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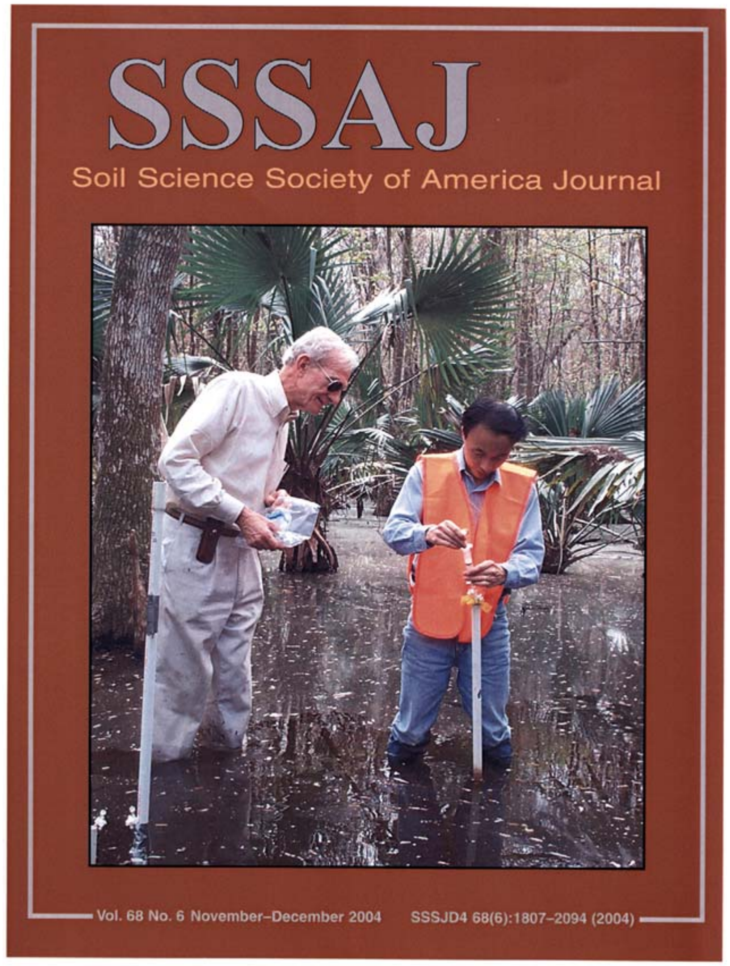
Major Scientific Publications Featuring NRI-funded Research

K. Yu and W. H. Patrick, Jr. 2004. ***Redox Window with Minimum Global Warming Potential Contribution from Rice Soils.*** *Soil Science Society of America Journal 68(6):1807-2094.*



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After carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) are the most significant atmospheric trace gases contributing to the greenhouse effect. While atmospheric concentrations of CH_4 and N_2O are generally lower relative to CO_2, their global warming potentials, or the capacity of a unit mass of the substance to heat up the atmosphere, are higher by a factor of 23 and 300 respectively. Agriculture accounts for approximately 50-70 percent of the overall anthropogenic CH_4 and N_2O emissions, while it contributes to only 5 percent of anthropogenic emissions of CO_2. Nitrous oxide can be produced from various nitrogen sources under diverse conditions. The two most important sources of N_2O from agriculture are through nitrification of ammonia from fertilizers or decomposing organic matter under aerobic conditions and denitrification of nitrate under moderately reducing conditions. On the other hand, CH_4 formation, or methanogenesis, in soils generally occurs under intensely reducing conditions characterized by permanent or long term flooded conditions. Redox, the intensity of oxidation or reduction, in soils is characterized by the redox potential, E_H. Rice fields shift between an aerobic and anaerobic environment because of irrigation and drainage practices, making this production system a potential CH_4 source during flooded periods and a N_2O source during drainage or shortly after flooding. This NRI funded study determined the E_H range that would minimize the production of CH_4 and N_2O thereby reducing the global warming potential of a broad range of rice soils. In addition, this study explored what redox-related soil characteristics govern the dynamics of this E_H window. Results show that a window of redox conditions exists for rice production that will minimize the impact of this production system on global warming. Initial organic matter and sulfur content, and release of degradable organic material to the soil during the growing season have significant influences on the timing for each soil to reach or maintain that window. These results suggest a rationale for water, organic matter residue, and fertilizer management strategies to minimize the global warming potential of rice production systems while enhancing productivity and the efficient use of resources.

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