Determination of Soil Hydraulic Properties at Different Scales, X. XUE* and R. ZHANG, Univ. of Wyoming.

To better understand scale-dependence and spatial variability of soil hydraulic properties, a large field experiment was conducted to measure infiltration using disc infiltrometers. At 65 sample locations, infiltrometers with three disc sizes and two tensions were employed for the infiltration measurements. At the same locations, soil core samples were collected with different core sizes and analyzed to obtain retention functions at the different measurement scales. A new method was developed to calculate soil hydraulic properties based on the infiltration data at any infiltration time. Compared with several existing methods, the new method was shown to provide better estimation of hydraulic conductivity and macroscopic capillary length. Statistical and geostatistical analyses were conducted for the hydraulic properties. The data of the filed and lab experiments were organized as a well-structured database to study scale-dependence and spatial variability of hydraulic properties in heterogeneous soils.

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The goal of this project is to determine the impact of wetlands on the viability of agriculture in the Prairie Pothole Region. Specific objectives are to determine the impact of temporary and seasonal wetlands on crop yields and economic returns within farming systems in the region and to use agronomic and economic evaluations to improve agricultural management and policy decisions concerning wetlands. National Wetland Inventory maps and field inspections were used to select 25 pairs of wetlands in Beadle and Hamlin counties in SD. Crop yield samples from corn, wheat, and soybean were collected during September and October, 1997 and 1998. Samples were harvested along four axes at each wetland. Budget generators were used to standardize unit prices, unit costs and many of the cost components of machinery operations. Production costs and net returns for each field management unit containing the wetland sites were estimated using farm budget generator procedures. Differences in crop management practices in the wetland basins compared to upland portions of fields were determined. Average net returns to management were negative for all crops planted through the wetland.


Understanding the kinetics and mechanisms of metal sorption on soil minerals and soils is fundamental in assessing the speciation, mobility, and bioavailability of metals in natural systems. The mechanisms of metal (Ni, Zn) sorption and precipitation formation on soil minerals via macroscopic and molecular approaches (x-ray absorption fine structure [XAFS] and diffuse reflectance spectroscopies [DRS] and scanning probe microscopy [SPM]) were studied over short and long time periods. Mixed-metal Al precipitates formed on an array of common mineral surfaces and on the clay fraction of soils. The precipitates formed on rapid time scales (as short as 15 min) at low metal surface loadings, and in a pH range well below that at which metal hydroxide precipitates would be expected to form. Time-resolved characterization of the mixed cation hydroxide precipitates shows that metal stabilization occurs during stepwise transformation of an initial metal-Al hydroxide to a precursor metal-Al phyllosilicate phase. These findings are significant in the long-term evaluation of toxic metals.

Accelerated Soil Weathering Due to Nutrient Inputs in Wisconsin Cropping Systems, M. Avila-Segura, P. Barak, Univ. of Wisconsin-Madison, D. A. Laird, USDA-NSSTL, Ames, IA, J. L. Posner

Excess nitrogen inputs produce soil acidification as a result of coupling of nitrogen and proton biogeochemical cycles and increased nitrate leaching causes increased cation leaching. Crops interact with soils by extracting cations and anions, excreting acidity or alkalinity, and storing alkalinity as organic anions. The Wisconsin Integrated Cropping Systems Trial at Arlington (WI)

Research Station has sampled soils and plants under standard rotations and nutrient inputs starting in 1989. Archived samples from this trial were used to study the coupling of nitrogen and proton cycles under real farm conditions and to evaluate acidification and alteration of soil chemical properties in common agroecosystems. Leaching of cations, potential acidification due to excessive nitrogen inputs, and crop-induced acidification are under evaluation as indicators of how agriculture impacts long term soil quality.

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The objective of this project is to investigate the effect of organic amendment type, age, rate, and multi-year application on snap bean disease incidence and induced systemic resistance in sandy field soils. Paprika mill sludge (PS; 10/20 dry T/A 1988; 10/15 dry T/A 1999) and PS composted with bark (PSB: 17/55 dry T/A) were applied in single- and multi-year applications. Soils were screened for general suppression with a cucumber damping-off (DO) bioassay. In soils sampled the day after incorporation, five mo old PSB (both rates) decreased (P=0.01) and fresh PS (both rates) increased (P=0.09) DO incidence. In soils assayed nine mo later, suppression was variable in all amended soils. All soils re-amended in the second season suppressed cucumber DO (P=0.05) and natural incidence of aerial Pythium of snap bean (P=0.05). Further data on root rot, white mold, and brown spot incidence in snap bean will be presented.

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Maysin is a flavone glycoside found in maize silks that retards growth of the corn earworm. We conducted quantitative trait locus (QTL) analysis for maysin concentration in multiple maize populations, not only to determine the genetic control of maysin synthesis, but also to better understand quantitative flux through a metabolic pathway. This poster reviews our major findings: (1) the importance of the regulatory locus p1 in controlling maysin concentration; (2) detection of a locus designated rem1 that enhances maysin content when homozygous recessive in the presence of functional p1; (3) evidence for the interconnectedness of p1 and a putative maysin locus; (4) independently significant synthesis of maysin and apimaysin, compounds that differ by a single hydroxy group; and (5) detection of a second locus that determines the salmon silk phenotype.

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Remotely sensed imagery has been the focus of considerable research for improving site-specific N recommendations for corn. Our objective is to use remotely-sensed bare soil images as a proxy for soil organic matter (OM) content and consequently mineralizable N, to adjust the current N recommendation accordingly. Field-scale variable N applications and small-plot N response studies have been implemented at five 50-ha irrigated cornfields in Nebraska and Kansas. Small plot studies have been located in separate zones within the five fields to represent the soil OM content range in each field. For some of the fields, residual soil NO(3)-N and corn yield response to applied N was consistent with the expectation of more N mineralization with greater soil OM contents, while in other fields this trend was not discernible.

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