Management of Nitrogen in Almonds and Pistachios

New Leaf Sampling and Nutrient Budgets for Almond and Pistachio

- Questions
- Opportunities

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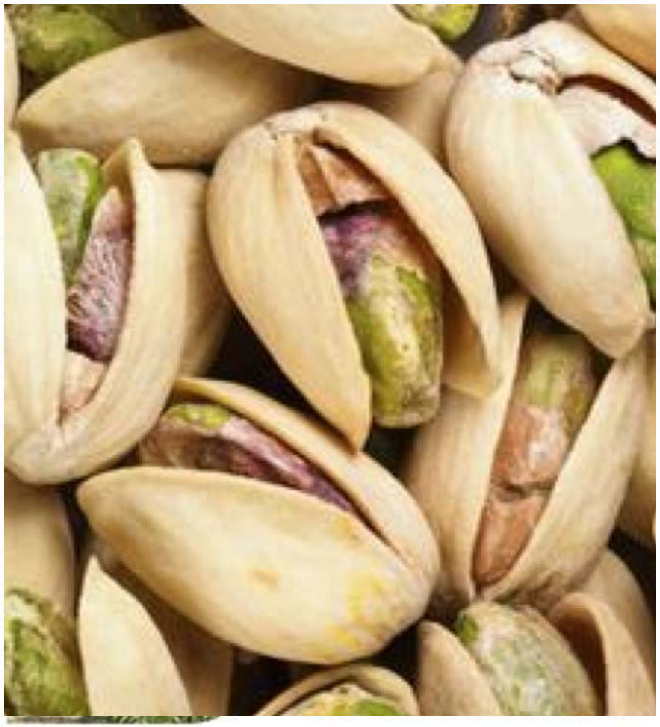
Nitrogen is essential for productivity but when managed poorly N results in environmental problems.



Historical N applications have Exceeded Crop Demand Resulting in Groundwater Contamination

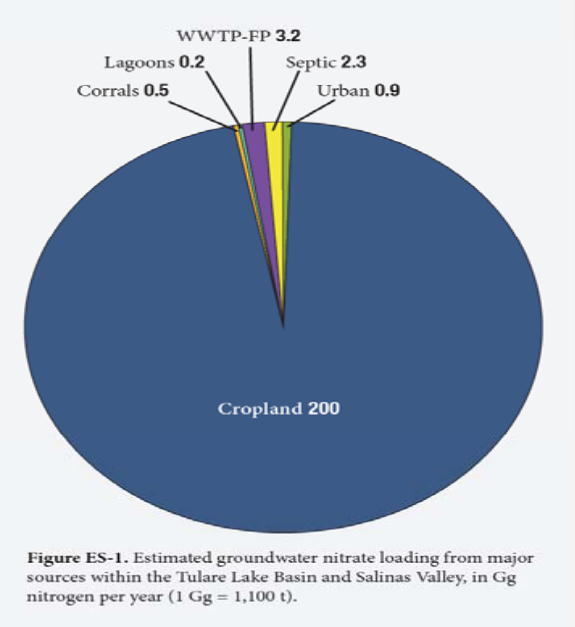
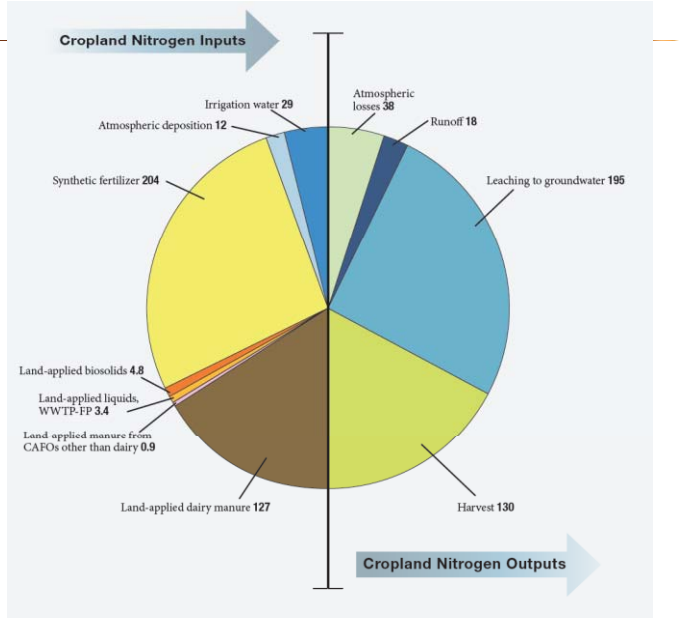
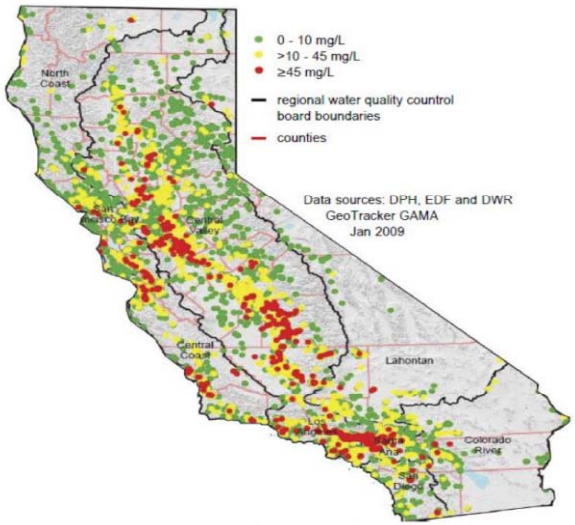


Figure ES-1. Estimated groundwater nitrate loading from major sources within the Tulare Lake Basin and Salinas Valley, in Gg nitrogen per year (1 Gg = 1,100 t).



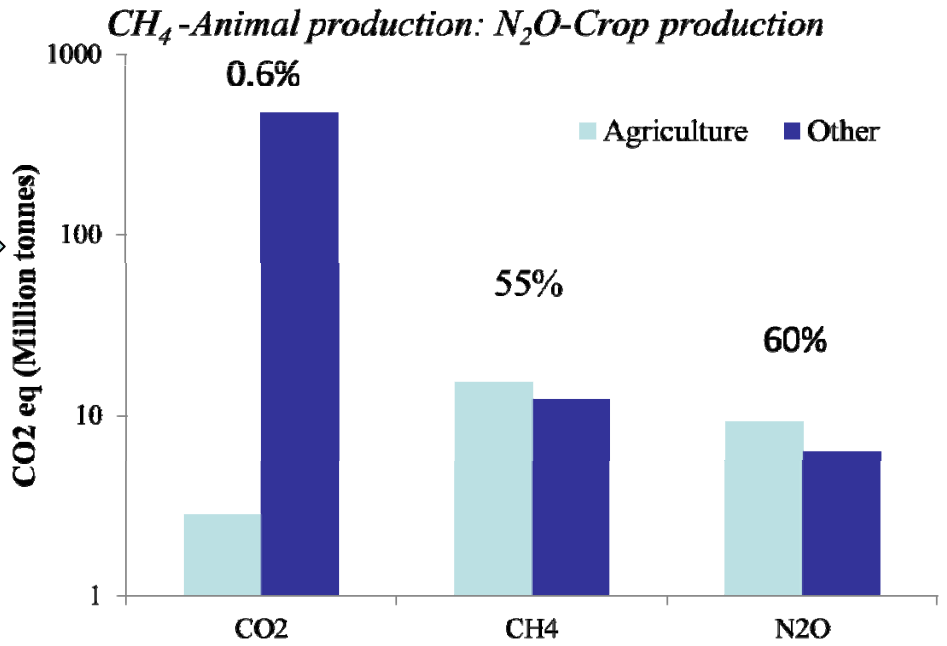
Nitrogen is essential for productivity but when managed poorly N results in environmental problems.

30 + % of wells exceed EPA drinking water levels (45 mg/L nitrate) and 250,000 people in SJV do not have access to 'safe' water.



(Ekdahl and others, 2009; Harter Report, 2012)

Agriculture is a major source of N_2O and CH_4



Legislative Response: Mandated Nitrogen Management Planning

- Application rates will be based upon field specific crop N budget estimations, accounting for all applied N x ‘efficiency factor’ (60-80%).
  - New techniques for N budgeting
  - Maximizing nitrogen use efficiency will be critical
- Certified Crop Advisor sign off required.
  - Training and certification process under development
  - Post season verification and reporting.
- Will require enhanced efficiency of N use. Site (orchard) specific management. In season monitoring and adjustment.
  - New techniques for leaf sampling
- In the short term this will be a self-reporting industry driven activity.
  - However, if improvements in ground water resources are not realized then a tightening of these regulations can be expected.

Whenever there is a problem, there is also an opportunity…

…Improving the Efficiency of Nitrogen use will Reduce Production Costs and Reduce Environmental Impact

Efficient Nitrogen Management
-the 4 R´s-

Apply the Right Rate

- Match supply with tree demand (all inputs- fertilizer, organic N, water, soil).

Apply at the Right Time

- Apply coincident with tree demand and root uptake.

Apply In the Right Place

- Ensure delivery to the active roots.
- Minimize movement below root zone

Use the Right Sampling and Monitoring Procedures

The 4 R's are specific to ever individual orchard and every year.

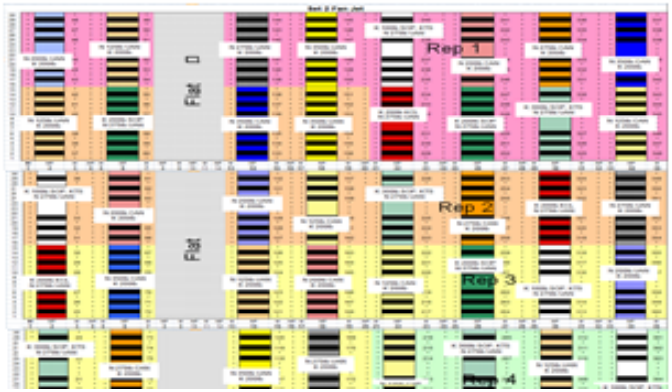
How do we estimate the 4 R's in Almonds?

Manipulative Experiment for five years

- Treatments
- 4 Nitrogen rates – 125, 200, 275 and 350lb/ac
- 2 Nitrogen Sources- UAN 32 and CAN 17
- 3 Potassium Rates- 100, 200 and 300lb/ac
- 3 Potassium Sources- SOP, SOP+KTS and KCl @200lb/ac
- Irrigation Types
- Fan Jet and Drip

Fertigation

- 4 times during the season
  - 20, 30, 30 and 20% in February, April, June and October
- Samples Collection
- Leaf and Nut samples collected from 768 individual trees five time in season
- All trees individually harvested



Large experiment covering approximately 100 acres.

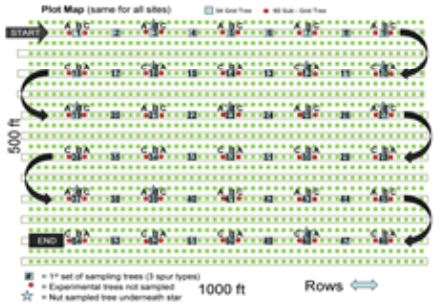
768 trees individually monitored for nutrients, yield, light interception, disease, water.

Trees were 9 leaf in 2008.

Nonpareil - Monterey

Observational Experiment for four years

Design and Sampling



- 114 trees x 4 Sites x 3 years.
- Yield.
  (About 1,130 data points)
- 5 in-season nutrient samples.
  (8,500 x 11 = 93,500 data points)

Efficient Nitrogen Management
-the 4 R´s-

Apply the Right Rate

- Match supply with tree demand (all inputs- fertilizer, organic N, water, soil).

Apply at the Right Time

- Apply coincident with tree demand and root uptake.
- CONTROLLED RELEASE?

Apply In the Right Place

- Ensure delivery to the active roots.
- Minimize movement below root zone

Determining the Right Rate and Timing

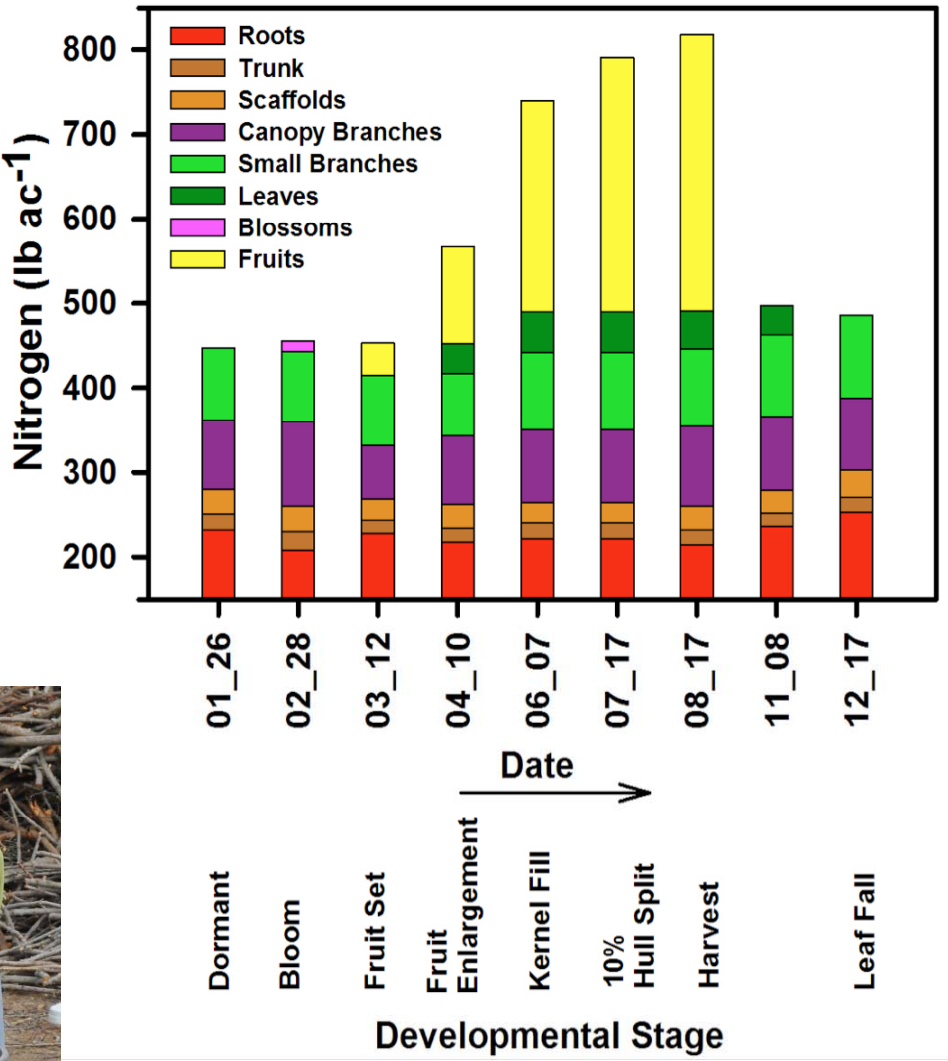
Nutrient Budget Approach

- **What is the total annual tree demand?**
- **When during growth and development does uptake occur?**

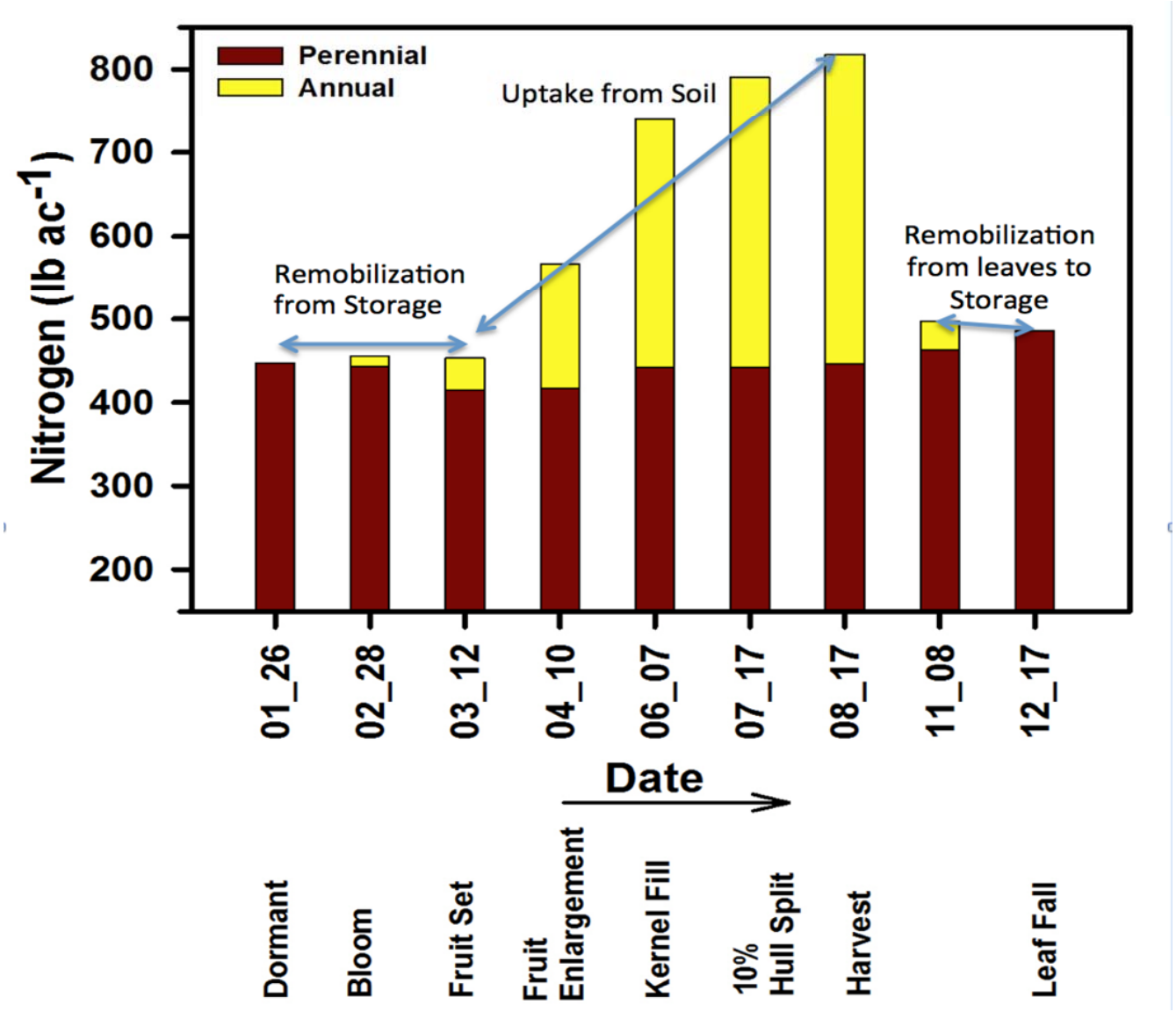
Approach:

- **Whole tree excavation, trunk coring, sequential nut collection and analysis, yield measurements- 1000's of individual trees at multiple sites and years**

Total Nutrient Demand and Timing



Total and Annual Dynamics of N in Mature Almond Tree (data from 12 year old trees)



Annual accumulation (Yield: 4,700 lbs)

2011: (320 lb N total)

Nuts = 90%
Leaves = 2%
Bloom = 4%
Perennial = 5%

Around 20 lbs/acre of N were needed to support growth in this 12 year old 85% canopy cover orchard. In younger orchards and in low yield years the demand for N for growth may reach 40 lbs/acre.

Nutrient Demand is Determined by Yield

Almonds

Nutrient removal Per 1000 lb Kernels

Nonpareil

- N removal 68 lb per 1000
- K removal 80 lb per 1000
- P removal 8 lb per 1000

Monterrey

- N removal 65 lb per 1000
- K removal 76 lb per 1000
- P removal 7 lb per 1000

Growth Requirement

- Yield 2,000 to 4,000 = 0 lb N
- Yield 1,000 to 2,000 = 20 lb N
- Yield <1,000 = 30 lb N

Pistachios

Nutrient removal Per 1000 lbs (Dry CPC Yield)

- Valuable for estimating demand or replacing nutrient export
- Provides insight into efficiencies
  - N removal 28 lbs per 1000
  - K removal 24 lbs per 1000
  - P removal 3 lbs per 1000
  - 25 lb N and 22 lb K per acre, per year is required for tree growth (Rosecrance et al 1998)

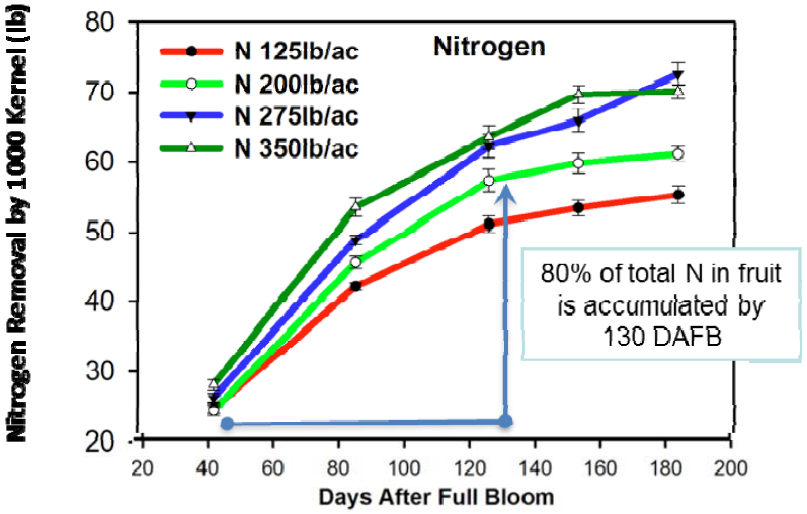
Applying at the Right Time

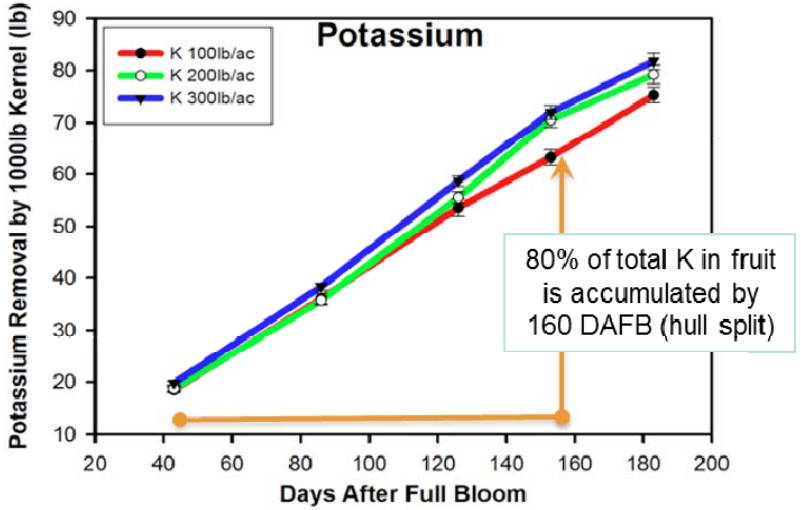
- When during the season should I apply my N and in what proportion?

- Need to:
  - **Understand fruit development**
  - **Know the shape of nitrogen demand through the season**
  - **Know when uptake from the roots occurs**
  - **Know the periods of higher leaching potential**

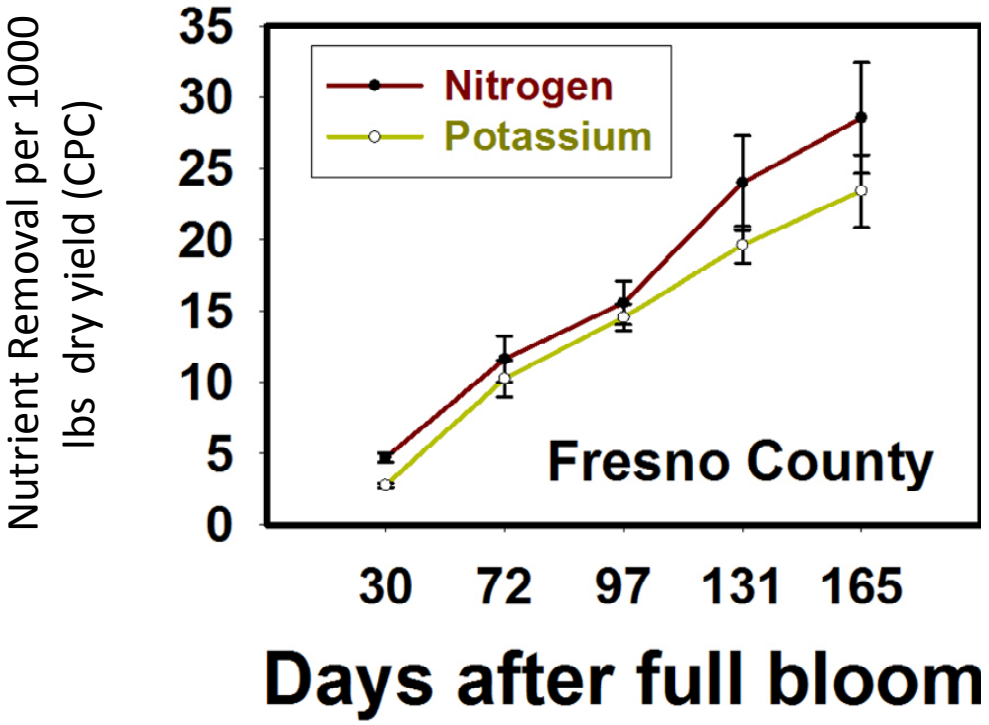
What is the shape of N demand through the season?

Almonds



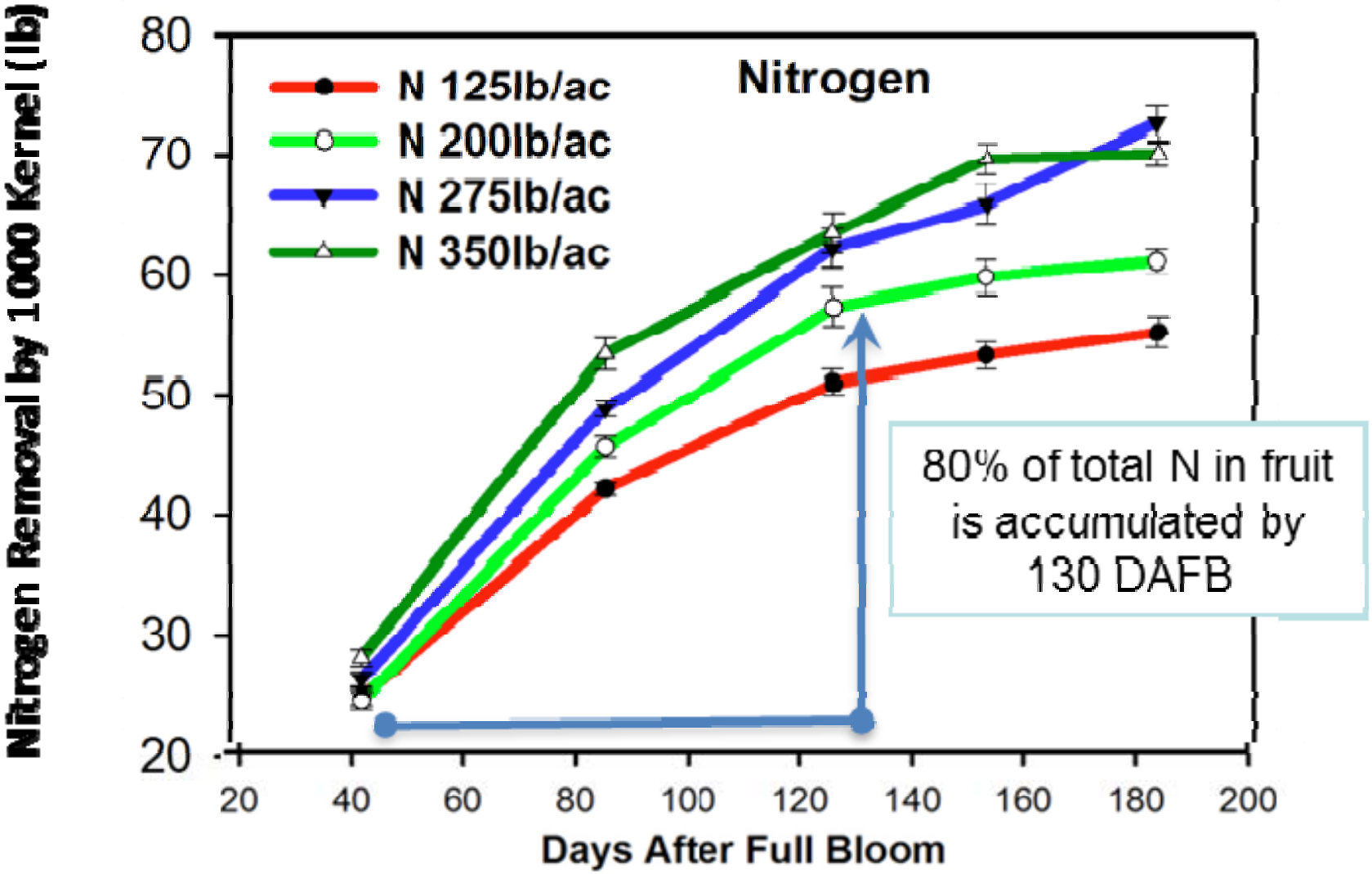


Pistachios



What is the shape of N demand through the season?

Almonds



Correction to FREP Report Page 27

remobilization, spur survival, tree productivity and NUE.

5. Validate current CVs and determine if nutrient ratio analysis provides useful information to optimize fertility management.

6. Develop and extend an integrated nutrient BMP for almond.

RESULTS AND DISCUSSION

Annual nutrient export in harvested fruit was determined in all years of this experiment. In years 2009 through 2011, nitrogen in fruit at harvest represented >85% of whole tree nutrient fluxes. Total N export from the orchard in harvested crop is proportional to the total size of the crop and the nutrient concentration in that crop which varies in proportion to the ratio of

was also determined, but is not presented in this report. Fertilizer N application above or below the 309 kg/ha rate altered N concentration in fruit and hence N export in fruit per 1000 kg kernel yield. In 2012, yield was exceptionally low resulting in a substantial excess N application in all treatments and an increase in fruit nutrient concentration and N export in fruit per 1000 kg kernel of up to 87 kg was observed (Table 1).

Sequential analysis of annual and perennial organs demonstrates that the majority of whole tree macro and micronutrient uptake occurs between anthesis and kernel fill with 35-50% of total N uptake occurring before 40 days after full bloom (DAFB) and 80-90% of the total N being accumulated by 112 DAFB coinciding with kernel filling. Over 70% of the total P and 65%-80% of the total K was accumulated in fruits by mid season. Ninety percent of total S, 80-90% of total Ca and

Table 1. Macronutrient export (kgs) in fruit by 1000 kg kernel yield in almond from 2008-2012 under fan jet irrigation. Means not connected by same letter within the same year are significantly different at *<0.05 and **<0.1. ns = not significant, T1= 140 kg N/ha, T2= 224 kg N/ha, T3= 309 kg N/ha and T4= 392 kg N/ha.

	2008				2009				2010				2011				2012			
	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
N	56	59	61	62	53	56	59	60	55	61	73	70	54	65	74	75	54	86	87	86
	c	bc	ab	a	b	ab	a	a	c	b	a	a	c	b	a	a	b	a	a	a
	*				*				*				*				*			
P	6.5	6.9	6.7	6.3	7.4	7.4	7.2	6.8	8.6	8.2	8.9	7.8	8.7	8.5	9	8.3	11	14	13	11
																	b	a	ab	b
	ns				ns				ns				ns				*			
K	53	54	54	52	74	72	73	71	88	81	80	82	77	76	78	75	91	100	87	88
									a	ab	b	ab								
	ns				ns				**				ns				ns			
S	2.3	2.4	2.4	2.5	2.1	2.2	2.2	2.2	2	2.2	2.5	2.4	2.4	2.7	2.9	3	2.4	3.5	3.1	3.1
									b	b	a	a	c	bc	ab	a	b	a	a	a
	ns				ns				*				*				*			
Ca	8.6	8.2	8.1	8.1	7.5	7.4	6.8	6.9	7.6	7.1	7.1	7.1	6.6	6.2	6	5.7	6.4	6.2	5.4	4.9
													a	b	bc	c				
	ns				ns				ns				*				ns			
Mg	4.8	4.7	4.7	4.7	4.5	4.5	4.4	4.3	4.6	4.4	4.6	4.4	4.6	4.4	4.5	4.4	5.1	5.5	5.0	4.7
	ns				ns				ns				ns				ns			

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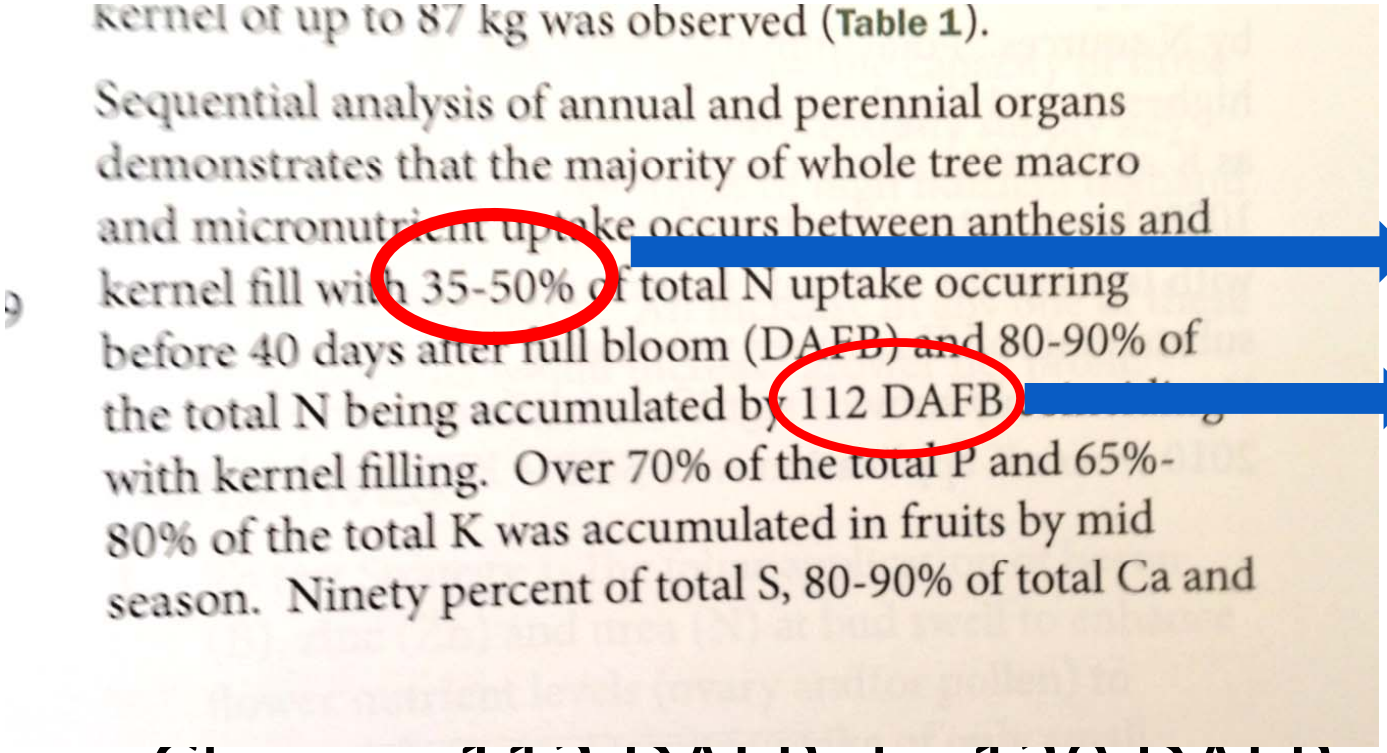
kernel of up to 87 kg was observed (**Table 1**).

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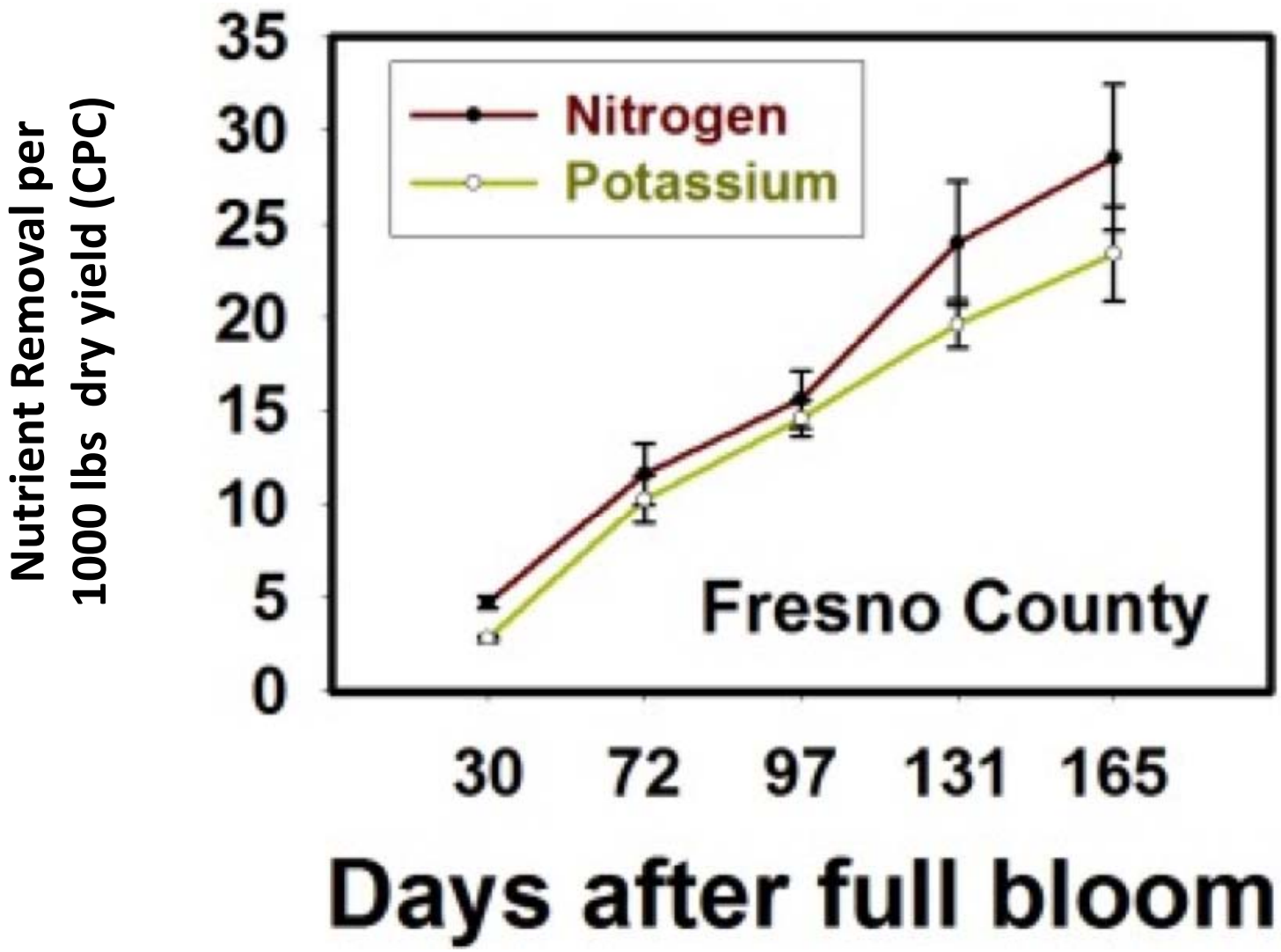
- Change 112 DAFB to 130 DAFB

What is the shape of N demand through the season?



Pistachio

Summary Right Rate

- How much Nitrogen do I need to apply for each pound of yield produced?

  - **Account for fruit demand**
  - **Account for vegetative demand**
  - **Account for total N inputs (water N; fertilizer N; organic N):**
    - **Consider N in water and other sources.**
  - **Optimize application efficiency:**

How efficient can we be?

How efficient can we be?

Experiment initiated in 2008 – 2013 utilizing best practices based on 4 R's and detailed monitoring:

Applying the Right Rate

- Match demand with supply (all inputs- fertilizer, organic N, water, soil).

At Right Time

- Fertigate coincident with demand.

In the Right Place

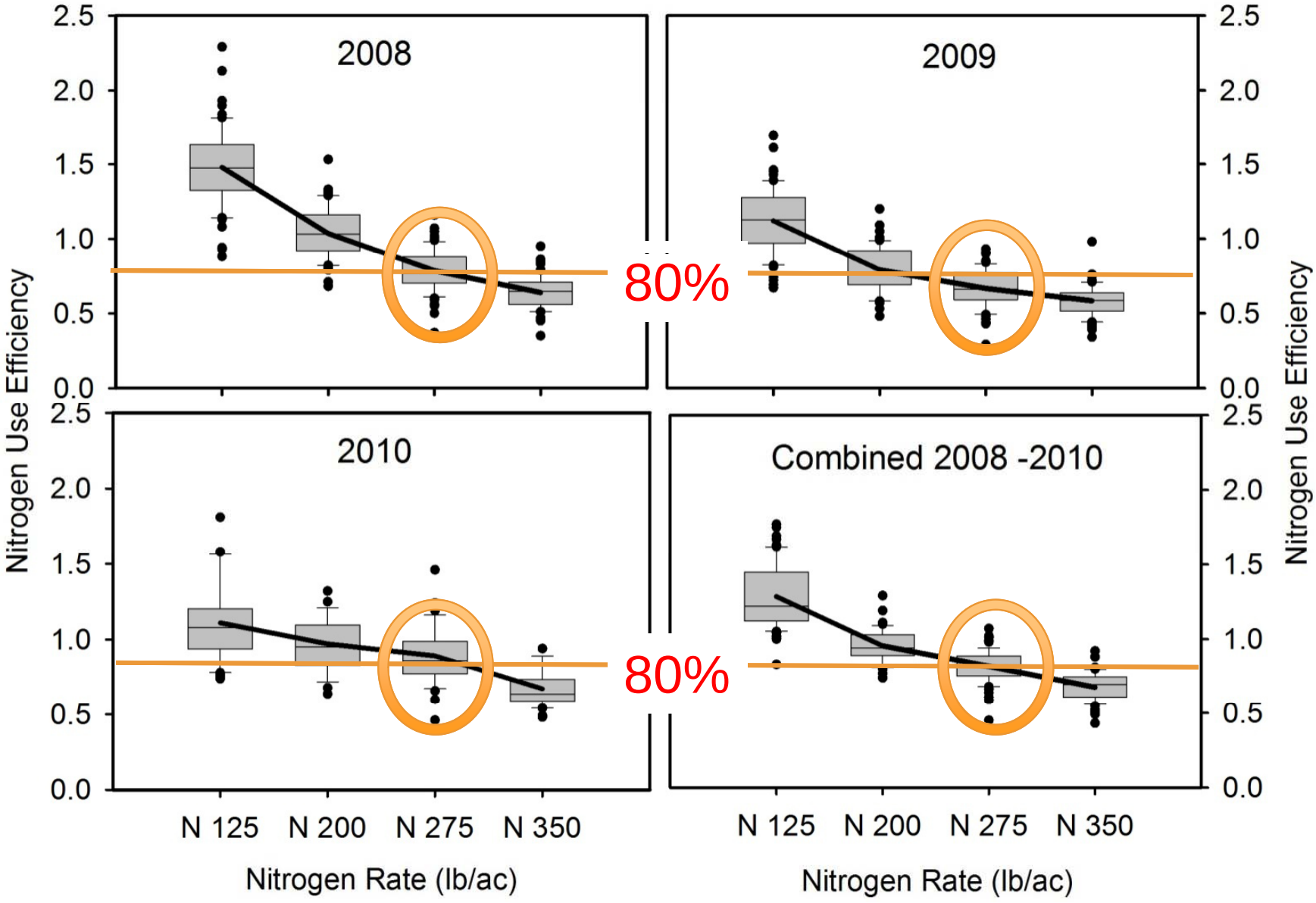
- Ensure delivery to the active roots.

Using the Right Source

- Soluble, compatible and balanced.

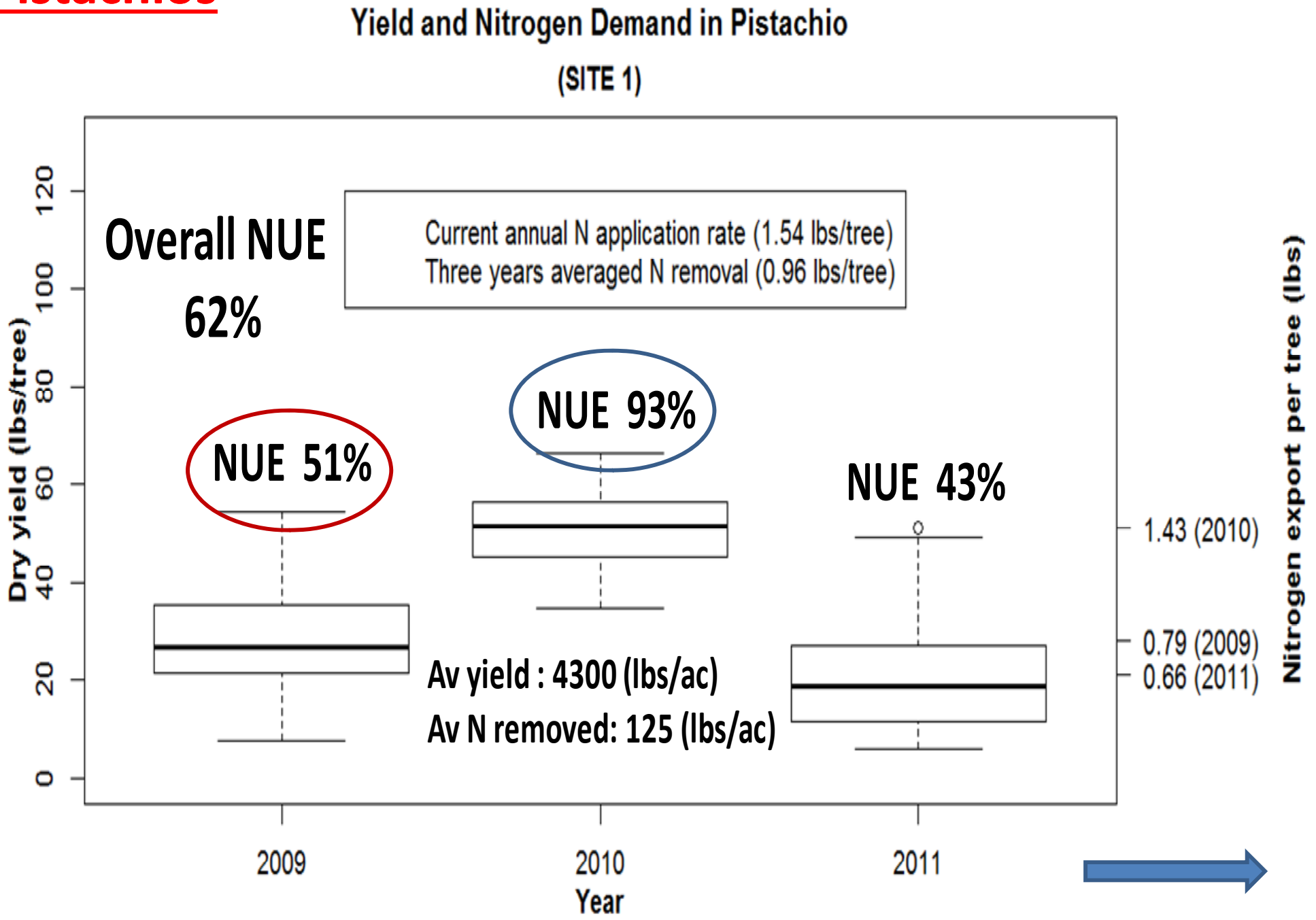
New Sampling Methods

Nitrogen Use efficiency 2008 – 2010 under optimum treatment (N 275) was >80%. : ALMONDS



NUE = N Export in Fruit/N Applied

Pistachios



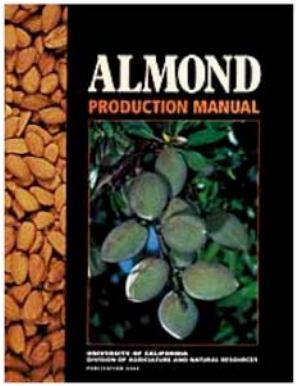
Fate of unused N?- Lost? In Profile? In high EC sub-soil?

How do we monitor our trees?

Early Leaf Sampling

What do we know and how do we manage?
Leaf Sampling and Critical Value Analysis

Table 26.2 Critical nutrient levels (dry-weight basis) in almond leaves sampled in July.



Nitrogen (N)	
Deficient below	2.0%
Adequate	2.2–2.5%
Phosphorus (P)	
Adequate	0.1–0.3%
Potassium (K)	
Deficient below	1.0%
Adequate over	1.4%
Calcium (Ca)	
Adequate over	2.0%
Magnesium (Mg)	
Adequate over	0.25%
Sodium (Na)	
Excessive over	0.25%
Chlorine (Cl)	
Excessive over	0.3%
Boron (B)*	
Deficient below	30 ppm
Adequate	30–65 ppm
Excessive over	300 ppm
Copper (Cu)	
Adequate over	4 ppm
Manganese (Mn)	
Adequate over	20 ppm
Zinc (Zn)	
Deficient below	15 ppm

*Critical values for boron deficiency and toxicity are currently being revised. Hull boron >300 ppm is excessive. Leaf sampling is not effective to determine excess boron.

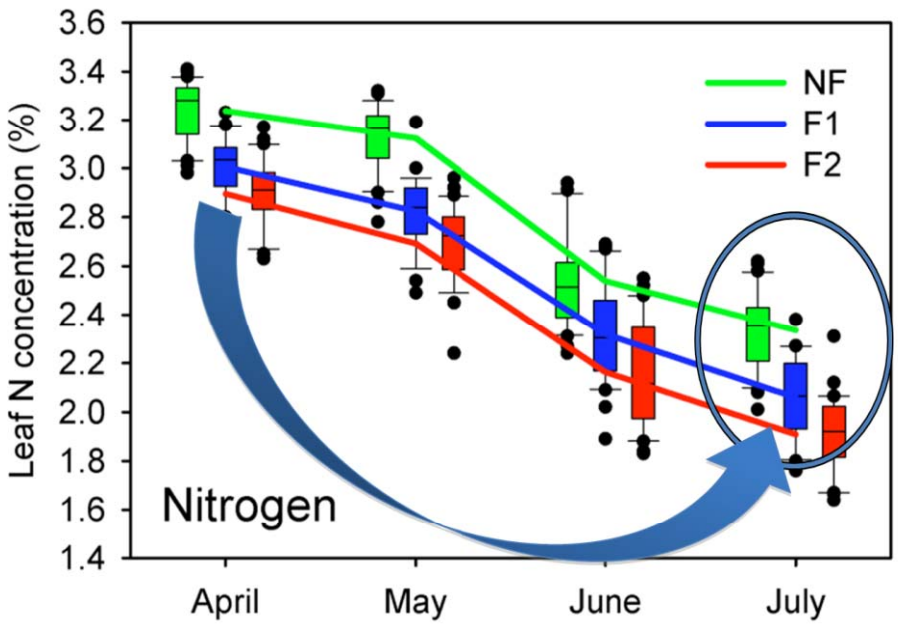
Three Problems exist with the summer leaf sampling practices

- **No guidance on how to take sample to properly represent field**
- **Timing of the sampling is to late to make in season adjustments**
- **Variability of the orchard was not included in the interpretation of the leaf nutrient values**

Improved Leaf Sampling and Interpretation

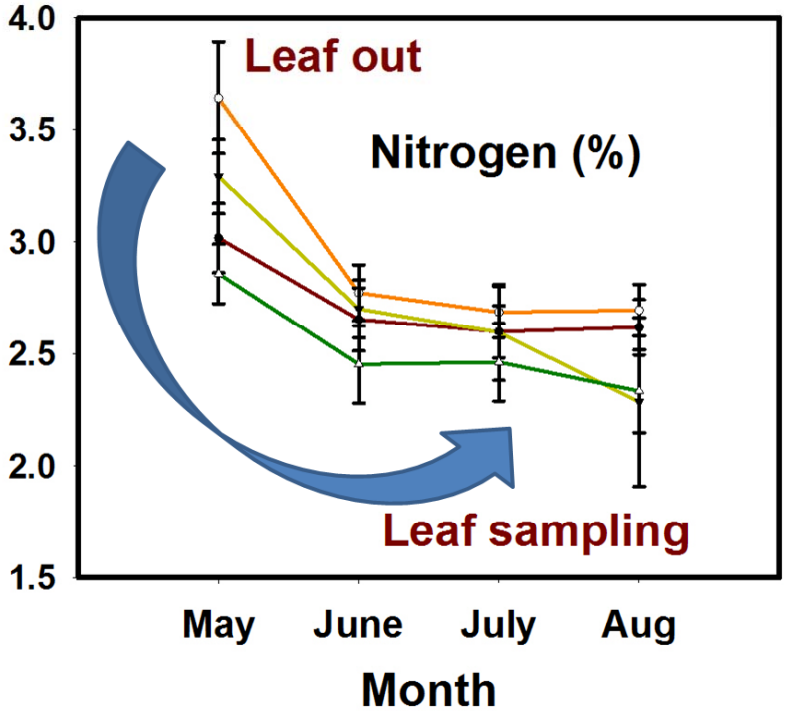
- Develop methods to sample in Spring and relate that number to Summer critical value.
- Improve sampling guidelines

Almonds



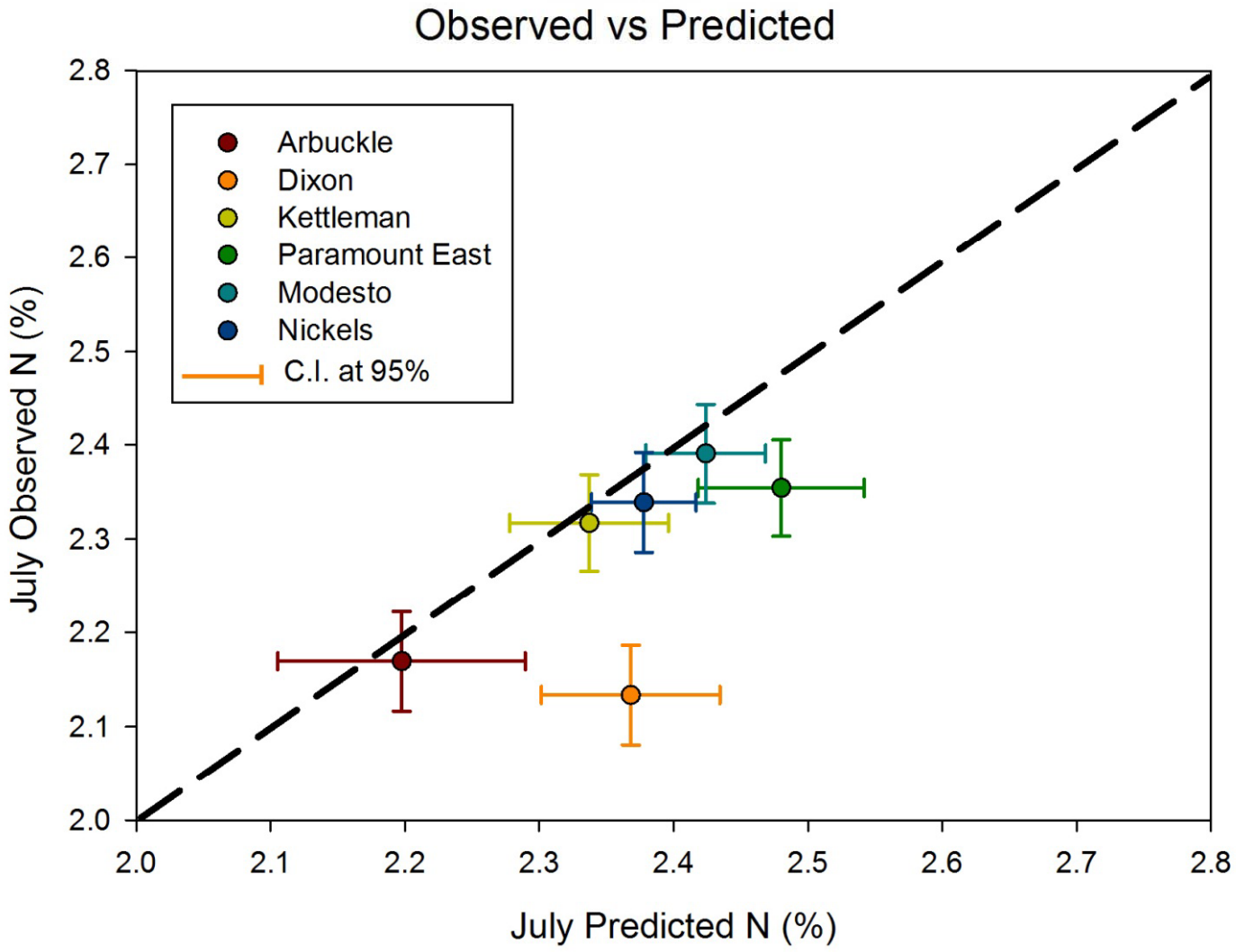
Approach: Multi site, multi year, multi tissue and multi element analysis.

Pistachios



In Almonds….

Predicting July N leaf concentration from April Leaf Samples.



This model requires the collection of non fruiting Spur leaves in April.

Sampling Criteria

- Collect leaves from 18 to 28 trees in one bag (depending of the confidence level and on the number of acres).
- Each tree sampled at least 30 yards apart.
- In each tree collect leaves around the canopy from at least 8 well exposed spurs located between 5-7 feet from the ground.
- In April, collect samples at 43 days after full bloom (DAFB) +/- 6 days).
- SUBMIT SAMPLES TO A LAB THAT HAS ADOPTED THE UCD-ESP GUIDELINES FOR EARLY SEASON SAMPLING OR A VALIDATED INTERNAL METHOD OR GO TO THE UCD MODEL PAGE TO CALCULATE JULY LEAF N
- If you would like to collect samples in July, then collect samples at 143 DAFB +/- 4 days. SAME RULES!

http://fruitsandnuts.ucdavis.edu/Weather_Services/Nitrogen_Prediction_Models_for_Almond_and_Pistachio/

In Pistachios…

Site	County	Year	Summer Observed leaf N	Summer predicted leaf N (from spring samples)
Buttonwillow (B1)	Kern	2012	2.9	2.8
Buttonwillow (B2)	Kern	2012	3.0	2.8
Buttonwillow (B3)	Kern	2012	2.9	2.8
Buttonwillow (NO1)	Kern	2012	2.8	2.8
Buttonwillow (NO2)	Kern	2012	3.0	2.8
KammAv				
KammAv				
KammAv				
KammAv				
KammAv				
Mad				
Mad				
Madera (NO1)	Madera	2012	2.6	2.5
Madera (NO2)	Madera	2012	2.7	2.6
Paramount (B1)	Kings	2012	2.6	2.6
Paramount (B2)	Kings	2012	2.7	2.7
Paramount (B3)	Kings	2012	2.5	2.7
Paramount (NO1)	Kings	2012	2.9	2.7
Paramount (NO2)	Kings	2012	2.7	2.7

AN EFFECTIVE MODEL HAS BEEN ALSO DEVELOPED TO PREDICT JULY TISSUE N FROM AN EARLY SEASON SAMPLE IN PISTACHIO

Sampling Strategies for Pistachio

- **What leaf type**: Sub terminal exposed non-fruiting branches. Collect 10 leaves per tree at 6-7 ft height- around the tree canopy.

- **Leaves from** 18-20 trees for NPKMg.

- **At what distance**: Samples should be 25 yards apart in an orchard of average variability.

- **When**: Between 30-45 days after full bloom.

- Samples can be pooled in one bag for analysis (SAVE MONEY).

- Analysis of the plant nutrients required: N, P, K, Ca, Mg, Cu. APPLY UCD-PPM MODEL

Non-Uniform Orchard:

- Repeat this process in each orchard zone of similar performance.

http://fruitsandnuts.ucdavis.edu/Weather_Services/Nitrogen_Prediction_Models_for_Almond_and_Pistachio/ (SEE PPM MODEL)

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Apply at the Right Time

- Apply coincident with tree demand and root uptake.

Apply In the Right Place

- Ensure delivery to the active roots.
- Minimize movement below root zone

Use the Right Sampling and Monitoring Procedures

The 4 R's are specific to ever individual orchard and every year.

Conclusions: Managing Nitrogen in Almond and Pistachio

Base your fertilization rate on realistic, orchard specific yield, account for all N inputs and adjust in response to spring nutrient and yield estimates.

- **Make a preseason fertilizer plan based on expected yield LESS the N in irrigation and other inputs.**
  - **1000lb almond kernel removes from 68lb N, 8lb P and 80lb K.**
  - **Pistachio 1000 lbs CPC yield removes 28 lbs N, 24 lbs K and 3 lbs P**
  - **Apply 20% of seasonal demand during or after leaf out**
- **Conduct (properly!) a leaf analysis following full leaf out.**
- **In May, review your leaf analysis results and your updated yield estimate, then adjust fertilization for remainder of season.**
- **Time application to match demand in as many split applications as feasible**
  - **80% N uptake occurs from full leaf out to hull split in Almond or by fruit maturity in Pistachio.**
  - **Apply up to 20% immediately post harvest, corrected for actual yield - but only if trees are healthy. Use foliars if N loss is possible.**
- **Every field, every year, is a unique decision**

TOOLS:

california almonds
Almond Board of California

Almond Early-Season Sampling and In-Season Nitrogen Application Maximizes Productivity, Minimizes Loss

Protocol for Early-Season Sampling and In-Season Nitrogen Budgeting

Authors: Sebastian Saa Silva, Saiful Muhammad, Blake Sanden, Emilio Laca, Patrick Brown (UC Davis and UC Cooperative Extension, Kern County)

Please note corrected calculations on pages 6 + 7.

Background:

Efficient and profitable nitrogen (N) application demands that N be applied at the right rate, with the right timing and in the right location, so that productivity is maximized and the potential for N loss to the environment is minimized. The goal of N management is to apply adequate but not excessive amounts of N. You cannot enhance orchard productivity by providing N in greater amounts than is demanded by the crop. With proper management, optimal productivity and minimal N loss can be achieved simultaneously. To help growers achieve the goal of efficient and profitable nitrogen application, a new method of tissue testing and yield-driven fertilization has been developed. The following approaches are based on four years of research at multiple sites and were validated in additional trials in 2012.

Right Rate:

For mature almonds (> 7 years), nut yield in the current year is the primary determinant of N demand. The amount of N that will be removed from the orchard for a given yield ranges from 50 to 75 lbs N per 1,000 lbs of kernel yield, depending on the N status of the tree. In four years of experimentation at multiple sites, the ideal N removal rate averaged 68 lbs N per 1,000 lbs of kernel yield. This removal rate corresponds to maximal yield and optimal use of N resources, and coincides with a whole-fruit N% of 1.8%. (Note: This conversion stated as kernel pounds also factors in the N removed with shells and hulls to equal the "total fruit" N removal). Higher fruit N removal rates (>68 lbs N/1,000 lbs kernel) occur when trees have received N in excess of demand. The amount of N required for vegetative growth in a yielding tree is small in contrast to that required by the fruit, and averages 20 to 40 lbs per acre per year in orchards with 70% or greater orchard light interception.

The amount of N required (from fertilizer or other amendments) is determined by crop size (yield x 68 lbs N per 1,000 lbs kernel yield) less N supplied from water and other N sources including manures, composts, nitrogen-fixing cover crops, etc. Previous N applications in excess of crop N removal can also enhance soil and tree N reserves, thereby reducing current fertilizer N demand.

Nitrogen in irrigation water is an excellent and free N 'fertilizer' and should be included in your total annual N budget. The supply of N (lbs/acre) from water is calculated by multiplying nitrate concentration in water (ppm) x acre feet irrigation applied x 0.61. If the N concentration in irrigation water is reported as Nitrate-N, then the

http://fruitsandnuts.ucdavis.edu/Weather_Services/Nitrogen_Prediction_Models_for_Almond_and_Pistachio/

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ADVANCED SENSING AND MANAGEMENT TECHNOLOGIES
To Optimize Resource Use in Deciduous Tree Crops

Overview
Crop Nutrient Status & Demand in Almond: Patrick Brown
- Nutrient Status in Almond
- Update 2012: Nutrient Status in Almond: Leaf Sampling
- Update 2011: Assessment of Nutrient Status in Almond
- Fertigation Trials in Almond
- Update 2012: Fertigation Trials in Almond
- Update 2011: Fertigation Trials

Crop Nutrient Status & Demand in Pistachio: Patrick Brown
Nitrogen Modeling: Dave Smart
Optimization of Water & Nitrate Use: Jan Hopmans
Measuring Canopy Light Interception: Bruce Lampinen
Water Status & Demand: Ken Shackel & Blake Sanden
Root Biology: Nitrogen & Water Utilization: Leo Lombardini
N Monitoring through Spectral Analysis: David Slaughter
Nitrogen & Water Modeling: Ted Sammis
Using Models to Estimate Orchard ET: Susan Ustin
Soil Controls on Nitrogen & Water Uptake: Manoj Shukla
Remote Sensing Crop Status: Mike Whiting

PRINT

Crop Nutrient Status & Demand in Almond: Patrick Brown

Development of Leaf Sampling Methods & Nutrient-Budget Fertilization

Patrick Brown, Saiful Muhammad and Sebastian Saa Silva

Growers of tree crops apply a range of different nutrient management strategies. One of the simplest forms of nutrient management bases fertilization decisions on the 'Critical Value' (CV) concept, where fertilizers are applied to ensure that leaf nutrient concentrations exceed what has been determined as the critical concentration for good yield levels. In this approach, leaf nutrient analysis only provides an indication of adequacy or deficiency, rather than specific information on appropriate fertilizer rates or timing of applications.

Nutrient management recommendations in most nut trees have been based on the Critical Value concept. Ideally, critical values are established by controlled experiments in which the relationship between yield and nutrient concentration is closely followed. The majority of critical values relating to almond, however, have been determined on the basis of visual symptoms.

Nitrogen Prediction Models for Almond
(Excel files for download)

These models, available in *Excel* format, were developed from 4 years of research in Nonpareil almond orchards. Download the Models for more information, including leaf sampling (collect in mid-April) and N values (predicted for July).

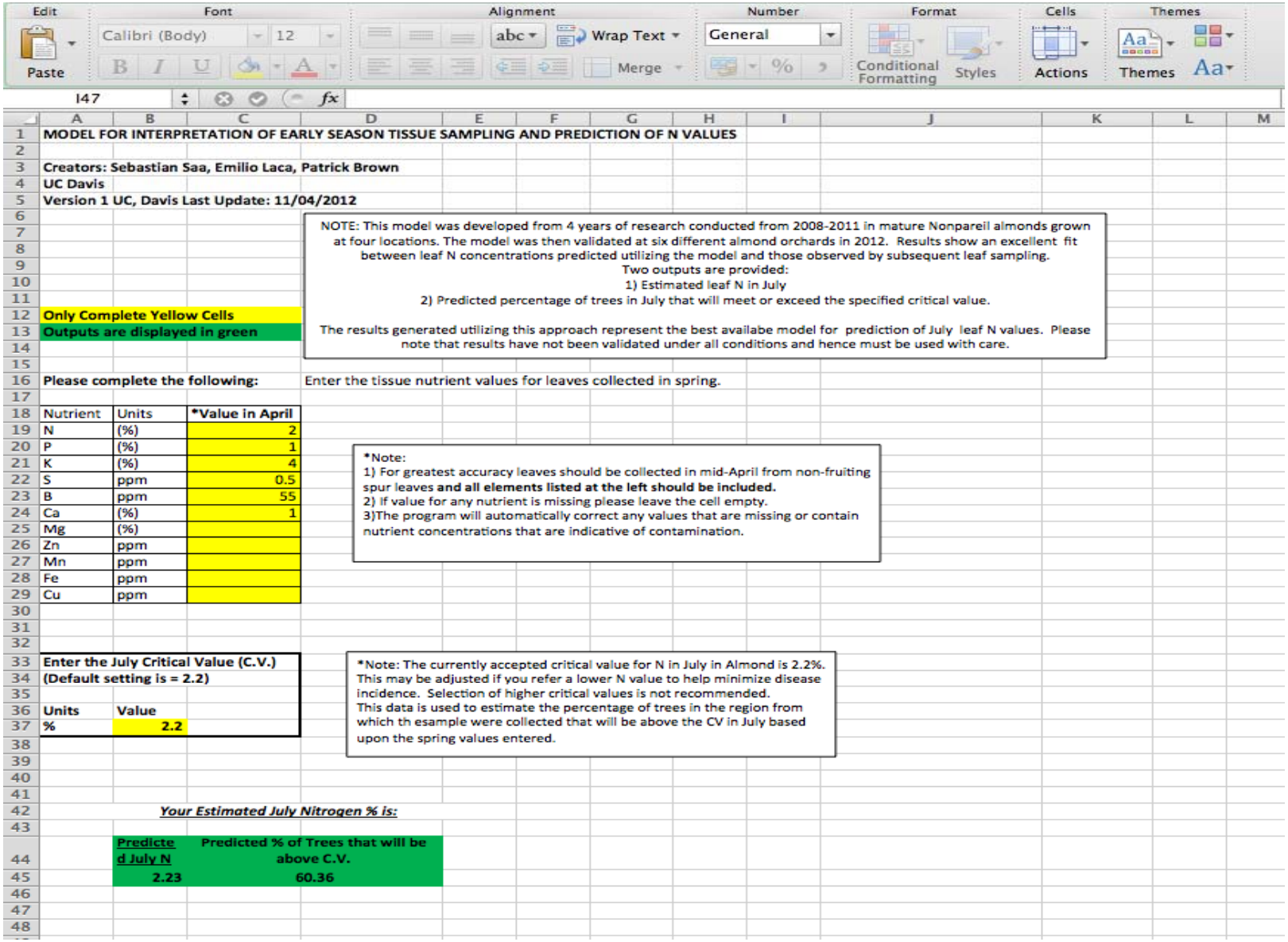
- *N-Prediction Model for Almond* (.xlsx, 22K)
- *N-Prediction Model for Almond: large datasets* (.xlsx, 317K) up to 1000 values

For questions regarding these models, contact:
Sebastian Saa Silva, Dept. of Plant Sciences, UC Davis

For a pdf file providing protocol for use of the model: early-season leaf sampling and in-season N budgeting:
Almond Early-Season Sampling and In-Season Nitrogen Application Maximizes Productivity, Minimizes Loss

Download the Excel Spreadsheet for either individual or Bulk analyses

All Testing Labs have been provided this model: Some labs continue to use their own approaches: These have not been validated by UC Research.



MODEL FOR INTERPRETATION OF EARLY SEASON TISSUE SAMPLING AND PREDICTION OF N VALUES

Creators: Sebastian Saa, Emilio Laca, Patrick Brown
UC Davis
Version 1 UC, Davis Last Update: 11/04/2012

NOTE: This model was developed from 4 years of research conducted from 2008-2011 in mature Nonpareil almonds grown at four locations. The model was then validated at six different almond orchards in 2012. Results show an excellent fit between leaf N concentrations predicted utilizing the model and those observed by subsequent leaf sampling.
Two outputs are provided:
1) Estimated leaf N in July
2) Predicted percentage of trees in July that will meet or exceed the specified critical value.

The results generated utilizing this approach represent the best availabe model for prediction of July leaf N values. Please note that results have not been validated under all conditions and hence must be used with care.

Only Complete Yellow Cells
Outputs are displayed in green

Please complete the following: Enter the tissue nutrient values for leaves collected in spring.

Nutrient	Units	*Value in April
N	(%)	2
P	(%)	1
K	(%)	4
S	ppm	0.5
B	ppm	55
Ca	(%)	1
Mg	(%)	
Zn	ppm	
Mn	ppm	
Fe	ppm	
Cu	ppm	

*Note:
1) For greatest accuracy leaves should be collected in mid-April from non-fruiting spur leaves **and all elements listed at the left should be included.**
2) If value for any nutrient is missing please leave the cell empty.
3)The program will automatically correct any values that are missing or contain nutrient concentrations that are indicative of contamination.

Enter the July Critical Value (C.V.)
(Default setting is = 2.2)

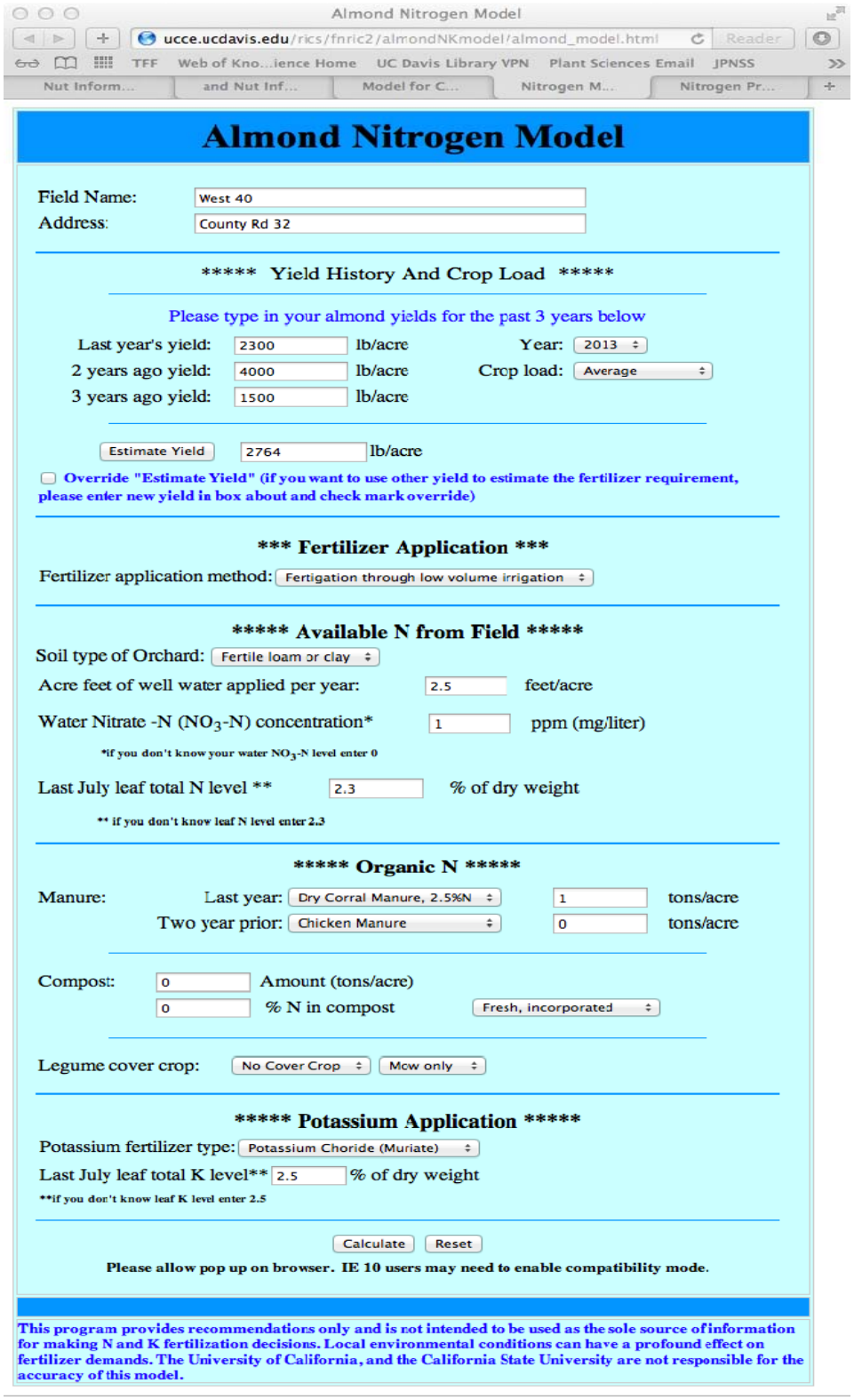
Units	Value
%	2.2

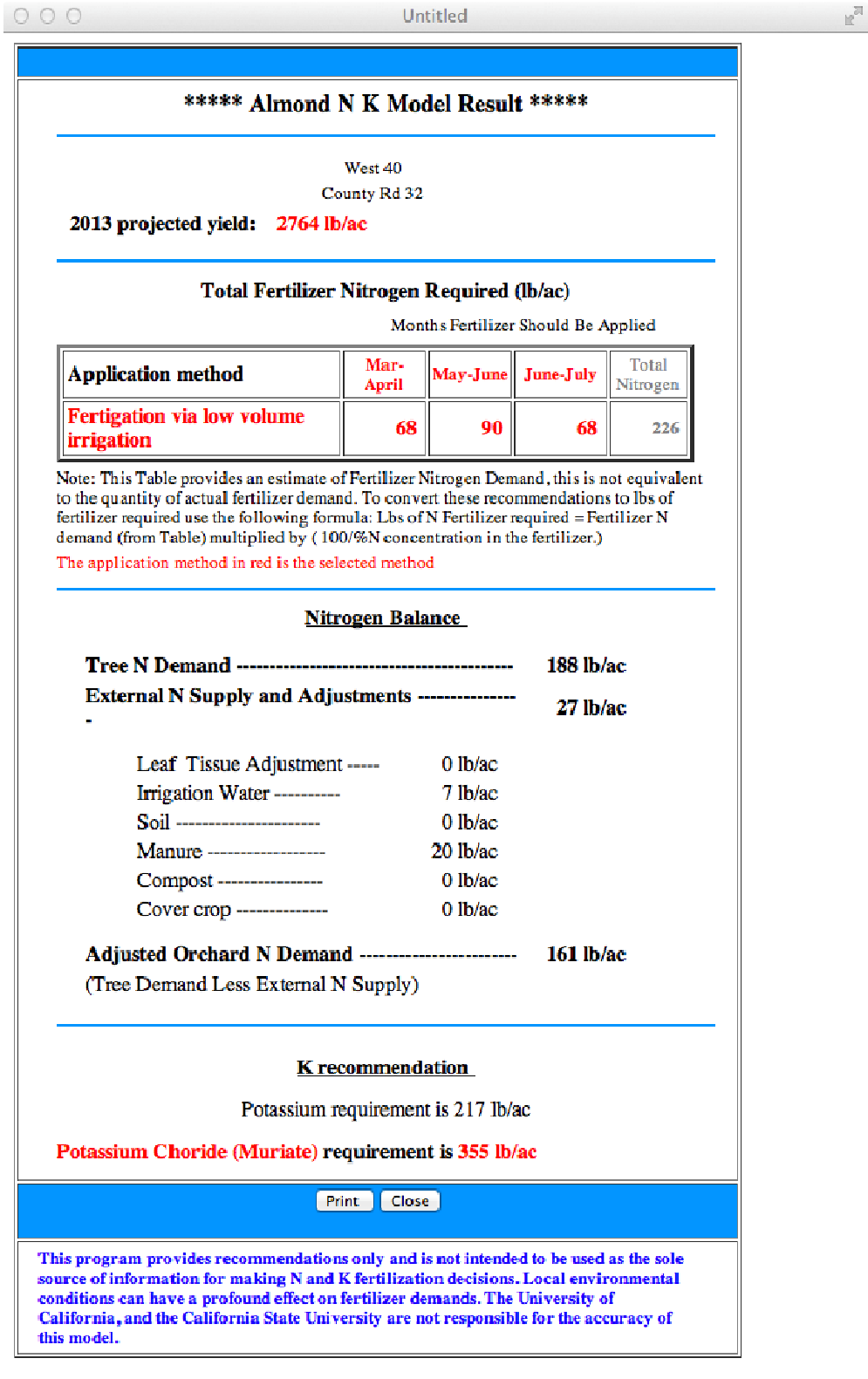
*Note: The currently accepted critical value for N in July in Almond is 2.2%. This may be adjusted if you refer a lower N value to help minimize disease incidence. Selection of higher critical values is not recommended.
This data is used to estimate the percentage of trees in the region from which th esample were collected that will be above the CV in July based upon the spring values entered.

Your Estimated July Nitrogen % is:

Predicted July N	Predicted % of Trees that will be above C.V.
2.23	60.36

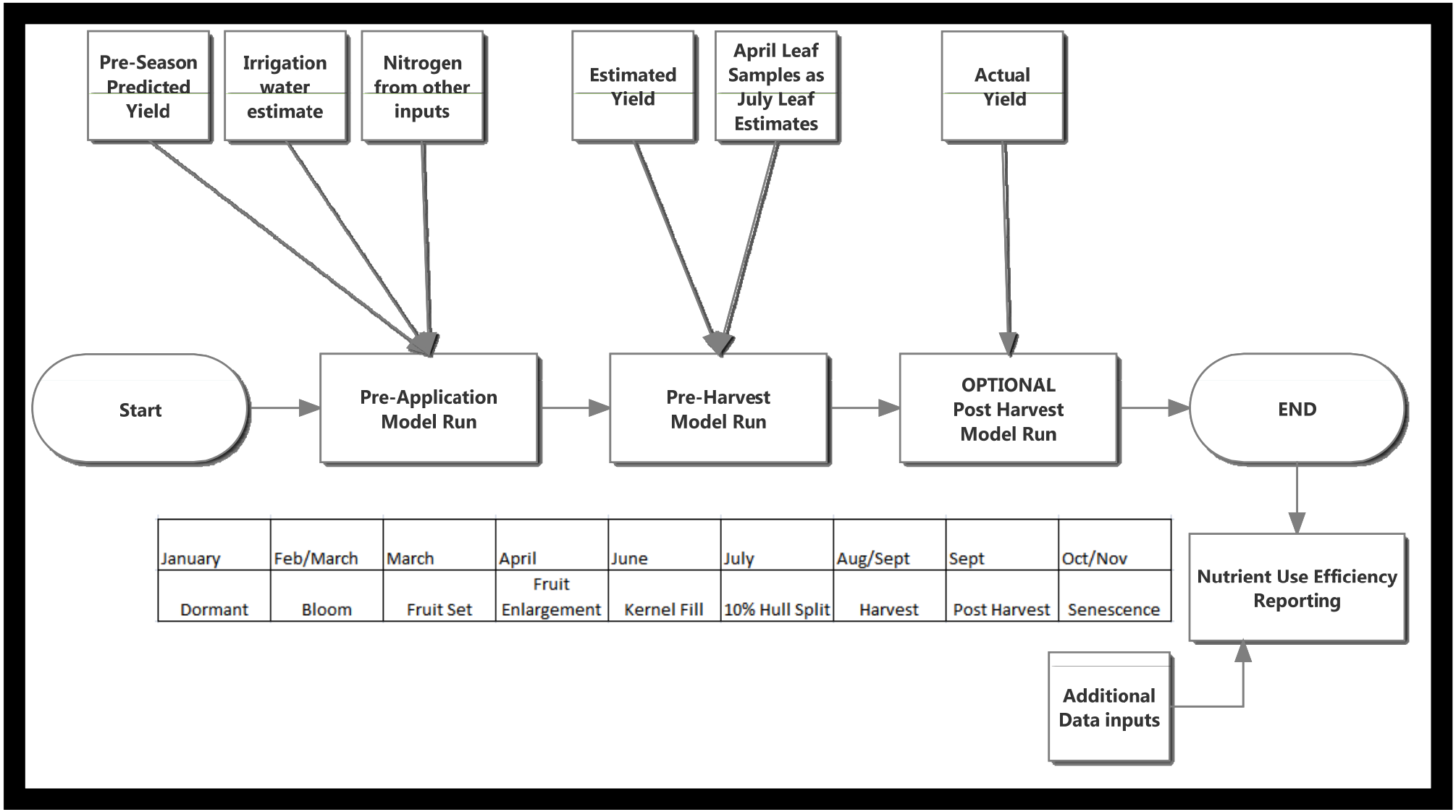
http://fruitsandnuts.ucdavis.edu/Weather_Services/Nitrogen_Prediction_Models_for_Almond_and_Pistachio/


Almond Nitrogen Model
ucce.ucdavis.edu/rics/fnric2/almondNKmodel/almond_model.html
Reader
TFF
Web of Kno...ience Home
UC Davis Library VPN
Plant Sciences Email
JPNSS
Nut Inform...
and Nut Inf...
Model for C...
Nitrogen M...
Nitrogen Pr...
Almond Nitrogen Model
Field Name: West 40
Address: County Rd 32
***** Yield History And Crop Load *****
Please type in your almond yields for the past 3 years below
Last year's yield: 2300 lb/acre
Year: 2013
2 years ago yield: 4000 lb/acre
Crop load: Average
3 years ago yield: 1500 lb/acre
Estimate Yield
2764 lb/acre
Override "Estimate Yield" (if you want to use other yield to estimate the fertilizer requirement, please enter new yield in box about and check mark override)
*** Fertilizer Application ***
Fertilizer application method: Fertigation through low volume irrigation
***** Available N from Field *****
Soil type of Orchard: Fertile loam or clay
Acre feet of well water applied per year: 2.5 feet/acre
Water Nitrate -N (NO_3-N) concentration* 1 ppm (mg/liter)
*if you don't know your water NO_3-N level enter 0
Last July leaf total N level ** 2.3 % of dry weight
** if you don't know leaf N level enter 2.3
***** Organic N *****
Manure:
Last year: Dry Corral Manure, 2.5%N 1 tons/acre
Two year prior: Chicken Manure 0 tons/acre
Compost: 0 Amount (tons/acre)
0 % N in compost
Fresh, incorporated
Legume cover crop: No Cover Crop
Mow only
***** Potassium Application *****
Potassium fertilizer type: Potassium Choride (Muriate)
Last July leaf total K level** 2.5 % of dry weight
**if you don't know leaf K level enter 2.5
Calculate
Reset
Please allow pop up on browser. IE 10 users may need to enable compatibility mode.
This program provides recommendations only and is not intended to be used as the sole source of information for making N and K fertilization decisions. Local environmental conditions can have a profound effect on fertilizer demands. The University of California, and the California State University are not responsible for the accuracy of this model.


Untitled
***** Almond N K Model Result *****
West 40
County Rd 32
2013 projected yield: 2764 lb/ac
Total Fertilizer Nitrogen Required (lb/ac)
Months Fertilizer Should Be Applied
Application method | Mar-April | May-June | June-July | Total Nitrogen
Fertigation via low volume irrigation | 68 | 90 | 68 | 226
Note: This Table provides an estimate of Fertilizer Nitrogen Demand, this is not equivalent to the quantity of actual fertilizer demand. To convert these recommendations to lbs of fertilizer required use the following formula: Lbs of N Fertilizer required = Fertilizer N demand (from Table) multiplied by (100/%N concentration in the fertilizer.)
The application method in red is the selected method
Nitrogen Balance
Tree N Demand ---------- 188 lb/ac
External N Supply and Adjustments ---------- 27 lb/ac
Leaf Tissue Adjustment ----- 0 lb/ac
Irrigation Water ---------- 7 lb/ac
Soil ---------- 0 lb/ac
Manure ---------- 20 lb/ac
Compost ---------- 0 lb/ac
Cover crop ---------- 0 lb/ac
Adjusted Orchard N Demand ---------- 161 lb/ac
(Tree Demand Less External N Supply)
K recommendation
Potassium requirement is 217 lb/ac
Potassium Choride (Muriate) requirement is 355 lb/ac
Print
Close
This program provides recommendations only and is not intended to be used as the sole source of information for making N and K fertilization decisions. Local environmental conditions can have a profound effect on fertilizer demands. The University of California, and the California State University are not responsible for the accuracy of this model.

Integrated Management Program

(December, 2013)

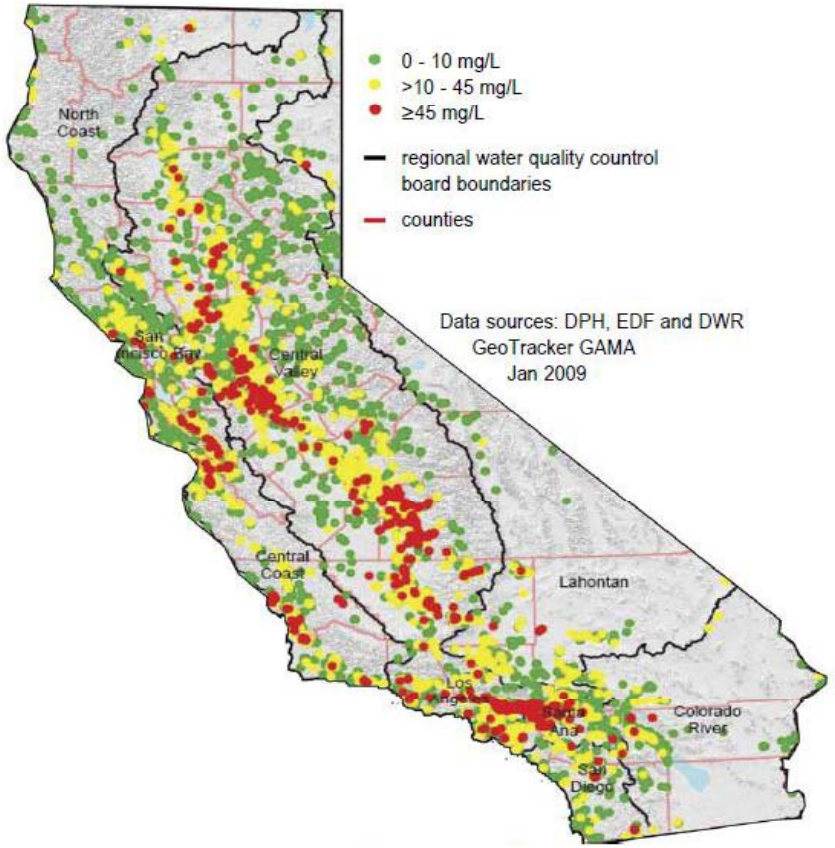


We are currently developing digital software with SureHarvest to integrate the 4 R's and correctly monitor the use of N.

Improving the Efficiency of Nitrogen Use is a Win-Win

Approaches to improve N use efficiency in Almond and Pistachio:

- Match orchard specific fertilizer rate and timing with orchard specific demand.
- Improve orchard sampling and monitoring techniques
- Adjust Fertilization IN-SEASON
- TO OPTIMIZE EFFICIENCY: MANAGE ALL FIELDS INDIVIDUALLY EVERY YEAR
- Manage irrigation to minimize losses.
- Optimize the nutrition for all other nutrients
- Manage in-field variability using: Variable Rate/Placement Methods, Modified Irrigation/fertigation systems design.



(Ekdahl and others, 2009; Harter Report, 2012)

Thank you!

- Historical Contributions: Weinbaum, Rosecrance, Uriu, Farm Advisors.

- Sebastian Saa
- Saiful Muhammad
- Ismail Muhammad
- Andres Olivos
- Blake Sanden
- Roger Duncan
- John Edstrom
- David Doll
- Bruce Lampinen
- Ken Shackel
- Emilio Laca

- Grower Cooperators
- Paramount Farming
- Almond Board of California
- USDA, CDFA