UMD Department of Environmental Science and Technology

Fall 2015 Seminar Series

presents

“Rhizosphere oxidation as a Phosphorus acquisition strategy - old wine in a new bottle?”

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As goes bioavailable phosphorus, so goes life! Phosphorus is a unique element for many reasons. Not the least because it is one of very few if not the only element, that is so vital to growth that to access it organisms alter the cycling of two or more other elements. I will present evidence of this coupling in wetlands plants. One of the classic features of wetland plants is oxidation of the rhizosphere, often visible as rust color deposits on plant roots due to oxidation of reduced iron species in the bulk soil. It is widely believed that this oxidation is a passive result of radial loss of oxygen primarily due to anoxic conditions in wetland soils. Through a combination of micro-array gene expression analyses, and biogeochemical, and physiological experiments we examined the effect of nutrient availability on rhizosphere oxidation in rice plants grown in a hydroponic experimental set up. The results unequivocally demonstrate that iron oxidation was exclusively a result of phosphorus starvation, suggesting that oxidation of rhizosphere is an active process controlled by plants. Phosphorus starvation led to upregulation of several genes in the roots of wetland plants, led to changes in the composition of root wall, as well as resulted in an increased oxygenation of the medium. Due to the reactivity of iron and phosphates, oxidized iron plaque on the roots serve as a strong sink for phosphates from the surrounding bulk soil. Reports suggest that this phosphate is bioavailable to plants. Since this response is also observed in other wetland plants such as Spartina alterniflora, capable of forming oxidized rhizosphere, we suggest that the active regulation of oxidized rhizosphere is another phosphorus acquisition strategy and not a result of anoxia. Such morphological [and biogeochemical] alterations in response to phosphorus starvation also occur in some diatoms and bacteria. Which raises interesting questions regarding the evolutionary basis for the occurrence of such coupling?

Wed. Oct. 7, 4:00 PM, Room ANS 0408
Animal Science/Agricultural Engineering Building
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