



WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2004AR70B

Title: Vadose-zone losses of soluble heavy metals from pasture soil amended with varying rates of poultry litter

Project Type: Research

Focus Categories: Non Point Pollution, Solute Transport, Water Quality

Keywords: equilibrium-tension lysimeters, leaching, heavy metals, arsenic, chromium, cadmium, pasture, poultry litter

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Non-Federal Matching Funds: \$30,900

Congressional District: 3

Principal Investigator:

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Abstract

Agriculture and the economies of the Ozark Highlands, (i.e., northwest Arkansas and northeast Oklahoma), and other regions throughout the southern United States, are largely influenced by the poultry industry. Consequently, animal waste disposal and, ultimately, surface and groundwater quality become major issues in areas with a large concentration of confined-animal-feeding operations.

Poultry litter contains notable amounts of heavy metals. Despite the cost-effective use of poultry litter as an organic nitrogen and phosphorous fertilizer, the potential impairment of groundwater drinking supplies from heavy metals, particularly arsenic (As), chromium (Cr), cadmium (Cd) and selenium (Se), contained in poultry litter is an important concern to those requiring clean drinking water supplies. Little information exists on the nature and concentration of these compounds in the soil solution as a result of the addition of poultry litter.

The likelihood of heavy metals leaching from pasture soils with a history of repeated poultry litter applications is too great to ignore. The ever-growing human population in the Ozark Highlands will depend on high quality, unimpaired drinking water sources. Therefore, to sustain high quality soil and water resources in northwest Arkansas and northeast Oklahoma, the effects of heavy metal accumulation from long-term poultry litter additions on solute leaching potentials need to be studied. Therefore, the objective of this research proposal is to continuously monitor water movement (i.e., drainage) and solute leaching, specifically heavy metals, from the root zone of tall fescue vegetation amended with varying rates of poultry litter.

Equilibrium-tension lysimeters will be employed to provide continuous, year-round drainage, solute concentration, and solute leaching loss data from the root zone of tall fescue, a common pasture grass in wide use throughout the Ozark Highlands, as a function of poultry-litter application rate. Equilibrium-tension lysimeters (0.19 m²), with a 0.2-m porous-stainless-steel plate, have been installed below undisturbed root zones of the tall fescue vegetation, at approximately a 0.9-m depth, in each of six plots with high soil-test P in the top 5 cm. Filtered leachate samples collected from the lysimeters will be acidified and analyzed for soluble heavy metals (i.e., Fe, Mn, Zn, Pb, Cu, Al, As, Cd, Cr, Ni, and Se). Drainage fluxes will be multiplied by solute concentrations to obtain leaching losses (i.e., loads) from the root zone of pasture soil. The type of data generated in this study will provide credible scientific evidence for soil leachate solution concentrations and loads that may aid regulators in defining new and/or adjusting existing solute concentration and load limits to realistic and achievable thresholds to maintain high quality groundwater resources in the Ozark Highlands region of the mid-South.