soil insecticide, and 2) a non-Bt, isogenic hybrid without insecticide. Treatment plots (0.2 ha) were established in a non-till field and replicated three times in a Latin square design. Saran mesh bags (26 x 14 cm; 1 mm by 1.5 mm mesh size) with roots from Bt-corn were buried in soil (15-cm depth) at the initiation of root senescence (just after anthesis). Subsamples of decaying roots were collected and analyzed for EEA at 1, 2 and 3 months thereafter and two times in spring months, before planting the next crop. Assays for the activities of 16 hydrolytic and oxidative enzymes involved in the acquisition of carbon, nitrogen, and phosphorous from detrital organic matter was performed. The assays covered the major groups of detrital macromolecules and the major categories of ectoenzymes (glycosidases, peptidases, esterases, oxidases, and peroxidases). Results from the assays showed no significant differences in enzyme activity between the three crop treatments over the various collection times. However, major differences were found between seasons. Significantly different activity levels over sampling times were expected because it is understood that there are different rates for enzyme activity levels throughout the process of decomposition. There does not appear to be any evidence that coleopteran-active Bt corn affects detrital resources used to support microbial metabolism, relative bioavailability of