

Almond Nitrogen Research and Practices: “Then and Now”

Managing Agricultural Nitrogen
June 11, 2012

Bob Curtis, Associate Director, Agricultural Affairs
Almond Board of California

Research and Practices Then: 1970s – 1980s

	Then: 1970s – 1980s
Crop demand	<ul style="list-style-type: none">•Primary factor dictating N use – crop potential•50 # N removed per 1000 # kernels
Yield vs. N use	<ul style="list-style-type: none">•Best practice: 2,000 # kernel yield with 200 # N•The norm: 1,200-1,300 # kernel yield with 200 # N•Over fertilization does not enhance yields
Nitrogen Use Efficiency (NUE)*	Best practice: 50% The norm: 42 - 46%

NUE = N harvested in crop/N applied

Research and Practices Then: 1970s – 1980s

	Then: 1970s – 1980s
Timing	<ul style="list-style-type: none">• Avoid dormant applications• Most efficient uptake in season• 1 or 2 applications/season
Application	<ul style="list-style-type: none">• Broadcast or banded• Flood or impact sprinkler
Leaf sampling	July leaf sample linked to next year's crop
Fertility budgeting	N fertilization model for almond – UC Fruit and Nut Research and Information Center http://ucce.ucdavis.edu/rics/fnric2/almondNKmodel/almond_n_model.html

2007 ABC-funded Grower Survey

Lopus, et al, July-September 2010 California Agriculture, “Survey examines the adoption of perceived best management practices for almond nutrition”, pp.149 - 154.

High level of adoption in almonds of BMPs

- 80.6% respondents (91% of acreage) use fertigation
- 65% respondents apply N with periods of maximum plant demand
- 79.4% collect leaf samples at least once annually

Identified research and extension needs – To optimize yields and meet environmental standards

- Improved sampling to account for orchard variability
- Better interpretation of UC critical values to execute fertility practices
- Early season leaf sampling enabling adjustments for this year’s crop

Research and Practices Then (1970s – 1980s) vs. Now (2012)

	1970s-1980s	2012
Crop demand	<ul style="list-style-type: none"> •Primary factor dictating N use – crop potential •50 # N removed per 1000 # kernels 	<ul style="list-style-type: none"> • 55 – 70 # N removed per 1,000 # kernels. Average 60 # N per 1000 # kernels
Yield vs. N use	<ul style="list-style-type: none"> •Best practice: 2,000 # kernel yield with 200 # N •The norm: 1,200-1,300 # kernel yield with 200 # N •Over fertilization does not enhance yields 	<ul style="list-style-type: none"> • 4,000 # kernel yield with 275 # N • No benefit from N application above this
Nitrogen Use Efficiency (NUE)*	<p>Best practice: 50%</p> <p>The norm: 42-46%</p>	<ul style="list-style-type: none"> • 75 – 85% research, production guideline 70% • Among the most efficient measured for any crop

* NUE = N harvested in crop/N applied

Research and Practices Then (1970s – 1980s) vs. Now (2012)

	1970s-1980s	2012
Timing	<ul style="list-style-type: none"> • 1 or 2 apps in-season 	<ul style="list-style-type: none"> • “Spoon feeding” – multiple apps, low doses: late spring, Apr-May, June-July, early post harvest • Match demand during tree growth and crop development: 80% applied late spring to June-July
Application	<ul style="list-style-type: none"> • Broadcast or banded • Flood or impact sprinkler 	Fertigation through drip or microsprinkler
Leaf sampling	July leaf sample linked to next year’s crop	<ul style="list-style-type: none"> • Goal: Improved leaf sampling - addresses orchard variability • Goal: Early season leaf sampling - adjustments for this year’s crop
Fertility budgeting	N fertilization model	Goal: Updated for more than just N

Current Research Findings and Effort

Low Off-Target Movement

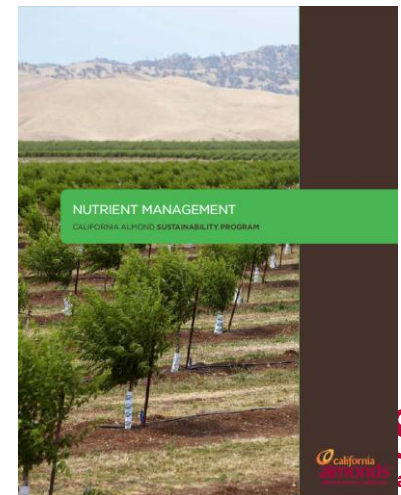
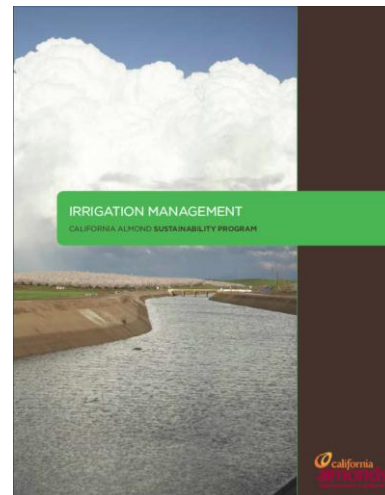
- Nitrates
 - Little movement below root zone : 2.9 – 7.6% = 8 to 21 pounds
- N₂O
 - Off-gassing much less than 1% of N applied (e.g., 0.24 - 0.63%)

What's next?

- Validate leaf sampling – will complete in 2012
- Nutrient budget for more than N – preliminary budget end of 2012
- Assessing nitrates in root zone and just below root zone?
- Validate/demonstrate results in other orchards
- General outreach: UC in concert with CA Almond Sustainability Program

CA Almond Sustainability Program

- How do we document that almond growers are sustainable?
- ‘Self-Assessment Tool’
 - Not a survey, a process by which growers/handlers assess themselves with a view towards continuous improvement
 - Content based on grower and expert input (UC, CSU, UCCE and private consultants)
 - Currently 5 modules:
 - Irrigation
 - Nutrient Management
 - Air Quality
 - Energy
 - Pest Management



Nutrient Management

1	How many pounds of nitrogen (N) were applied per acre for this orchard in the season being assessed?	lbs/acre
2	How many pounds of phosphorus (P) were applied per acre for this orchard in the season being assessed? (NOTE: Please use actual P instead of P ₂ O ₅ *)	lbs/acre
3	How many pounds of potassium (K) were applied per acre for this orchard in the season being assessed? (NOTE: Please use actual K instead of K ₂ O*)	lbs/acre
4	What is the percent soil organic matter for this orchard, as measured in the past 5 years**? IF YOU HAVEN'T TESTED FOR THIS, CHECK HERE <input type="checkbox"/>	%

For my orchard, I am using the following practices and/or technologies for maximizing nutrient management efficiency:

Not familiar with this	I haven't tried it	I have tried it	My current practice	Not applicable
------------------------	--------------------	-----------------	---------------------	----------------

SOURCE		Not familiar with this	I haven't tried it	I have tried it	My current practice	Not applicable
5	The following sources of nitrogen were utilized in this orchard in the past year. (Select all that apply):					
	a. commercial in-organic nitrogen fertilizer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	b. manure (not recommended for food safety reasons) <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	c. compost <input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	d. nitrogen-fixing cover crops	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6	If compost, manure, or nitrogen-fixing cover crops were used, their nitrogen contribution to the crop was estimated and used in calculating the total nitrogen applied.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Irrigation well water (if used) has been analyzed for its nitrogen content at least once during the past 3 years.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2009-11 Sustainability Statistics-Nutrient Management

- N (Nitrogen) applied annually - 187 lbs/A
- P (Phosphorus) applied annually - 44 lbs/A
- K (Potassium) applied annually - 167 lbs/A

- Fertigation: 91% - microsprinkler 76% , drip 15%
- Three or more split-applications of N/year: 77%
- Plant tissue tests done before applying nutrients: 90%
- Variable-rate applications of nutrients: 47%
- Fertilizers timed to irrig/rain to ensure N moves into root zone: 90%

- N provided by compost, manure or N-fixing covers accounted for: 51%
- N provided by irrigation water accounted for: 56%
- Have written nutrient management plan and budget: 44%

