



2017

# THE ALMOND CONFERENCE

WHAT'S NEW IN ALMOND TREE NUTRITION AND REGULATION?

Room 308-309 | December 6 2017



# CEUs – New Process

## Certified Crop Advisor (CCA)

- Sign in and out of each session you attend.
- Pickup verification sheet at conclusion of each session.
- *Repeat this process for each session, and each day you wish to receive credits*

## Pest Control Advisor (PCA), Qualified Applicator (QA), Private Applicator (PA)

- Pickup scantron at the start of the day at first session you attend; complete form.
- Sign in and out of each session you attend.
- Pickup verification sheet at conclusion of each session.
- Turn in your scantron at the end of the day at the last session you attend.

*Sign in sheets and verification sheets are located at the back of each session room.*

# AGENDA

- **Sebastian Saa**, Almond Board of California, moderators
- **Franz Niederholzer**, UCCE
- **Amy Hughes**, Environmental Defense Fund
- **Parry Klassen**, East San Joaquin Water Quality Coalition





# What's New in Nutrient Management

**F.J.A. Niederholzer**  
*UC ANR CE Farm Advisor,  
Colusa/Sutter/Yuba Counties*

**University of California**  
Agriculture and Natural Resources



# **WHAT FACTORS INFLUENCE ALMOND PRODUCTION POTENTIAL?**

- **Canopy size**
  - Matching rootstock x variety x spacing
  - Irrigation
  - Nutrition
- **Spur health**
  - Irrigation
  - Nutrition (nitrogen & potassium)
  - Pest (mites & disease) management

Nutrient	Nutrient removed in 1000 lb kernel	Nutrient/acre removed in average crop
<b>Potassium</b>	195.2 lbs	<b>195.2 lbs</b>
<b>Nitrogen</b>	165.9 lbs	<b>165.9 lbs</b>
Phosphorus	21.86 lbs	21.86 lbs
Calcium	6.68 lbs	16.30 lbs
Magnesium	4.64 lbs	11.32 lbs
Sulfur	2.62 lbs	6.39 lbs
<b>Boron</b>	0.76 lbs	<b>0.76 lbs</b>
Iron	0.46 lbs	0.46 lbs
<b>Zinc</b>	2.72 oz	<b>2.72 oz</b>
Manganese	1.66 oz	1.66 oz
Copper	0.34 oz	0.83 oz

**Truck-load(s)**

**Card-board boxes**

# Nitrogen





# NITROGEN DELIVERS THE GREATEST ROI IN ALMOND NUTRITION/FERTILITY @ CURRENT COSTS/PRICES

Annual N Treatment (N/acre)	2008 Kernel yield (lb/acre)	2009 Kernel yield (lb/acre)	2010 Kernel yield (lb/acre)	2011 Kernel yield (lb/acre)
125 lb	3,506 <sup>a</sup>	2,715 <sup>a</sup>	2,849 <sup>a</sup>	3,811 <sup>a</sup>
200 lb	3,534 <sup>a</sup>	2,943 <sup>ab</sup>	3,413 <sup>b</sup>	4,274 <sup>b</sup>
275 lb	3,732 <sup>a</sup>	3,183 <sup>b</sup>	3,734 <sup>bc</sup>	4,643 <sup>c</sup>
350 lb	3,733 <sup>a</sup>	3,489 <sup>b</sup>	4,030 <sup>c</sup>	4,735 <sup>c</sup>

ROI →

15.3

28.9

30.2

P. Brown, UC Davis

# THE FEDERAL STANDARDS FOR NITRATE IN DRINKING WATER

**10 ppm N-nitrate**

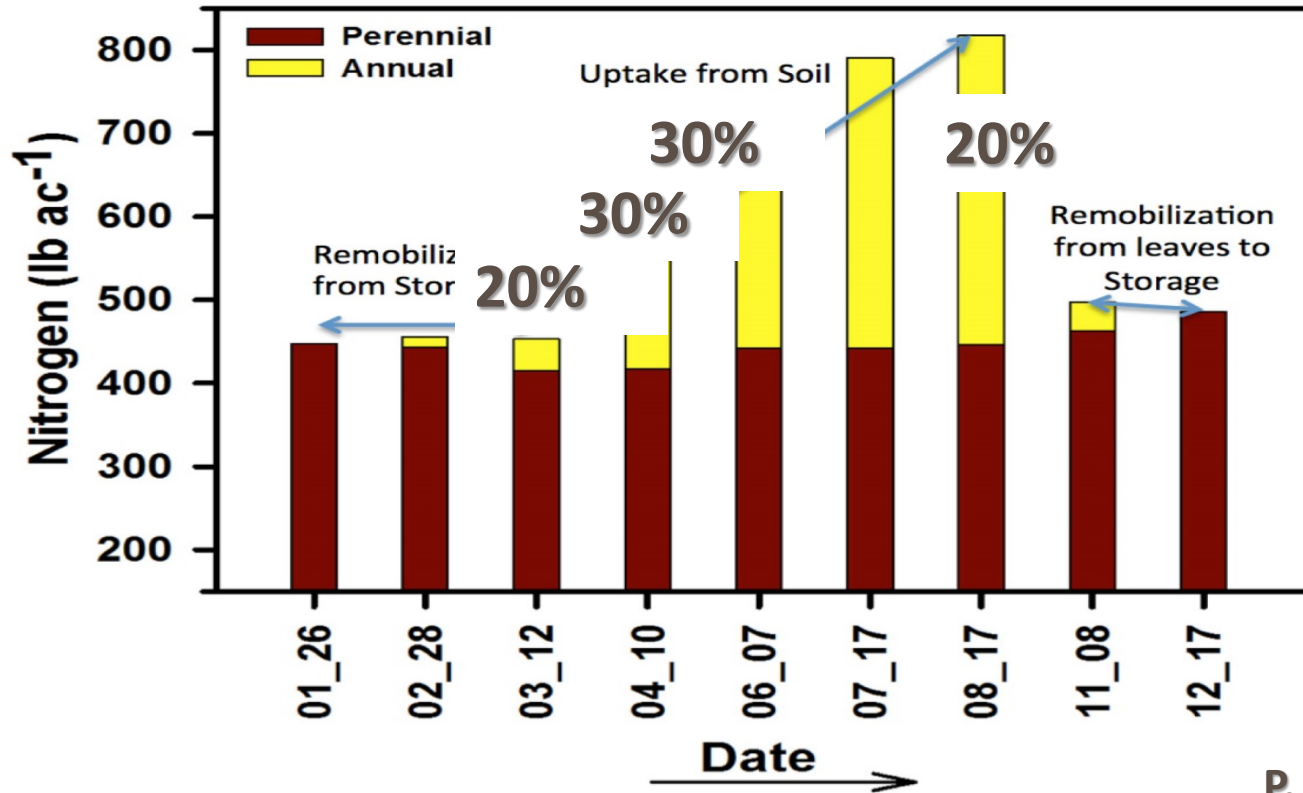
**=**

**45 ppm nitrate**

# HOW TO MINIMIZE A/R & MAINTAIN POTENTIAL FOR LARGE CROP IN UNCERTAIN TIMES

- Know the time(s) of biggest N need (demand)
- Deliver/keep adequate N in the root zone at those times.
- Limit/eliminate significant N application at times showing limited (any?) benefit.

# FOR MATURE TREES, TARGET TIME OF MOST NEED = LEAF OUT TO HULL SPLIT (CROP GROWTH)



# WHAT HASN'T ADDED VALUE IN LIMITED RESEARCH?

- **Fall N application**
  - no yield benefit from 30 or 60 lbs N/acre in October in 2 years of research in Colusa Co. Work continues. Check out results/details at Poster 48
- **Foliar N in-season**
  - Done right, no harm, but where's the ROI?

# **TISSUE ANALYSES = PROGRESS REPORT AND/OR PART OF A FINAL GRADE FOR A NUTRITION PROGRAM**

- **Spring sample (Nitrogen)**
- **Summer sample (all but boron)**
- **Hull sample (boron)**
- **Check shoot/spur growth in summer**

# DIFFERENT SPRING LEAF SAMPLING PROTOCOLS EXIST. PICK ONE AND FOLLOW IT, CHECK AGAINST SUMMER RESULTS

- **UC ESP Leaf Sampling Protocol**

- 43 days ( $\pm$  6 d.) after full bloom

- Take all leaves of 2-3 non-bearing spurs around the tree

- Sample 18-28 trees, each at least 90' feet apart

- Request full nutrient analysis from lab

- Plug results into UC model in Excel. Find the model at:

- [http://ucanr.edu/sites/scr/Crop\\_Nutrient\\_Status\\_and\\_Demand](http://ucanr.edu/sites/scr/Crop_Nutrient_Status_and_Demand)

- Patrick Brown/

**or**

- <https://www.sustainablealmondgrowing.org/>

**UC Leaf  
Sampling  
Protocol  
helps  
growers  
avoid N  
deficiency  
anywhere in  
the block  
w/o pushing  
disease (hull  
rot, etc.)  
disease.**

<b>Summer leaf sample result (% N by dry weight)</b>	<b>% of trees that are NOT nitrogen deficient (&gt; 2.2% N)</b>
<b>2.0</b>	<b>6.6</b>
<b>2.1</b>	<b>22.6</b>
<b>2.2</b>	<b>50.0</b>
<b>2.3</b>	<b>77.4</b>
<b>2.4</b>	<b>93.4</b>
<b>2.5</b>	<b>98.8</b>
<b>2.6</b>	<b>99.9</b>
<b>2.7</b>	<b>100</b>
<b>2.8</b>	<b>100</b>
<b>2.9</b>	<b>100</b>



# **DELIVER THE NITROGEN TO THE ACTIVE ROOT ZONE AND KEEP IT THERE.**

- In warm, moist soil, any nitrogen source is transformed in days (urea,  $\text{NH}_4^+$ ) or weeks (manure, compost, etc.) into nitrate.
- Nitrate moves readily with water.
- Over irrigation = nitrate loss from the rootzone.
- Efficient nitrogen management = efficient irrigation management

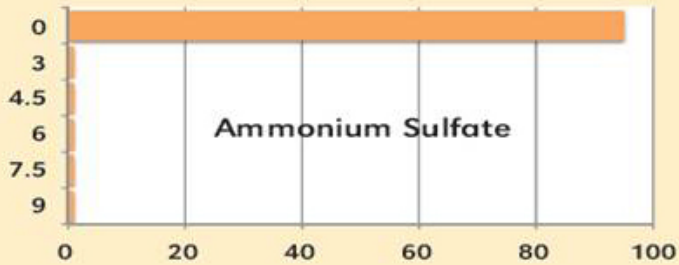


Photograph: Paul Popper/Popperfoto/Getty Images

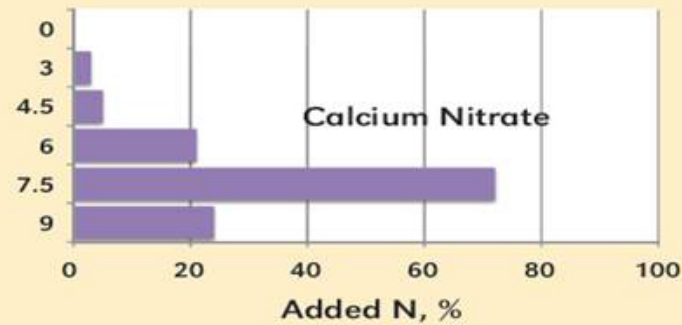
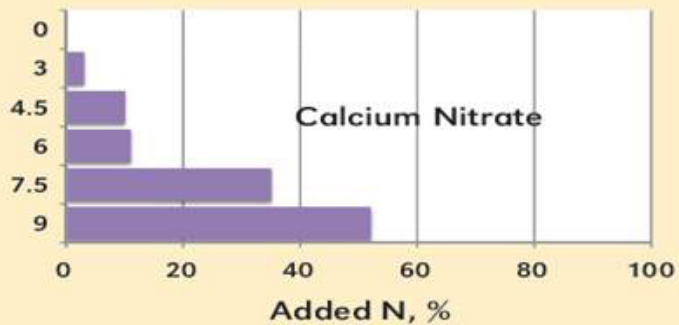
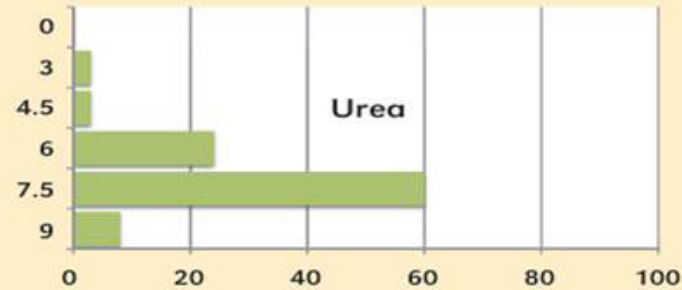
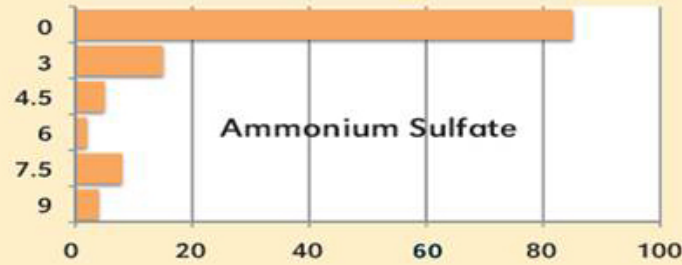
**In terms of leaching potential, urea moves, initially, like which other nutrient form injected through irrigation systems into the soil:**

- **a) Nitrate**
- **b) Ammonium**
- **c) Ammonia**
- **d) Mono ammonium phosphate (MAP)**

Yolo Loam



Hanford Sandy Loam



**RIGHT PLACE:  
IRRIGATION  
RAPIDLY  
MOVES UREA  
AND NITRATE  
INTO SOIL.  
SURFACE  
APPLIED N  
FOLLOWED  
BY 90 MIN  
IRRIGATION**

## DELIVERING N EFFICIENTLY INCLUDES...

- injecting urea or nitrate in the second half of the irrigation set. The longer the set, the later the injection.  $\frac{3}{4}$  of N in UN32 is leachable during injection.
- targeting the active roots. Active roots are irrigated roots. Don't apply fertilizer where irrigation water doesn't reach.
- Injecting N through full coverage sprinklers feeds weeds (and crop trees)

**YIELD IN THE SAME BLOCK CAN DIFFER BY VARIETY.  
WHY FERTILIZE ALL @ THE SAME RATE?**



# FERTILIZING TREES MEANS MATCHING FEED TO NEED. EASY DOES IT WITH YOUNG TREES



# GENERAL RULE FOR YOUNG TREES: 1 OZ N/TREE/YEAR OF GROWTH PER APPLICATION





# SPECIFIC TIPS FOR FERTILIZING 1<sup>ST</sup> LEAF TREES

- Too much N = root burn & die back
- 1-4 oz/tree/**YEAR**
- 1 OZ/TREE/application **MAX**
- Bulky, dry mixes (15-15-15) under sprinklers works best, keep at least 18” from the trunk. Low rate via drip can be OK
- Avoid applying in very hot weather w/ high water use
- Be xtra careful with certain varieties (Monterey, Butte) on plum or plum hybrid roots.

**FOR 2<sup>ND</sup> & 3<sup>RD</sup> LEAF TREES, KEEP 1  
OZ/TREE/YEAR/APP RULE, WATCH K LEVELS**

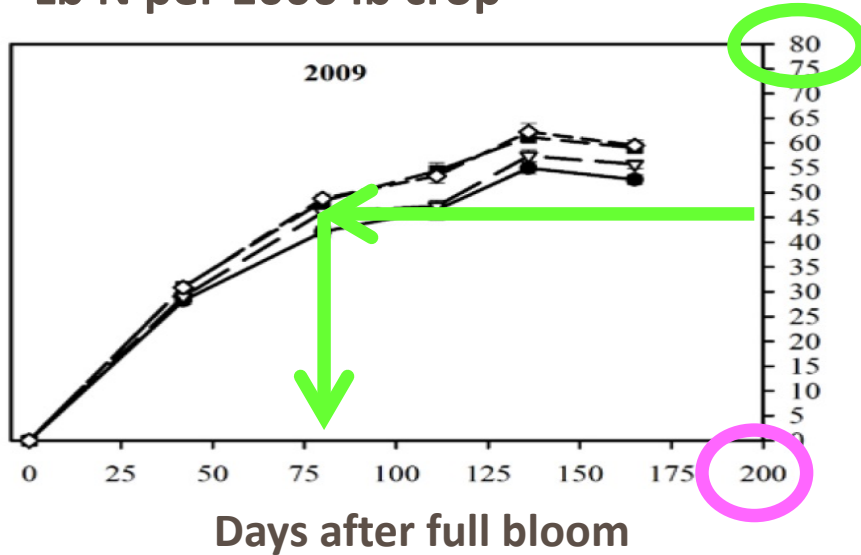


# Potassium

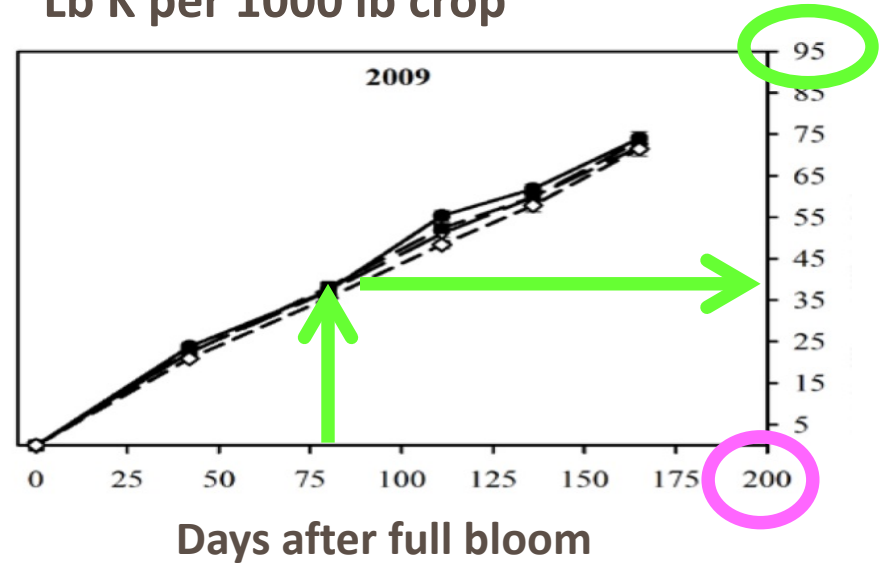


# ALMOND NUT K & N ACCUMULATION PATTERNS DIFFER DURING A GROWING SEASON.

Lb N per 1000 lb crop



Lb K per 1000 lb crop



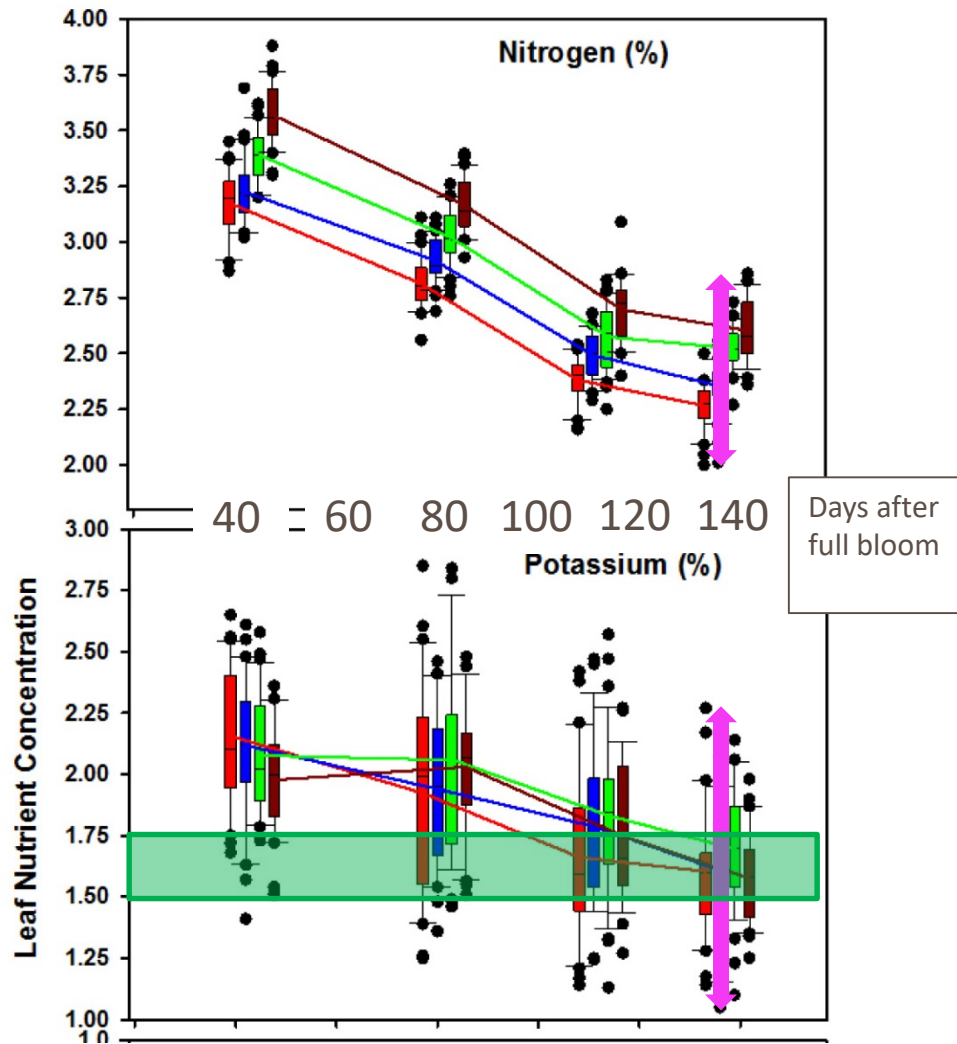
Nitrogen storage in woody tissue = ~40 lbs N/acre

Potassium storage in woody tissue = ~25 lbs K/acre

# SOIL CEC (SOIL K STORAGE POTENTIAL) INFLUENCES K INPUT PLANS & PRACTICES

Practice	High CEC Soil (>15 meq/100 g of soil)	Low CEC soil (<15 meq/100g of soil)
Dormant Soil Applications	Yes – can be “slugged” on	Yes – but only partial budget
Banding gypsum to move potassium	Yes, if heavy clay	<b>NO</b>
In-Season Applications	Yes, if needed	Yes- 40-60% of the budget
Fertigation of K	Yes	Yes – be cautious of large applications

**LEAF POTASSIUM  
VALUES VARY MUCH  
MORE THAN NITROGEN  
WITHIN THE SAME  
FIELD.**



# **SUMMER LEAF LEVELS ARE A REPORT CARD FOR PREHARVEST FERTILITY & KEY PLANNING INPUT(S) FOR POSTHARVEST FERTILITY PROGRAM**

	<b>Critical July leaf nutrient concentration (%)</b>	
	<b>Old target</b>	<b>New target</b>
<b>Nitrogen</b>	<b>2-2.5</b>	<b>2.4-2.5</b>
<b>Potassium</b>	<b>&gt;1.4</b>	<b>1.0</b>

## WHAT'S NEW IN BORON AND ZINC NUTRITION?

**Zinc:** Lower rates of zinc sulfate (5 lbs/acre) in October instead of 20 lbs/acre in November. Save \$, zinc and nitrogen.

**Boron:** Watch your water sources and harvest hull boron levels. Fall or pink spray still best nutrient ROI out there – if needed.



**RIGHT TIMING, LOCATION, & RATE ARE VITAL TO EFFECTIVE, EFFICIENT & SAFE N & K FERTILIZATION MATERIAL IS LESS CRITICAL**

	<b>Nitrogen</b>	<b>Potassium</b>
<b>Annual Rate*</b>	68 lbs N	80 lbs K (96 lbs K <sub>2</sub> O)
<b>Timing</b>	Mar-early June; <b>Sept</b> 20-30-30- <b>20</b>	Mar-June; Sept.
<b>Location</b>	Tree row, upper 0-2' root zone	Tree row, upper 0-2' root zone
<b>Material</b>	Grower choice	Grower choice

*\*per 1000 lbs kernel crop (includes hull, shell and kernel). Adjust annual rate for the current year based on cropload and tissue tests*

A close-up photograph of several green almonds on a branch, with vibrant green leaves. The almonds are in various stages of growth, some appearing more rounded and others more elongated. The background is softly blurred, showing more of the tree and a hint of a person in the distance.

# Generating Carbon Credits from Nitrogen Fertilizer Optimization

Amy Hughes  
Environmental Defense Fund

December 6, 2017

**THIS PROJECT IS SUPPORTED BY THE U.S. DEPARTMENT OF AGRICULTURE'S AGRICULTURAL MARKETING SERVICE THROUGH GRANT 15-SCBGP-CA-0046 AND NATURAL RESOURCE CONSERVATION SERVICE THROUGH A CONSERVATION INNOVATION GRANT. ITS CONTENTS ARE SOLELY THE RESPONSIBILITY OF THE AUTHORS AND DO NOT NECESSARILY REPRESENT THE OFFICIAL VIEWS OF THE USDA.**

# Optimizing Nitrogen Fertilizer Management in California Crops

Thanks to two grants, EDF looks to pilot a nitrogen management project with **California almond growers** to demonstrate how soil health management systems and nitrogen management can be **integrated into carbon markets**.



# WHAT IS THE ENVIRONMENTAL DEFENSE FUND'S HISTORY OF WORKING ON CREDITS FROM AGRICULTURE?



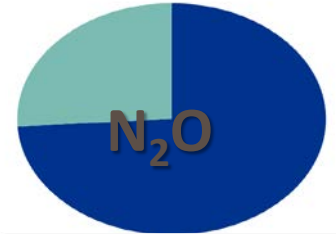
# WHAT IS THE RICE PROTOCOL AND WHY DOES IT MATTER TO ALMONDS?

- Rice production emits methane - potent greenhouse gas
- 2007 - began work with UC Davis and the California Rice Commission
  - Growers collected information to establish a baseline and adopted approved practices
- June 2015 - California Air Resources Board approved their Rice Cultivation Compliance Offset Protocol
- June 2017 - first carbon credits generated
  - Six rice growers from three states
  - Sold to Microsoft



# OPTIMIZING NITROGEN FERTILIZER MANAGEMENT IN CALIFORNIA CROPS

- According to EPA, **approximately 75%** of all U.S. nitrous oxide emissions is generated by agriculture.
- EDF is partnering with growers and the Almond Board of California to **identify** and **incentivize** activities that reduce nitrous oxide emissions and nitrate leaching.



# WHAT IS A NITROGEN FERTILIZER EFFICIENCY CREDIT?

- Represents quantity of emissions reduced by changing nitrogen application practices
- Marketable commodity
  - California Cap-and-Trade Program
  - Canadian Province of Ontario Cap-and-Trade Program
  - International Civil Aviation Organization's (ICAO) Carbon Offsetting Scheme for International Aviation (CORSIA)





# WHY GENERATE CREDITS?

- Growers are under increasing pressure to **minimize nitrogen losses** to air and water.
- **Optimizing nitrogen applications** can reduce nitrate leaching and nitrous oxide emissions.
- Reducing nitrogen losses will help reduce operational costs and maximize the nitrogen reaching the plant to ensure that growers **maintain or increase yields**.
- Credits are an **economic reward** for farmers who are implementing nitrogen management practices.

# WHAT IS A PROTOCOL?

- Method based on studies of nitrogen applications
- Describes how to quantify the amount of nitrous oxide emissions reduced from a baseline
- Developing agricultural protocols and quantification methodologies that reward growers for reducing their emissions
  - **American Carbon Registry:** *“Methodology for N<sub>2</sub>O Emission Reductions through Changes in Fertilizer Management”*

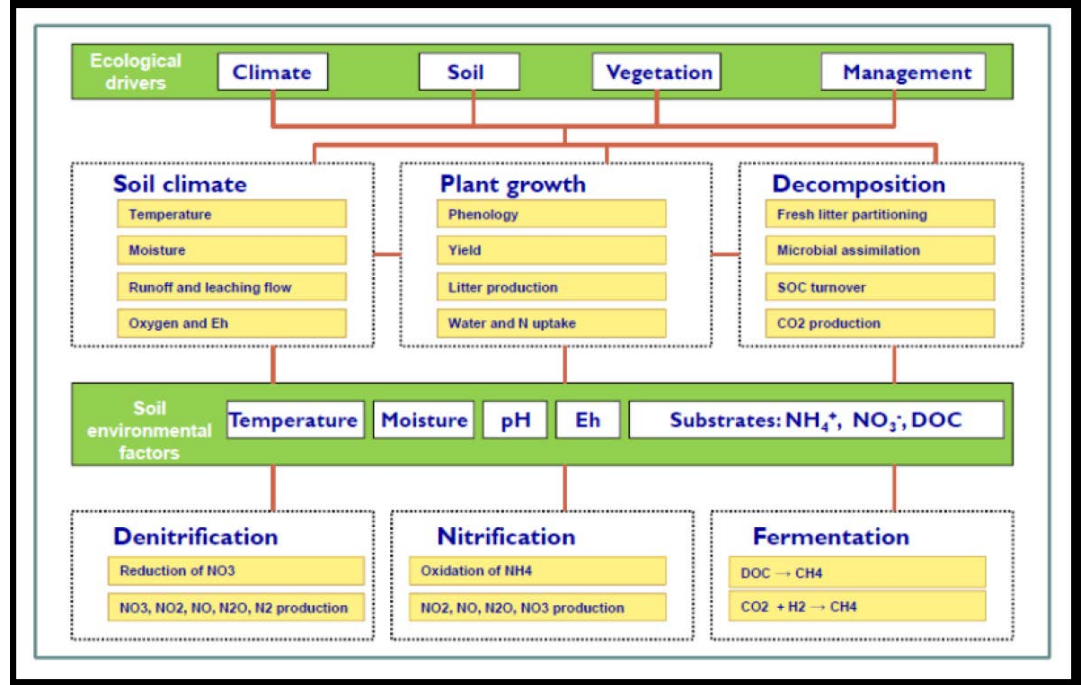
# WHAT ARE THE APPROVED PRACTICES TO GENERATE NITROGEN FERTILIZER EFFICIENCY CREDITS?

- ✓ **10% nitrogen rate reduction**
- ✓ **20% nitrogen rate reduction**
- ✓ **Pump and Fertilize**
- ✓ **Nitrogen applied as CAN17**

- Growers may choose to implement **one or more** of the approved practices, depending on specific farm conditions.
- Implementation of any practice is the decision of the grower.
- Growers may change which practices they implement each year.

# DNDC SIMULATIONS OF CALIFORNIA ALMONDS

- Created set of sites representing full range of biophysical characteristics of locations where orchards are grown in California
- Simulated sites using range of N management strategies hypothesized to reduce reactive N losses
- Evaluated effectiveness of each strategy
  - Alone
  - In combination with other strategies



# MANAGEMENT OVERVIEW

- **Bloom:** 2/15
- **Irrigation:** bi-weekly as needed from bloom to two weeks prior to harvest date
- **Fertigation:** 2-3 times from early-spring to summer
- **Harvest:** August – September
- **Canopy Pruning:** 15% removal of stem biomass in winter; pruned material chipped and applied to orchard alley surface

# MULTI-INTERVENTION SCENARIOS

## Area-weighted, Statewide Results

### *Selected Set:*

- **N2O Benefit** (reduction <0%)
- **N Leaching Benefit** (reduction <0%)
- **Minimal Yield Reduction:** (no more than 5% loss)

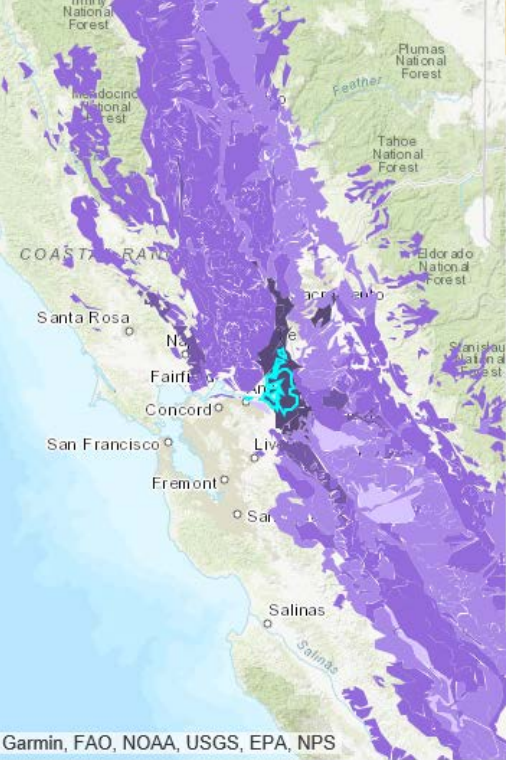
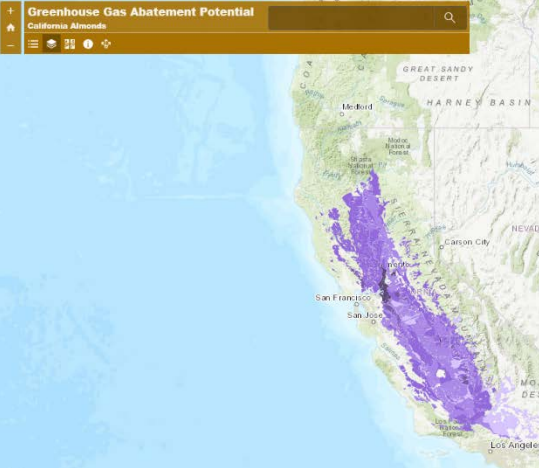
N management				reduction from baseline	
rate	form	applications	groundwater	N2O	N leaching
80% N	CAN	baseline (2-3x)	PAF	-23%	-11%
80% N	CAN	6x	PAF	-22%	-13%
80% N	CAN	baseline (2-3x)	no test	-21%	-6%
80% N	CAN	6x	no test	-20%	-7%
90% N	CAN	baseline (2-3x)	PAF	-20%	0%
80% N	CAN	15x	PAF	-20%	-16%
90% N	CAN	6x	PAF	-18%	-2%
80% N	CAN	15x	no test	-18%	-10%
90% N	CAN	15x	PAF	-16%	-5%
90% N	UAN	6x	PAF	-7%	-14%
80% N	UAN	15x	no test	-7%	-18%
90% N	UAN	baseline (2-3x)	no test	-5%	-8%
90% N	UAN	6x	no test	-5%	-9%
90% N	UAN	15x	PAF	-4%	-15%
100% N	UAN	baseline (2-3x)	PAF	-2%	-5%
100% N	UAN	6x	PAF	-2%	-6%
90% N	UAN	15x	no test	-1%	-10%

# COST/BENEFIT ANALYSIS TOOL – ALMOND CALCULATOR

- Assess implementation of changes to growing practices, taking into account:
  - Fertilizer costs/savings
  - Grower time
  - Offset revenue
  - Volume of N<sub>2</sub>O reductions
- Determine best practices for growers based on combination of **soil, weather, and economics**
- Working to make this available to growers

Current Practice	
Region	Sacramento Valley
ID Number	1
N amount	Base Nitrogen Use
N Fertilizer Type	UAN 32
# of N Applications	2-3 Applications
Pump and Fertigate	
Emissions Summary	
Irrigation	CO <sub>2e</sub> Before (tons/Acre) 0.289
# of acres	CO <sub>2e</sub> After (tons/Acre) 0.211
	Tons/Acre Reduction
N Applications	Total # of tons avoided
Cost of Fertilizer	Carbon Price (\$/ton)
Cost of Water	Revenue from Credits/Grower
Total Summary	
Revenue	Costs
Baseline	General Expenses
Project	Labor Expenses
Project	Overhead Expenses
Price	Total Expenses
Revenue	Revenue
Revenue	Total Revenue
Total	Profit
New Practice	
Sacramento Valley	San Joaquin North
1	1
Base Nitrogen Use	Base Nitrogen Use
UAN 32	UAN 32
2-3 Applications	2-3 Applications
No	Yes
Flood	Sprinkler
200	200
Growing Strategy for Minimum Emissions at Your Location	
N Amount	20% Nitrogen Reduction
N Fertilizer Type	UAN 32
# of N Applications	6 Applications
Pump and Fertigate	Yes
Irrigation Type	Drip
CO <sub>2e</sub> Emitted (Tons/Acre)	0.176
Potential Reduction (Tons/acre)	0.113

# GREENHOUSE GAS ABATEMENT POTENTIAL MAP



(1 of 3)

Map unit key #: 660955

Baseline emissions (tCO<sub>2</sub>e/ac): 0.60

Minimum emissions (tCO<sub>2</sub>e/ac): 0.22

Reduction potential (tCO<sub>2</sub>e/ac): 0.39

Best management practice: 20% Nitrogen rate reduction applications p  
- drip irrigatio

**Almond acreage (as a share of total map unit area): 0.09%**

Almond acre

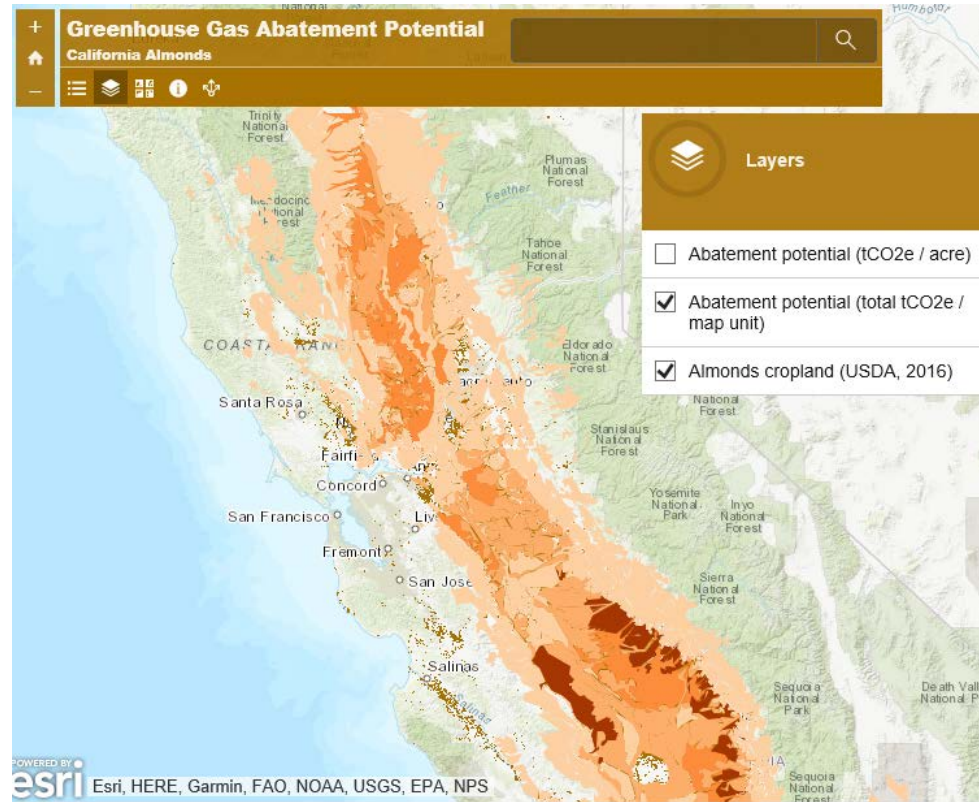
**Aggregate abatement**

Almond acre **potential (tCO<sub>2</sub>e): 35.73**

Garmin, FAO, NOAA, USGS, EPA, NPS



# AGGREGATE GREENHOUSE GAS ABATEMENT POTENTIAL MAP



# OPTIMIZING NITROGEN FERTILIZER MANAGEMENT IN CALIFORNIA CROPS

- Identified four weather and soil specific practices to decrease nitrous oxide emissions
- Requires data collection similar to Nutrient Management Plans (NMP) reported to the Irrigation Lands Regulatory Program
- Seeking almond growers interested in piloting these practices

## Questions

### Amy Hughes

- Environmental Defense Fund
- [amhughes@edf.org](mailto:amhughes@edf.org)
- 810-449-2470





## Coalition Overview

**Parry Klassen**

East San Joaquin Water  
Quality Coalition

# COALITION OVERVIEW

- In operation since 2003
- 3,397 Landowner / operators
- 704,670 irrigated acres
  - Madera, Merced, Stanislaus, Tuolumne, Mariposa counties
- Average size of member operation
  - 199 acres



# State Water Resources Control Board

- ESJWQC Waste Discharge Requirements adopted Dec 2012; petitioned immediately
- State Board released second draft WDR October 10, 2017
  - State Board Workshop December 6, (Sacramento)
  - Written comments due December 15, 2017
  - Adoption January 23, 2018
- Coalition presented at workshop and is preparing formal comments
- Petition to Superior Court (*if we or others don't like outcome*)
  - Court could further modify or order adoption as is
- Will apply to all Central Valley Coalition WDRs
- Go to [www.esjcoalition.org](http://www.esjcoalition.org) General Order for process documents

# STATUS QUO MAY CHANGE; BUT NOT YET

- Current requirements still in place for all CV coalitions
- State Water Board petition process will force changes in 2018 and beyond
- Basic message: *Complete required reports and stay in compliance!*
  - Water Board still pursuing those who have not joined coalitions or filed for individual permits
  - Regional Water Board actively enforcing against non-reporters
    - Farm Evaluation, Nitrogen Summary Report, Sediment & Erosion Plan

# State Water Resources Control Board

- Draft State Water Board WDR includes mandates to:
  - Monitor all domestic wells on member parcels
  - Requires equal reporting for low and high vulnerability areas
    - Additional time for low vulnerability farms
    - Reduced frequency of Farm Evaluation reporting (every 5 years)
  - Allows Coalition to report data to Regional Water Board using anonymous identifiers for members and farms
    - Farm Evaluations
    - Irrigation and Nitrogen Management Plans
    - Management Practice Implementation Report



# State Water Resources Control Board

- **Creates “Irrigation and Nitrogen Management Plan”**
  - Report “Total Water Applied”
  - Report  $E_T$  (evapotranspiration)
- **Data maintained on farm; not reported to coalition**
  - Report nitrogen from all sources (irrigation water, fertilizer, compost, manure) individually
- **Creates Management Practices Implementation Report**
  - Must report new practices implemented every year if located in Management Plan areas (surface or groundwater)
- **Applies to all California Irrigated Lands Programs**

# What Is Now Required

## ***MEMBER RESPONSIBILITIES***

- Complete Farm Evaluation\*
- Complete Nitrogen Management Plan
  - In high vulnerability groundwater area; submit Summary Report to ESJ annually
    - Certified by 3<sup>rd</sup> party or grower trained and self certified
    - Low vulnerability keep on site; no certification required
- Sediment and Erosion Control Plan
  - In areas identified as high vulnerability for erosion and sediment discharge
- Participate in annual outreach events

\* *Enforcement fines for non-reporting are exceeding \$30,000!*

# Are Growers Applying Too Much Nitrogen to Their Crops?

## Question being asked by water quality regulators and the public

- If more nitrogen is applied than the crop can use, excess nitrogen can potentially leach into groundwater aquifers and cause contamination
- Groundwater aquifers in high vulnerability area already have nitrates above state standards or due to
  - geological characteristics,
  - have conditions that could lead to groundwater contamination from nitrates.
- We must prove we are not over-applying

# NITROGEN MANAGEMENT PLAN WORKSHEET

NMP Management Unit: \_\_\_\_\_

1. Crop Year (Harvested): _____	4. APN(s):	5. Field(s) ID	Acres
2. Member ID# _____			
3. Name: _____			

CROP NITROGEN MANAGEMENT PLANNING		N APPLICATIONS/CREDITS	15. Recommended/ Planned N	16. Actual N
<b>6. Crop</b>		<b>17. Nitrogen Fertilizers</b>		
<b>7. Production Unit</b>		18. Dry/Liquid N (lbs/ac)		
<b>8. Projected Yield</b> (Units/Acre)		19. Foliar N (lbs/ac)		
9. N Recommended (lbs/ac)		<b>20. Organic Material N</b>		
<b>10. Total Irrigated Acres</b>		21. Available N in Manure/Compost (lbs/ac estimate)		
<b>Post Production Actuals</b>				
<b>11. Actual Yield</b> (Units/Acre)		<b>22. Total Available N Applied</b> (lbs per acre)		
<b>12. Total N Applied</b> (lbs/ac)		<b>23. Nitrogen Credits (est)</b>		
<b>13. ** N Removed</b> (lbs N/ac)		24. Available N carryover in soil; (annualized lbs/acre)		
<b>14. Notes:</b>		25. N in Irrigation water (annualized, lbs/ac)		
		<b>26. Total N Credits</b> (lbs per acre)		
		<b>27. Total N Applied &amp; Available</b>		

PLAN CERTIFICATION		
28. CERTIFIED BY:	29. CERTIFICATION METHOD	
	30. Low Vulnerability Area, No Certification Needed	
	31. Self-Certified, approved training program attended	



## REPORTING A/Y

### ***TOTAL APLIED NITROGEN DIVIDED BY TOTAL YIELD***

- Summary template asks for A/Y to be calculated
- Divide “**Total Applied Nitrogen**” (commercial, compost, irrigation water N)  
by **Total Yield**
  - Total yield per management unit
  - Total N applied per management unit
- Coalition calculates amount of N removed from A/Y that you report

# Determining if “Excess Nitrogen” is Applied to a Crop

- We acknowledge
  - Applied/Yield (A/Y) calculation is not a perfect measure of potential for nitrogen to leach into groundwater
  - Important variables not considered in A/Y calculation:
    - Timing of nitrogen applications
    - Amounts of nitrogen in each application
    - Timing and amounts of irrigation water
  - Field's A/Y is key indicator of excessive nitrogen applications

# SOURCES OF NITROGEN REMOVED NUMBERS

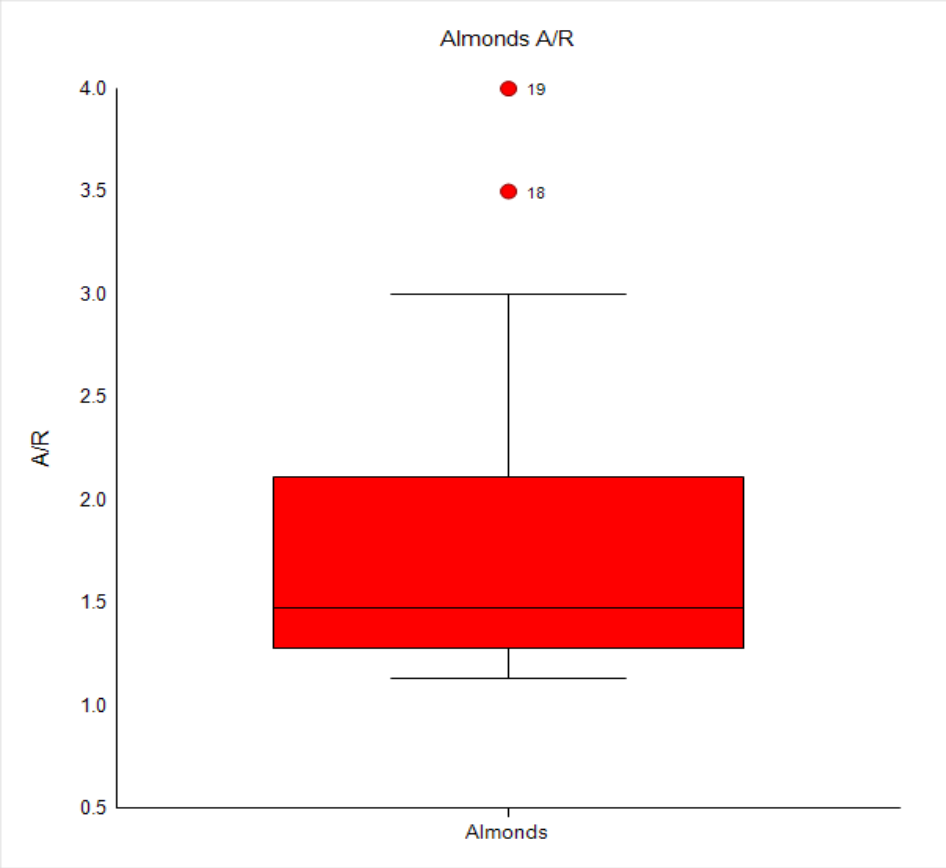
- “Nitrogen Removed” developed through scientific studies
- Some crops have more information needed for calculating nitrogen removed than others
- In coming years, much effort put into refining nitrogen removed numbers
  - reflect variables of crop production in the Central Valley
- For now, will use existing CDFA/UC numbers



# DETERMINING AN “OUTLIER”

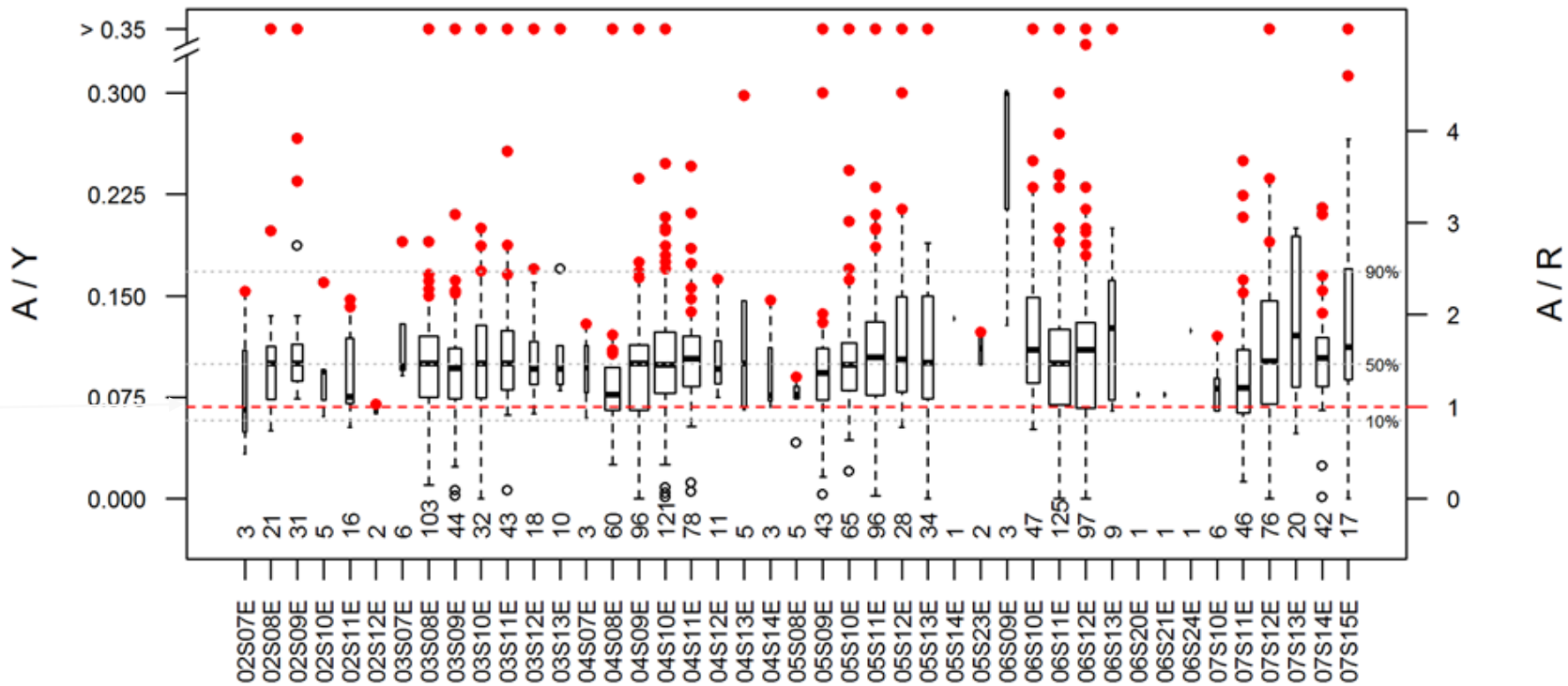
- Using a statistical analysis, the coalition:
  - Compares the A/Y for each management unit to the A/Y of all other management units of the same crop grown in the coalition region
  - Analysis produces “outliers”
    - Data points that lie outside the normal range compared to other data points.

# TOWNSHIP AGGREGATION OF NMP SUMMARY REPORTS



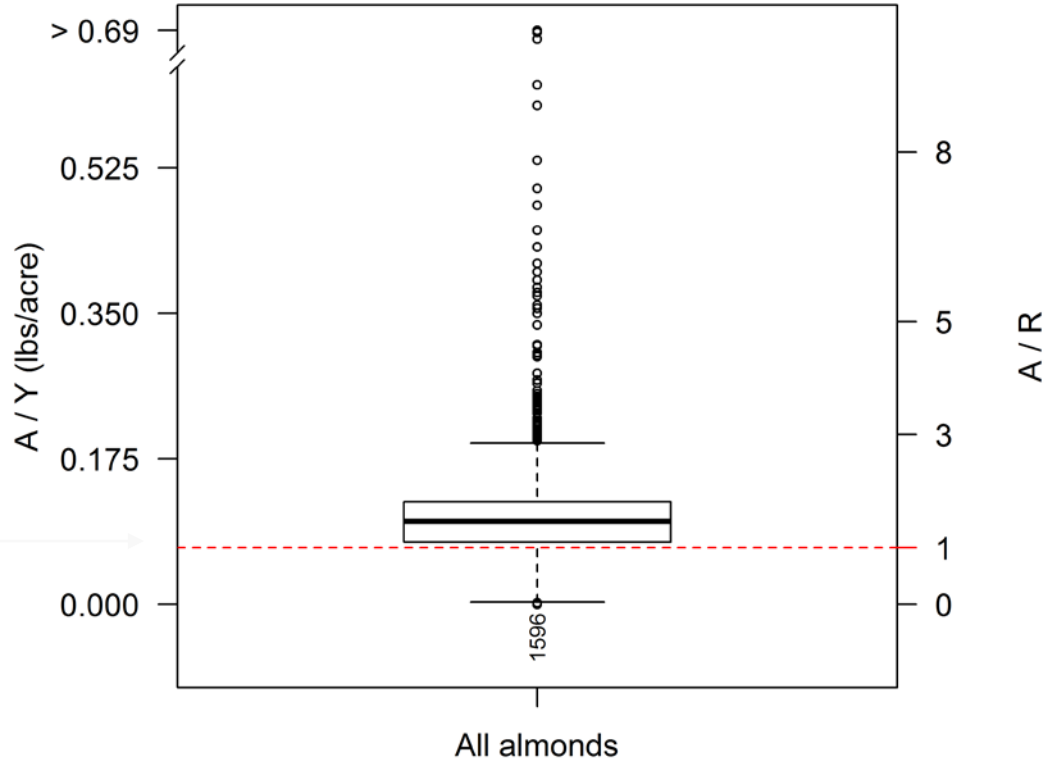
Red dots = potential outliers

### Almonds



Red dotted line represents A/R = 1. Based on 68 lbs of N per 1000 lbs almond nut meats (per UC/ABC studies)

# Almonds - Box and Whisker Plot by Crop (all ages)



Red dotted line represents  $A/R = 1$ .

# Section 2

## Nitrogen Use Evaluation: Almonds

Member ID # xxxx

Management Unit	Crop Age	<u>Applied-N/</u> <u>Yield-pounds</u>	<u>Applied-N</u> (pounds/acre)	<u>Removed-N</u> (pounds/acre)	<u>Applied-N –</u> <u>Removed-N</u>
<b>Name</b>	<b>Age</b>	<b>A/Y*</b>	<b>A</b>	<b>R</b>	<b>A – R**</b>
66	> 4	266.0	249	64	185
70,71	> 4	168.0	308	125	183
72	> 4	179.0	298	113	185
73	> 4	124.0	321	176	145
75	> 4	108.0	303	191	112

\* This **A/Y\*** differs from your reported A/Y because all yields were converted to units of pounds and the ratio multiplied by 1000.

\*\* **R** estimates are based on the assumption that nitrogen removed at harvest for Almonds is 0.068 pounds of nitrogen per pound of yield.

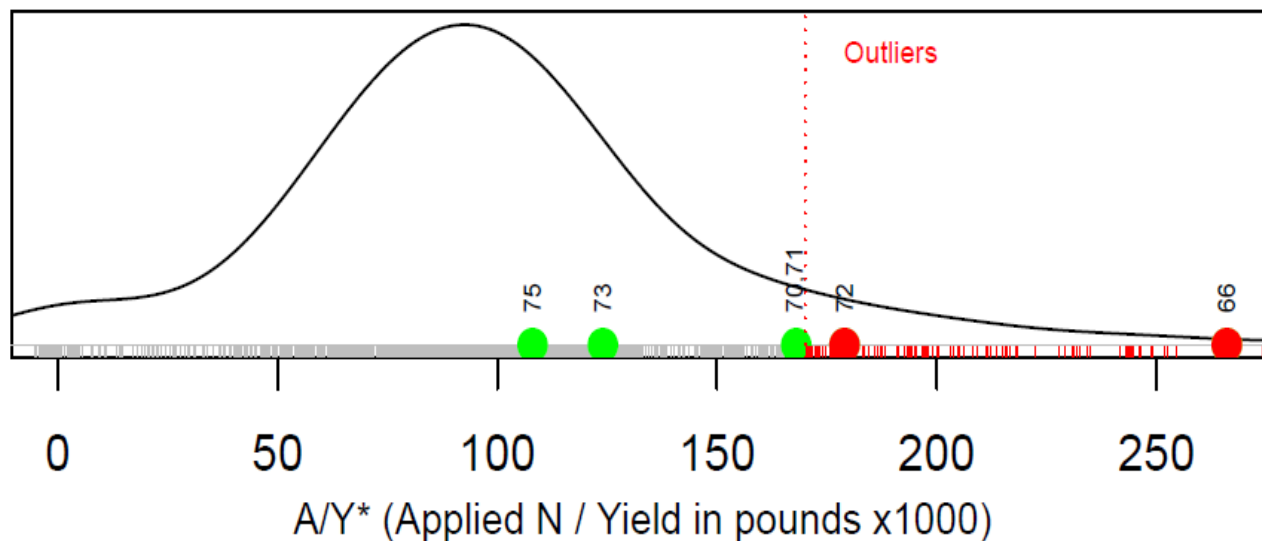
# How Do Your Management Units Compare To All Other Almonds Growers?

835 Coalition members reported on 2143 Almonds Management Units.

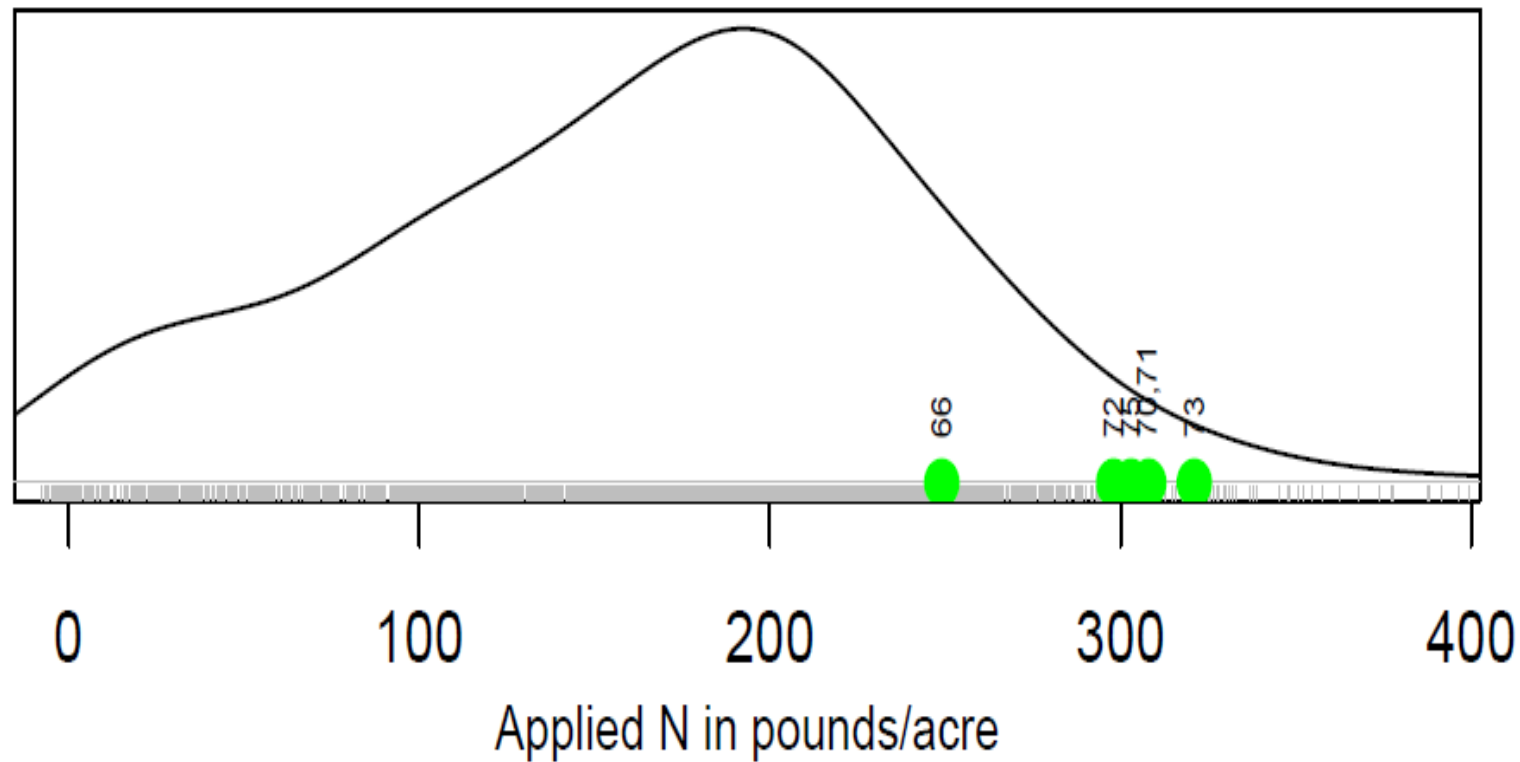
Median A/Y\* = 97                      A/Y\* values larger than 170 are considered outliers.

Median A = 171 pounds/acre

## Your A/Y\* Compared To All Other Almonds Growers



## Your Applied N Compared To All Other Almonds Growers



# **POTENTIAL REASONS A FIELD OR MANAGEMENT UNIT IS AN “OUTLIER”**

- **Crop yield was lower than anticipated for the amount of nitrogen applied**
  - Low yields could result from
    - Poor crop set
    - Pest damage
    - Factors beyond a growers' control
- **More nitrogen was applied than the crop could use**
- **Coalition will verify that outliers are correct**



# WHAT IS EXPECTED OF OUTLIERS

- Within 5 years, bring A/Y value back to non-outlier status
  - Assessment of status is based on a 3-year running average
- How?
  - Reduce the amount of N applied
  - Improve Yield
- Coalition will provide an assessment of the change in A/Y needed to get out of the outlier range
- Discuss nutrient management with CCA or agronomist

# EFFICIENT NITROGEN MANAGEMENT

## *APPLYING THE 4 R'S PRINCIPLE*

- Apply the *Right Rate*
- Apply at the *Right Time*
- Apply in the *Right Place*
- Use the *Right Source*

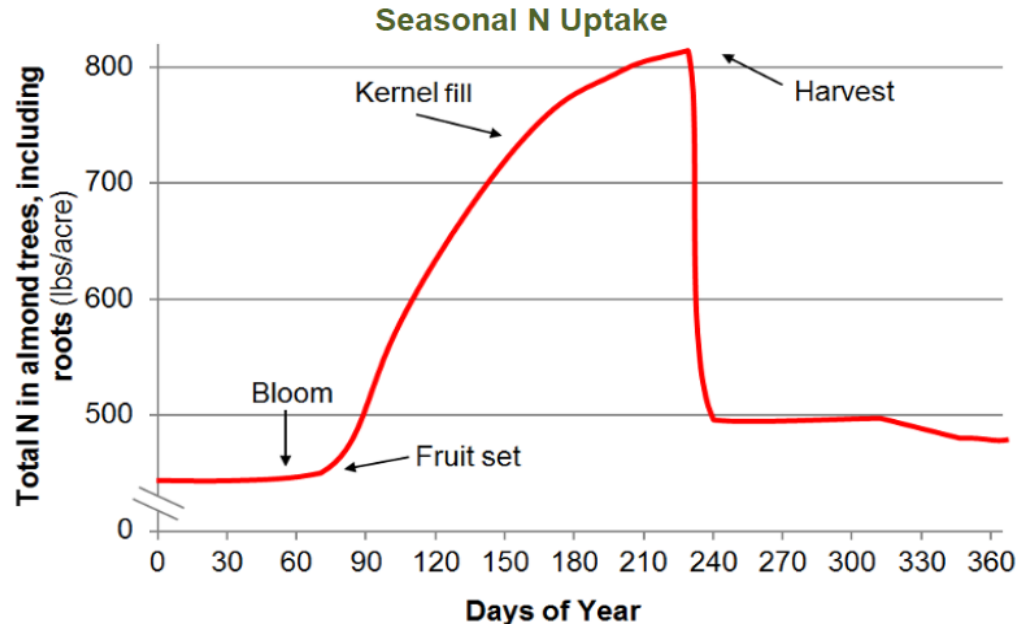
# ALMOND NITROGEN CROP CONSUMPTION CURVES

## TIMING OF NITROGEN APPLICATION TO MATCH CROP NEED/USE

### Section 4

Fertilizer Guidelines: Almonds

## Almond Nitrogen Uptake and Partitioning



About 136 lbs N is removed from the orchard per ton of in-shell walnuts harvested.



**Questions?**

# CEUs – New Process

## Certified Crop Advisor (CCA)

- Sign in and out of each session you attend.
- Pickup verification sheet at conclusion of each session.
- *Sign in sheets are located at the back of each session room.*

## Pest Control Advisor (PCA), Qualified Applicator (QA), Private Applicator (PA)

- Pickup scantron at the start of the day at first session you attend; complete form.
- Sign in and out of each session you attend.
- Pickup verification sheet at conclusion of each session.
- Turn in your scantron at the end of the day at the last session you attend.

*Sign in sheets and verification sheets are located at the back of each session room.*

# What's Next

## Almond Stage Presentation at 3:00 p.m.

- How Important is the Quality of Data from In-Field Sensors in Making Accurate Navel Orangeworm Treatment Decisions in Almonds?, presented by Semios



## Almond Stage Presentation at 3:30 p.m.

- Navigate Your Utility Bill, presented by Coldwell Solar



*3:00 p.m. – 5:00 p.m. Coffee Break is sponsored by Actagro*

