

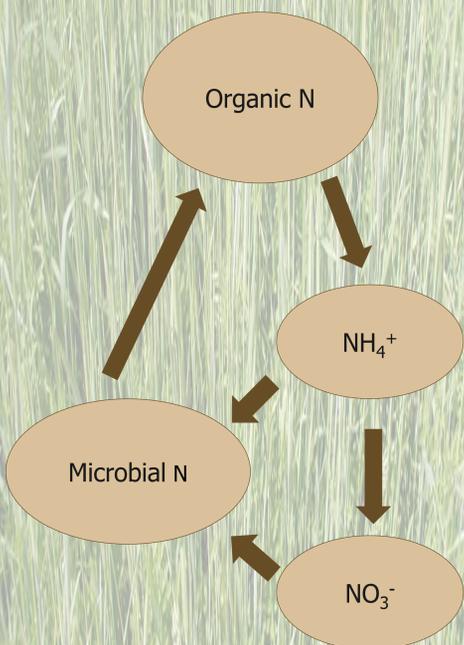
Denise M. Finney\*, Sara E. Eckert, and Jason P. Kaye

Department of Ecosystem Science & Management, The Pennsylvania State University, University Park, PA 16802

## Why Study Nitrogen in Organic Systems?

Nitrogen management is a central challenge in agriculture: growers must balance N provision to support crop growth with N retention to minimize pollution.

Reliance on biological nitrogen inputs in organic systems complicates this balancing act due to the fact that N availability is governed by microbially-mediated processes.

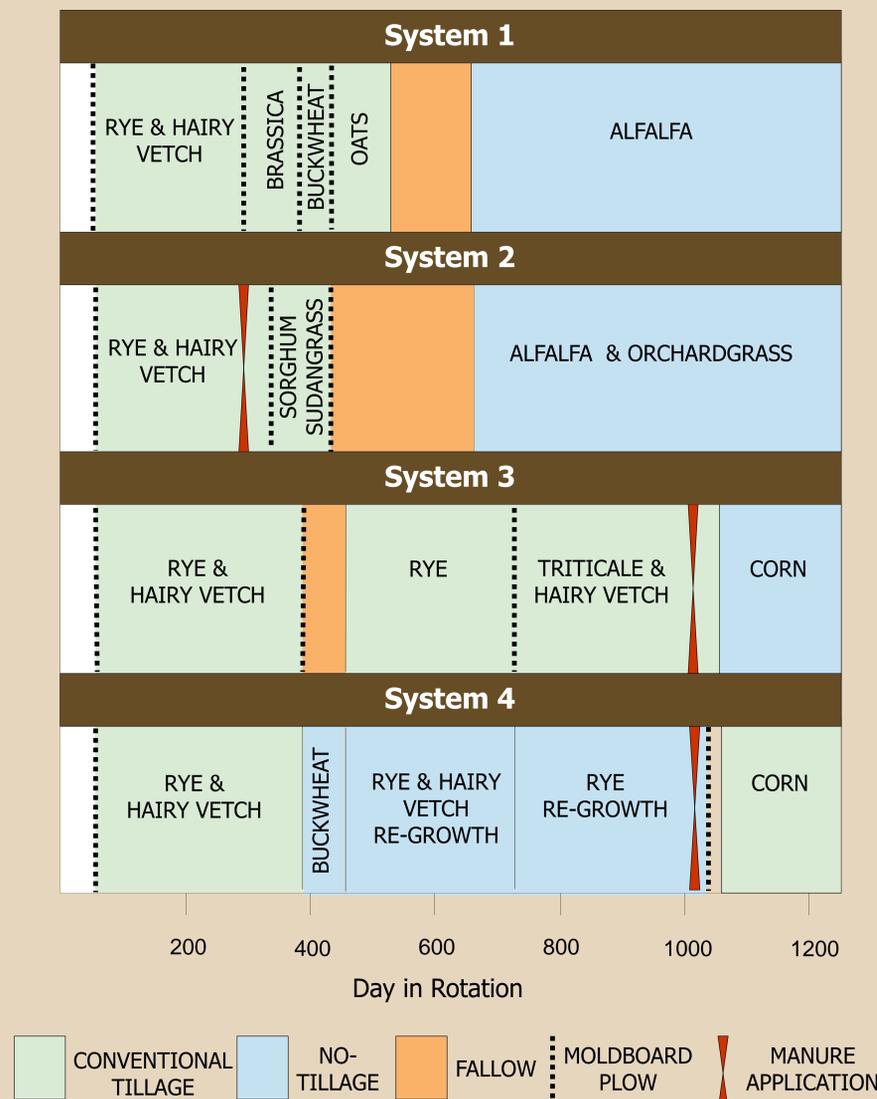


Management decisions are likely to influence microbially-mediated N transformations. Of particular interest in organic systems are weed management tools such as tillage, fallowing, and crop rotation and their impact on N dynamics.

## Research Questions

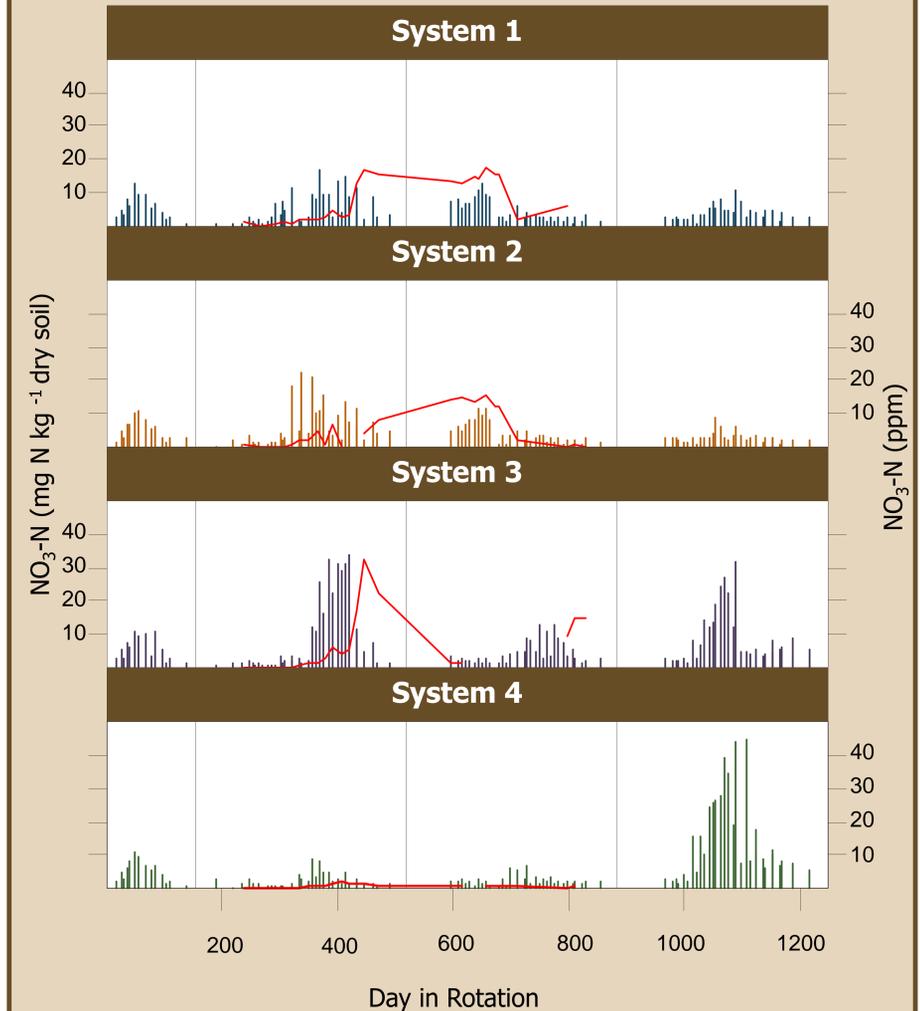
1. What management decisions in organic cropping systems influence surface soil nitrate concentrations?
2. What factors may lead to nitrate leaching from organic systems?

## Experimental Cropping Systems



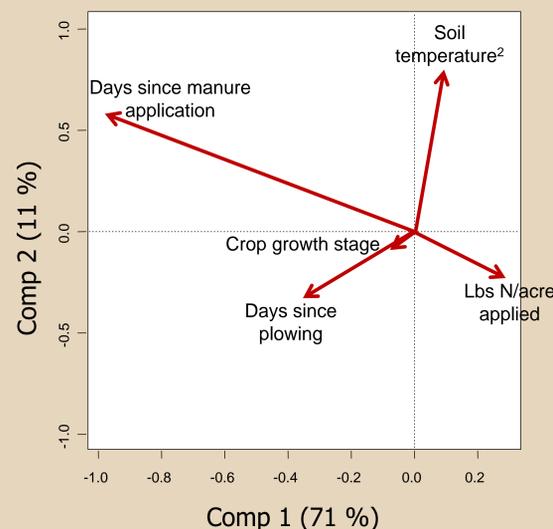
**Figure 1.** Four experimental organic cropping systems initiated in August 2007 (start1) and August 2008 (start 2).

## Surface Soil and Deep Soil Water Nitrate



**Figure 2.** Four organic cropping systems varied in the timing and magnitude of elevated surface soil  $\text{NO}_3\text{-N}$  concentrations. Bars indicate the concentration of  $\text{NO}_3\text{-N}$  (mg N kg<sup>-1</sup> dry soil) in surface (top 20 cm) soil (left axis). Red lines indicate the concentration of  $\text{NO}_3\text{-N}$  (ppm) in deep soil water (right axis) collected in tension lysimeters at the soil bedrock interface. Elevated  $\text{NO}_3\text{-N}$  concentrations in soil water follow elevated concentrations in surface soil, particularly during fallow periods.

## Factors Influencing Surface Soil Nitrate



**Figure 3.** Partial least squares regression loadings biplot showing environmental and management factors that influence surface soil (top 20 cm) nitrate concentrations. Factors that did not influence nitrate concentrations were soil gravimetric water content and the cumulative number of plowing operations performed by the time of sampling.

## Key Findings & Future Directions

- Inorganic N availability in organic cropping systems is dynamic through the growing season and influenced by environmental conditions and management decisions.
- Moldboard plowing events influence N availability in the short-term, but do not have a cumulative effect on nitrate dynamics.
- Fallow periods increase the potential for nitrate leaching.
- Our next step is to develop a theoretical model of inorganic N availability based on experimental data. Such a model could inform decision support tools to assist producers who rely on biological nitrogen inputs to optimize N management while pursuing other management goals such as weed control.

\*Contact: dm272@psu.edu  
UID: 74328

