



# **Fertilizer Management and Nutrient Budgeting** Sebastian Saa, Saiful Muhammad, Blake Sanden, Patrick Brown\*

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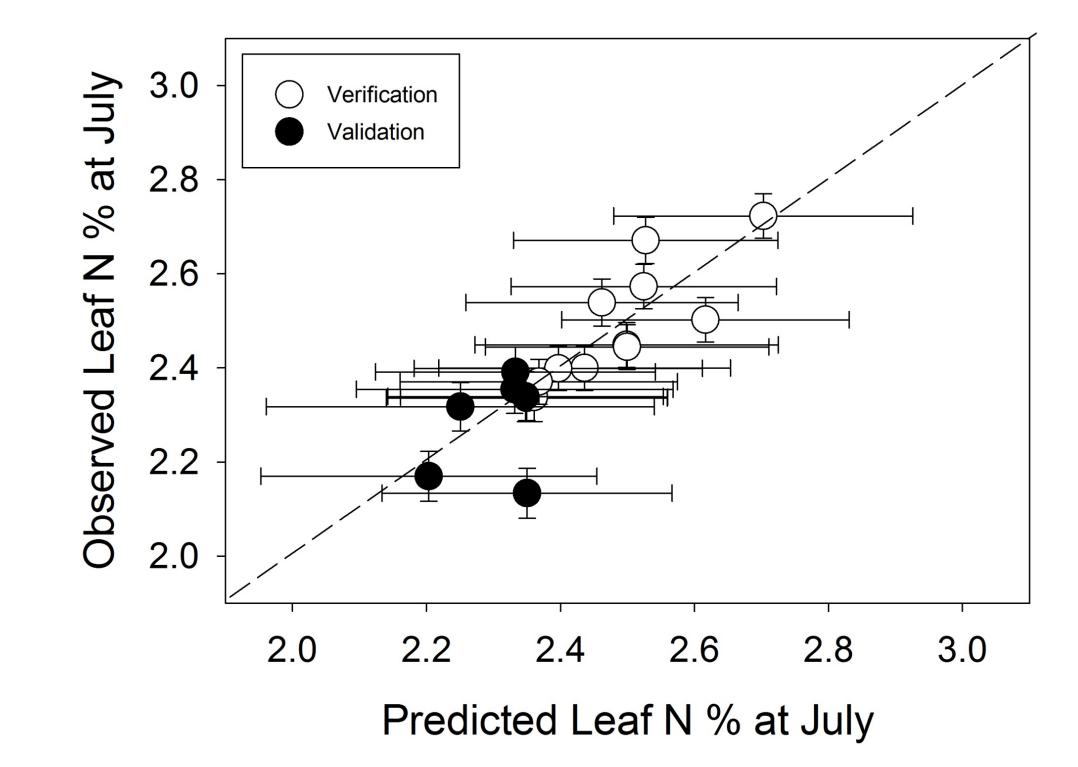


- **Predict July leaf N % using an April sampling.** 1.
- **Develop a leaf sampling protocol representative of CA almond orchards.** 2.
- Develop fertilizer response curves to relate nutrient demand with fertilizer rate and nutrient use efficiency. 3.
- Develop a phenology and yield based nutrient model for almond. 4.
- **Deploy model in online system** 5.

# Results

# Can we sample leaves in April and Predict July?

Overall, great fit between predicted and observed.



### The proper way to sample in April

full size

Sample at 43+/-6 days after full bloom when the

2. Identify six non fruiting spurs around the canopy

leaves from each spur (picture below).

3. Use your hand and your thump nail to clamp all the

NUTRIENT ANALYSIS (N, P, K, B, Ca, Zn, Cu, Fe,

Mg, Mn, S) and application of UCD-ESP program.

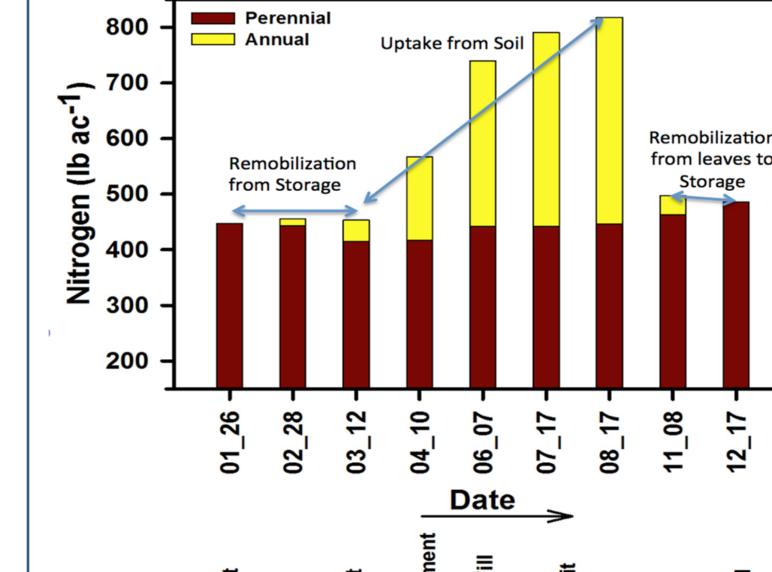
majority of leaves on non-fruiting spurs have reached



- 4. Collect leaves from 18-28 trees per orchard 5. Each sample tree must be at least 30 yards apart . Use a grid design if possible (left picture). Send the samples to the lab and ask for a FULL Spacing:

## **Total Nutrient Demand**





How much is exported for every **1000 lb of Kernels produced?** Table 2. Nutrient Removal per 1000 lb of Kernel produced.

Nutrient removal Per 1,000 lb (Almond =Kernel equivalent)

Nonpareil

• N removal 68 lb per 1,000 • K removal 80 lb per 1,000 • P removal 8 lb per 1,000 Monterey • N removal 65 lb per 1,000 • K removal 76 lb per 1,000

Figure 1. Verification (orchards and years used to develop the model) and validation (additional set of orchards) of the model performance. Dashed line is the 1:1 concurrence between predicted and observed values. Bars show the 95% confidence intervals. Circles represents average N % observed in July (y axis) and predicted by the model (x axis) with a sample of 30 pooled trees for the 18 site-year combinations in the study



n Set Set	Split est	Fall	• P rea
Dormar Bloom Fruit Se Enlarge Kernel	10% Hull ( Harve	Leaf	Growth I
Figure 2. Changes in nitrog		ulation	• Yiel
in fruit and perennial organ			<ul><li>Yiel</li><li>Yiel</li></ul>
almond trees			

emoval 7 lb per 1,000 Requirement eld 2,000 to 4,000 = 0 lb N eld 1,000 to 2,000 = 20 lb Neld < 1,000 = 30 lb N

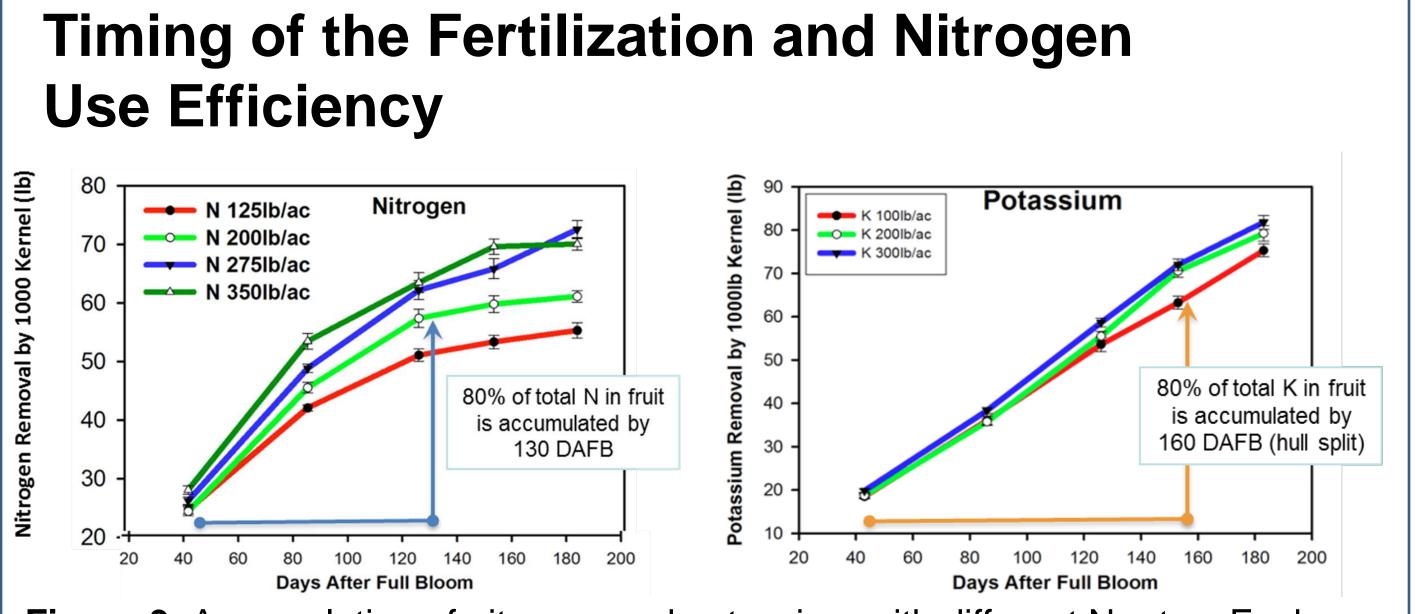
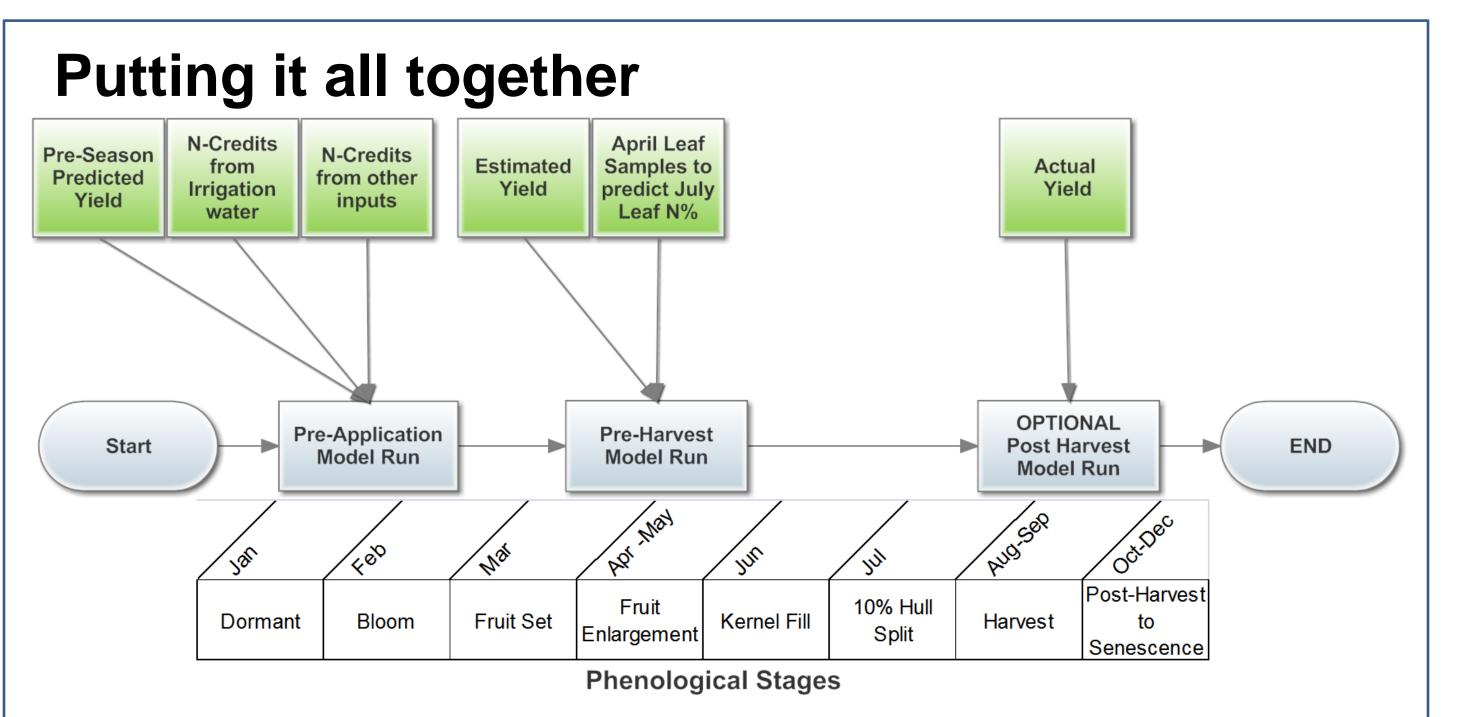


Figure 3. Accumulation of nitrogen and potassium with different N rates. Each point shows mean and std error

### Nitrogen Use efficiency 2008 – 2010 under optimum treatment (275lbs of N/ac) was >80%





### **Right Rate:**

Match tree and crop demand with supply, taking into consideration the contribution of nutrients from all sources, including fertilizer, organic nitrogen, water and soil.

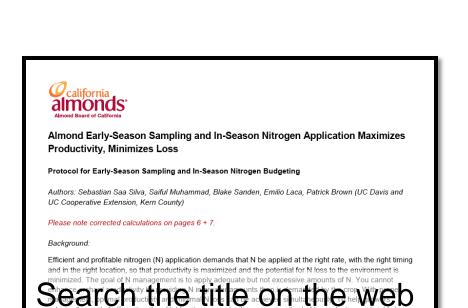
# Assess plant nitrogen demand based on yield

Every 1000 lb of kernels harvested removes 68 lb N, 8 lb P and 80 lb K. Accurate yield estimates better reflect nitrogen demand. Revise yield estimates as conditions change. • Pre-season predicted kernel yield

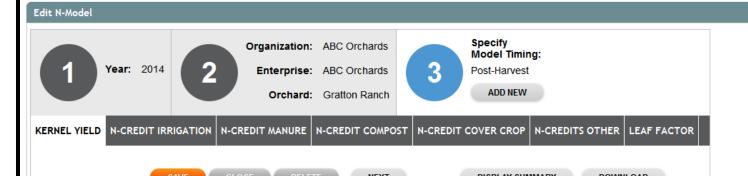
# Web Resources for More Information and Models

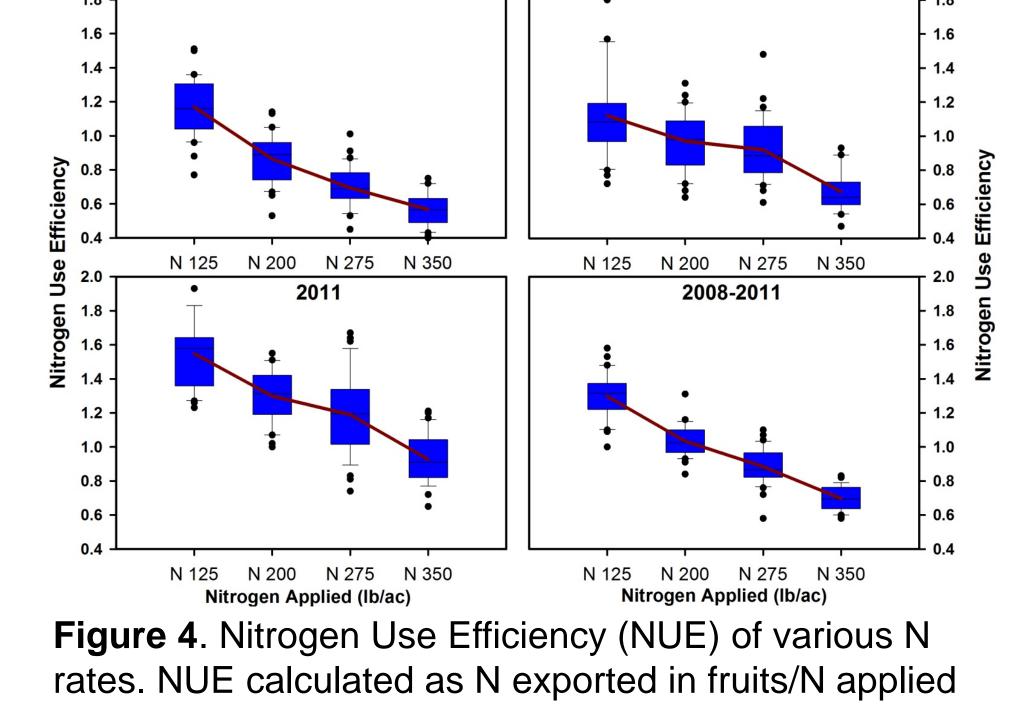












Base your fertilization rate on realistic, orchard specific yield, account for all N inputs and adjust in response to spring nutrient and yield estimates.

Every field, every year, is a unique decision

Post-bloom estimated kernel yield Post-harvest actual kernel yield

#### Assess nitrogen contributions from all sources

- Nitrogen in irrigation water.
- Credits from soil amendments.

#### Assess tree nitrogen status to determine if OK or less than adequate.

• Post-bloom leaf samples can predict July leaf N%, an indicator of tree nitrogen status.

#### **Right Time:**

Spoon-feed applications during the growing season to maximize uptake and minimize loss potential.

- Most (~80%) N uptake between full leaf out and kernel fill.
- The remaining N uptake (~20%) between hull split and immediately post harvest

#### **Right Place:**

Ensure delivery to the active root zone.

• Fertigation often ensures highest nutrient use efficiency.

SureHarvest

SUSTAINABILITY FROM THE GROUND U

• If nitrogen is likely to be soil lost from the soil, consider applying nitrogen foliarly

Right Rate:				
amount of N tl kernel yield, d N removal rate and optimal us kernel pounds fruit N remova amount of N re	at will be removed from the orch pending on the N status of the tr averaged 68 lbs N per 1,000 lbs e of N resources, and coincides also factors in the N removed wir rates (>68 lbs N/1,000 lbs kerne quired for vegetative growth in a	e current year is the primary dete ard for a given yield ranges from ree. In four years of experimenta s of kernel yield. This removal ral with a whole-fruit N% of 1.8%. (f th shells and hulls to equal the 'f el) occur when trees have receive yielding tree is small in contrast orchards with 70% or greater or	50 to 75 lbs N per 1,000 lbs of tion at multiple sites, the ideal te corresponds to maximal yie vote: This conversion stated a votal fruit* N removal). Higher ad N in excess of demand. Th to that required by the fruit,	l eld as
1,000 lbs kern fixing cover cr	l yield) less N supplied from wa	er amendments) is determined b ter and other N sources including in excess of crop N removal can lemand.	manures, composts, nitroger	n-
budget. The s	pply of N (lbs/acre) from water is	ree N 'fertilizer' and should be in s calculated by multiplying nitrate	,	

SAVE CLOSE DELETE NEXT	DISPLAY SUMMARY AS PDF	DOWNLOAD SUMMARY		
ls of kernel per acre	CALCULATIONS	UPDATE		
ACTUAL YIELD (OR PREDICTED YIELD):	KERNEL YIELD			
O YIELD: 🚱	PREDICTED	3000 lbs/Acre		
	ESTIMATED	2500 lbs/Acre		
	ACTUAL	2400 lbs/Acre		
O YIELD: 👔	CROP NITROGEN DEMAND BASED ON YIELD			
	PREDICTED YIELD	204 lbs N/Acre		
A ESTIMATED YIELD:	ESTIMATED YIELD	170 lbs N/Acre		
	ACTUAL YIELD	163 lbs N/Acre		
ACTUAL YIELD:	N CREDITS			
	IRRIGATION	41.0 lbs N/Acre		

