Almond Orchards and Greenhouse Gases: Calculating Nitrous Oxide Emissions from Two *N* Fertilizers & Two Micro-Irrigation Systems

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PROJECT SUMMARY

Objectives:

- Compare soil nitrous oxide (N_2O) emissions in almonds from two forms of nitrogen (N) fertilizer: urea ammonium nitrate and calcium ammonium nitrate.
- Evaluate seasonal variation in soil N_2O emissions.
- Identify factors that control soil N_2O emissions; namely, water-filled pore space, soil temperature, inorganic N concentration, and pH.
- Develop spatial and temporal models for more accurate estimation of soil N_2O emissions.
- Use an isotopic tracer approach to estimate orchard fluxes of nitrogen (NH_4^+, NO_3^-, HN_3, and N_2O).
- Parameterize the DeNitrification DeComposition model (DNDC) for use in a decision support framework.

Background:

Offsite transport of nitrogen 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 a perfect 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.

In the real world, almond orchards are somewhat leaky. Some of the N is released in various forms and quantities—and at various times—to the soil, soil microbes, into water and the atmosphere.

“Whither nitrogen?” represents one of a range of interlocking questions being examined collaboratively by several research teams trying to unlock the complexities of what happens when water, nitrogen, and microbes interact in the orchard under varying conditions.

Their collective ultimate goal is to improve nutrient-use efficiency 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) 300 times more potent than CO_2.

Discussion:

This ongoing project, being coordinated with several others under the direction of Patrick Brown, is focused specifically on a comparative study of soil N_2O emissions associated with two forms of nitrogen fertilizer applied with two different irrigation systems, and assessing nitrogen use efficiency by the tree. It is also documenting the absorption of another potent GHG, methane.

The project is gathering data on key parameters to provide input for the development of the computer-based models (DNDC) to be used to monitor and predict the movement of N over space and time.

The results are expected to provide practical management tools for growers to improve nitrogen use efficiency for both almonds and pistachio. And, they are expected to provide reliable information for regulators rather than unreliable assumptions.

Project Cooperators and Personnel: Daniel L. Schellenberg, Maria del Mar Alsina Marti, Christine M.Stockert, Patrick Brown, and Saiful Muhammed, University of California, Davis; Blake Sanden, University of California Cooperative Extension, Kern County; Franz Niederholzer, UCCE, Yuba County; Paramount Farming Co.; Nickels Soil Laboratory

For More Details, Visit

- Poster location13, Exhibit Hall, Session 2; or on the web (after January 2012) at AlmondBoard.com/AICposters
- 2010 - 2011 Annual Report CD (10-AIR2-Smart); or on the web (after January 2012) at AlmondBoard.com/ResearchReports
- Related Reports: 11-PREC2-Brown, 11-PREC5-Brown, 11-PREC4-Hopmans, 11-HORT11-Shackel/Sanden