

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

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## PROJECT SUMMARY

### Objectives :

- Evaluate and compare soil nitrous oxide (N<sub>2</sub>O) emissions in almond orchards from two forms of nitrogen (N) fertilizer: urea ammonium nitrate and calcium ammonium nitrate (NO<sub>3</sub><sup>-</sup>).
- Evaluate seasonal variation in soil N<sub>2</sub>O emissions before and after fertilizer application.
- Identify factors that control soil N<sub>2</sub>O 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<sub>2</sub>O emissions.
- Use an isotopic tracer approach to estimate orchard fluxes of nitrogen (NH<sub>4</sub><sup>+</sup>, NO<sub>3</sub><sup>-</sup>, HN<sub>3</sub>, and N<sub>2</sub>O).

### 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 tree growth and nut development.

In the real world, almond orchards are leaky and not all of the N is absorbed by the tree. The rest is released in various forms and quantities—and at various times—to the soil, water, and atmosphere.

Consequently, “whither nitrogen?” represents only one of a range of interlocking questions

being explored 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<sub>2</sub>O, a known greenhouse gas 300 times more potent than CO<sub>2</sub>.

### 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<sub>2</sub>O emissions associated with two forms of nitrogen fertilizer applied with two different irrigation systems, and assessing nitrogen use efficiency by the tree.

The project is gathering data on key parameters in the test orchard to provide input for the development of computer-based models 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.

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**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; John Edstrom, UCCE, Colusa County; Paramount Farming Co.; Nickels Soil Laboratory

### For More Details, Visit

- Poster location 14, Exhibit Hall, Session 3; or on the web (after January 2011) at [AlmondBoard.com/AICposters](http://AlmondBoard.com/AICposters)
- 2009-10 Annual Report CD (09-AIR2-Smart); or on the web (after January 2011) at [AlmondBoard.com/ResearchReports](http://AlmondBoard.com/ResearchReports)
- Related Reports: 10-PREC2-Brown; 10-Hort15- Hopmans