Mitigation of Reactive N Mobilization (N_2O and NO_3^-) Using Injected, High Frequency, Low Nitrogen Fertigation (HFLN)

Project Leader: David R. Smart
Dept. of Viticulture and Enology, University of California, Davis, 595 Hilgard Lane, Davis, CA 95616
(530) 754-7143, drsmart@ucdavis.edu

PROJECT SUMMARY

Objectives:

- Assess soil nitrous oxide (N_2O) emissions in almond using two forms of nitrogen (N) fertilizer application: 1) low frequency high N and 2) injected high frequency low N for drip fertigation (HFLN).
- Evaluate N fertilizer type in limiting N_2O-forming soil N transformations.
- Identify microbial factors that control soil N_2O emissions; namely, nitrification and denitrification.
- Develop 3-D models over short term time scales for linking soil N_2O emissions to the Hydrus model.
- Use isotopic tracers to help estimate orchard fluxes of nitrogen (NH_4^+, NO_3^-, NH_3, and N_2O).
- Assist with parameterization of the DeNitrification DeComposition (DNDC) and Hydrus models for use in a decision support framework.

Background and Discussion:

Offsite transport of reactive N from agriculture is facing increased regulatory scrutiny. Thus, one critical challenge facing California almond growers can be summed up in a two-word question: "Whither nitrogen?"

In an ideal world, the answer would be that N is fully taken up from soils by the tree, where it contributes to both growth and nut production. But in the real world, almond orchards are somewhat leaky. Some of the N is released in various gaseous forms to the atmosphere and some leached beyond the root zone—into subsurface well waters.

"Whither nitrogen?" and "how much nitrogen?" represent two interlocking questions being examined collaboratively by several research teams trying to unlock the complexities of what happens when water, nitrogen, and soil microbes interact in the orchard under varying conditions.

Their collective ultimate goal is to improve nutrient-use efficiency (NUE) in almond production, and thereby both maximize yield economically and minimize the offsite loss of reactive forms of nitrogen — especially N_2O, a known greenhouse gas (GHG), as well as nitrate (NO_3^-) contamination of groundwater.

This ongoing project, being coordinated with several other researchers, is focused on a comparative study of soil N_2O emissions and NO_3^- leaching using two methods of applying a given total of N fertilizer: comparing fewer but higher N applications targeted to tree demand (current practice) versus applying a small concentration of N with each irrigation (HFLN). Nitrogen use efficiency (NUE), here defined as N assimilated by the tree as a percent of applied N is also monitored. We are documenting the oxidation of another potent GHG, methane (CH_4).

The results are expected to provide practical management tools for growers to improve NUE for both almonds and pistachio. Another important aspect of the project is to provide reliable information for regulators rather than unreliable assumptions.

Project Cooperators and Personnel: Maria del Mar Alsina Marti, Christine M.Stockert, Patrick Brown, and Saiful Muhammad, UC Davis; Blake Sanden, UCCE - Kern County; Franz Niederholzer, UCCE - Yuba County; Paramount Farming Co.

For More Details, Visit

- Poster location 53, Exhibit Hall A and B during conference; or on the web (after January 2014) at www.almondboard.com/researchreports
- 2012.2013 Annual Report CD (12-AIR2-Smart); or on the web (after January 2014) at www.almondboard.com/researchreports
- Related Projects: 13-PREC2-Brown; 13-PREC5-Brown; 13-PREC4-Hopmans; 13-HORT11A-Sanden; 11-STEWCROP4-Kimmelshue