Evaluating Nitrogen Management Strategies to Minimize Reactive Nitrogen

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

PROJECT SUMMARY

Objectives:

- To compare GHG emissions (N2O, CH4 and CO2) from a single orchard under the N management practice of and computer controlled very high frequency low N and low water applications.
- To evaluate temporal variability of GHG emissions with respect to environmental factors such as volumetric water content and seasonal temperature variation.
- Identify microbial factors that control soil N2O emissions; namely, nitrification and denitrification.
- Acquire ground verification data using the spatial models of event related N2O fluxes we've developed to capture N2O emissions episodes for soils that have not been previously evaluated for calibration of the DNDC model. Assemble annual emissions budgets.
- Compare NO3- movement below the root zone from the orchard under computer controlled very high frequency low N and low water application. Assemble annual leaching budgets.
- Use modeling exercises to evaluate Best Management Practices for NO3- leaching to groundwater.

Background and Discussion:

Offsite transport of reactive N (nitrate, ammonia, nitrous oxide, etc.) from agriculture is facing increased regulatory scrutiny. Thus, a challenge facing California almond growers is what causes and what can reduce offsite reactive N loss.

In an ideal world, the applied N fertilizer is fully taken up from soils by the tree (NUE=100%), where it contributes to both growth and nut production. But in the real world, almond orchards, as are all crops, are somewhat leaky.

Some of the N is released in various gaseous forms to the atmosphere and some as nitrate (NO_3^-) leached below the root zone.

Understanding N leakage represents several interlocking questions being examined collaboratively by several researchers trying to understand what happens when water, nitrogen, and soil microbes interact in the orchard under varying conditions.

The ultimate goal is to identify Best Management Practices (BMPs) with superior nitrogen use efficiency (NUE) in almond production, and maximize yield while minimizing offsite transport of reactive forms of N — primarily N_2O, a potent greenhouse gas (GHG), and NO_3^-, into groundwater.

This ongoing project, is focused on a comparative study of soil N_2O emissions and NO_3^- leaching using computer assisted irrigation and fertigation. Our experience with BMPs trials has indicated that limiting water and N to the root zone and increasing its residence time and targeted to tree demand (current practice) may enhance the "spoon feed" practice. Our experience has led us to the conclusion the most effective way to achieve spoon fed water and N is through computer assisted applications which ease the operational demands on growers. Nitrogen use efficiency, here defined as N assimilated by the tree as a percent of applied N plus mobilized reactive N (N_2O and NO_3^-), will be intensively monitored. A long term objective is to increase N that gets into the tree and lessen the totality of reactive N forms mobilized.

The results are expected to provide practical management tools for growers to improve NUE for both almonds and pistachio. A further aspect of the project is to provide reliable objective information on N_2O emissions and NO_3^- leaching dynamics for regulatory agencies.

Project Cooperators and Personnel: Patrick Brown, Jan Hopmans, Thomas Harter, Hanna Ouaknin, Christine M. Stockert, Patrick K. Nichols, Kristin Steger, Rebekah Davis; UC Davis.

For More Details, Visit

- Poster location 49, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2018) at Almonds.com/ResearchDatabase
- 2016 - 2017 Annual Report (16-AIR2-Smart) on the web at Almonds.com/ResearchDatabase
- Related Projects: 17-HORT3-Yaghmour (Niederholzer); Poster 50-Parkhurst – Carbon Credits