Inverse availability between Cd and As to rice across redox gradients

Limmer, M.A.[1*] & Seyfferth, A.L.[1]
[1]University of Delaware, Department of Plant & Soil Sciences, Newark, DE, USA. limmer@udel.edu

The extent of water inundation affects both greenhouse gas emissions and trace metal cycling in rice paddies. Under flooded cultivation, rice paddy production generates substantial methane emissions and rice grain accumulates high levels of arsenic. Thus, alternative irrigation strategies have been suggested, but often with limited awareness of impacts to other redox-sensitive elements. In this work, rice paddy microcosms were subjected to varying levels of flooding, from nonflooded to continuously flooded. Concentrations of trace metals in the porewater, porewater redox, and methane fluxes were measured weekly throughout the growing season. Soil redox was also logged at 15-minute intervals throughout the growing season. At harvest, plants were divided into several plant parts including polished grain, bran, unripe grain, unfilled grain, rachis, nodes, flag leaves, straw, roots, and root iron plaque extracts. The various plant parts were analyzed for elemental composition. Methane fluxes were positively correlated with grain As but negatively correlated with grain Cd. Porewater concentrations of Mn were also positively correlated with grain As. Additional correlations between porewater, soil, and plant data will be discussed across two years of field data.