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CROPS, CLIMATE, CULTURE AND CHANGE

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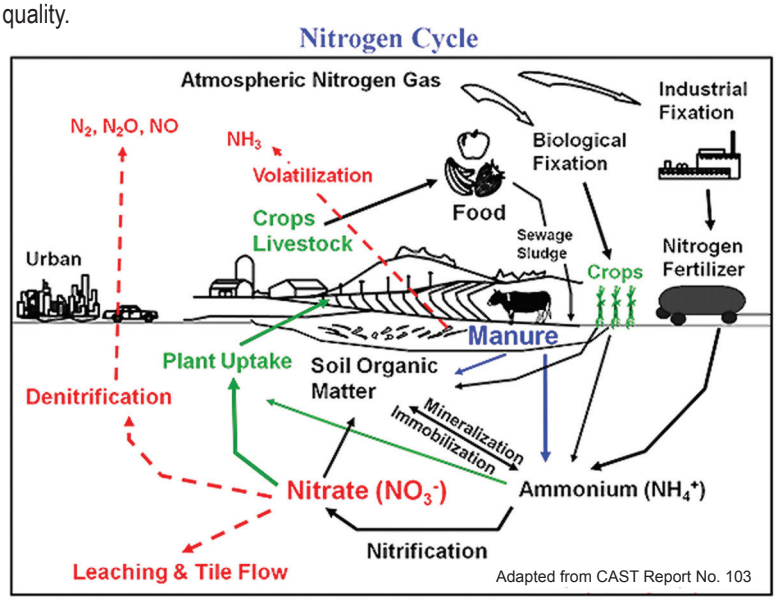
Pictures shown, from top to bottom, are: Corn nitrogen response, corn biomass samples, Graduate Student Jose Pantoja collecting fall soil samples, Jose Pantoja presenting at CSCAP-sponsored high school summer camp.

Soil Nitrogen Cycle

Dr. John E. Sawyer, Iowa State University

Nitrogen (N) is an essential nutrient for animals and plants. For cereal crops, it is often the most limiting nutrient and therefore important in regard to fertilization and management. Nitrogen is abundant in nature; air is 78% N; rocks of the earth's crust have 50 times more N than the atmosphere; and the surface layer of most cultivated soils contains 1,200 to 6,000 lb N/acre, with more than 90% in organic forms. However, the majority of this N is not in a form that plants can take up, and must be converted to plant available ammonium (NH_4) or nitrate (NO_3), or supplied from atmospheric N_2 fixation by plant/microbe symbiosis or industrial fertilizer manufacture. Nitrogen is very reactive in that it can change among many forms: organic, such as amino acids, proteins, and chlorophyll; gasses, such as ammonia (NH_3), dinitrogen (N_2) and nitrous oxide (N_2O); and ions, such as NH_4^+, nitrite (NO_2^-) and NO_3^-. Conversion from one form to another occurs by many chemical and biological processes, which are highly influenced by environmental conditions, especially temperature and moisture. The overall interaction between soil, air, microbes, plants, animals, and humans is called the N cycle (see figure). In soils, plants and microbes interact with all components of the cycle, with many processes occurring simultaneously and all having potential influence on the fate of N. A major factor complicating N management for crop production, and the importance of climate, is that the soil is an open system – meaning that N can move out of the soil ("be lost") to the atmosphere or to ground and surface waters. If such movement did not occur, then N management would be much less complicated. Research continues to better understand the intricacies of the soil N cycle and the influence from climate, with the goal to provide management options in order to enhance N use by crops and therefore improve agronomic efficiency, economic profitability, and environmental quality.



For more information, contact:
Dr. John Sawyer, Professor, Iowa State University, jsawyer@iastate.edu, 515-294-7078
Lynn Laws, Communication Specialist, Climate and Corn-based Cropping Systems CAP, lynnlaws@iastate.edu or 515-294-7380
Project web site and e-mail: sustainablecorn.org | info@sustainablecorn.org

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USDA United States Department of Agriculture National Institute of Food and Agriculture

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