

# Development of a Nutrient-Budget Approach and Optimization of Fertilizer Management in Almond

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## PROJECT SUMMARY

### Objectives:

- Determine how leaf-nutrient status varies across a range of representative orchards and environments, and how it varies within the canopy and during the growing season.
- Develop a phenology and yield-based nutrient model for almond.
- Develop fertilizer-response curves based on yield data and nutrient levels, and assess nutrient-use efficiency.
- Determine nutrient-use efficiency of selected commercially important fertilizer sources of nitrogen and potassium.
- Determine the nutrient storage pool of perennial tree organs under differential N fertilization.
- Develop and promote new best management practices for nutrient use in almond.
- Develop and then validate a new leaf nutrient sampling protocol for almonds.

### Background and Discussion:

Optimal nutrition is essential to maintain the competitiveness of California's orchards and successful and cost-effective fertilization entails both maximizing production and protecting the environment.

In a 2007 survey growers indicated that using July leaf sampling plus the University of California's "critical values" guidelines may not provide adequate guidance on nutrient management. That finding was the impetus for this multiyear, multidisciplinary, and multi-location project.

Data from 2008, 2009, and 2010 from four well-managed orchards was used to fit a leaf nitrogen prediction model that could be used

early in the season (April). Once this model was created, it was validated collecting data from six almond orchards in 2012. Results from this validation process showed an excellent fit between predicted and observed July nitrogen values. Thus, a new tool for early leaf nitrogen sampling is available for California Almond growers and analytical labs.

The development of a nutrient budget for California Almond has been completed. Data clearly show that 80% of the total N and 70% of the total K is accumulated in fruit by mid June. Yield and N concentrations determine N demand which averages 62lb N removed in fruit for every 1000lb kernel yield. Mean fruit K removal is 80lb for 1000lb kernel yield.

Cumulative nitrogen use efficiency (NUE) of over 80% has been achieved in these trials from an N rate of 275lb/ac in a 4000-4800 lb. production orchard; representing one of the highest NUE's recorded in tree production. N losses through leaching and gaseous emission are very low in this orchard.

The stored N in the perennial tree organs is essential for flowering and fruit development in early spring when soil N uptake is low. The N reserves in perennial organs begin to accumulate in early summer and continue through season.

The results of these research activities will be incorporated into a nutrient-budget approach to develop an integrated set of science-based, sustainable and yield-oriented best management practices for nutrient management in almond.

**Project Cooperators and Personnel:** Sebastian Saa and Saiful Muhammad, University of California, Davis; Blake Sanden, University of California Cooperative Extension, Kern County; Roger Duncan, UCCE, Stanislaus County; Brent Holtz, UCCE, Madera County; Franz Niederholzer, UCCE, Sutter and Yuba counties; Paramount Farming Co.

### For More Details, Visit

- Poster location 27, Exhibit Hall A & B during conference or on the web (after January 2013) at [www.almondboard.com/researchreports](http://www.almondboard.com/researchreports)
- 2011.2012 Annual Report CD (11.PREC2.Brown); or on the web (after January 2013) at [www.almondboard.com/researchreports](http://www.almondboard.com/researchreports)
- Related projects: 12.HORT11A-Sanden/Shackel; 12.HORT13.Lampinen; 12.AIR2.Smart; 12.HORT15.Hopmans; 12.PREC5.Brown