University of California

Nitrogen Management Training

for Certified Crop Advisers

MODULE 7B

Permanent Crops

Part 1

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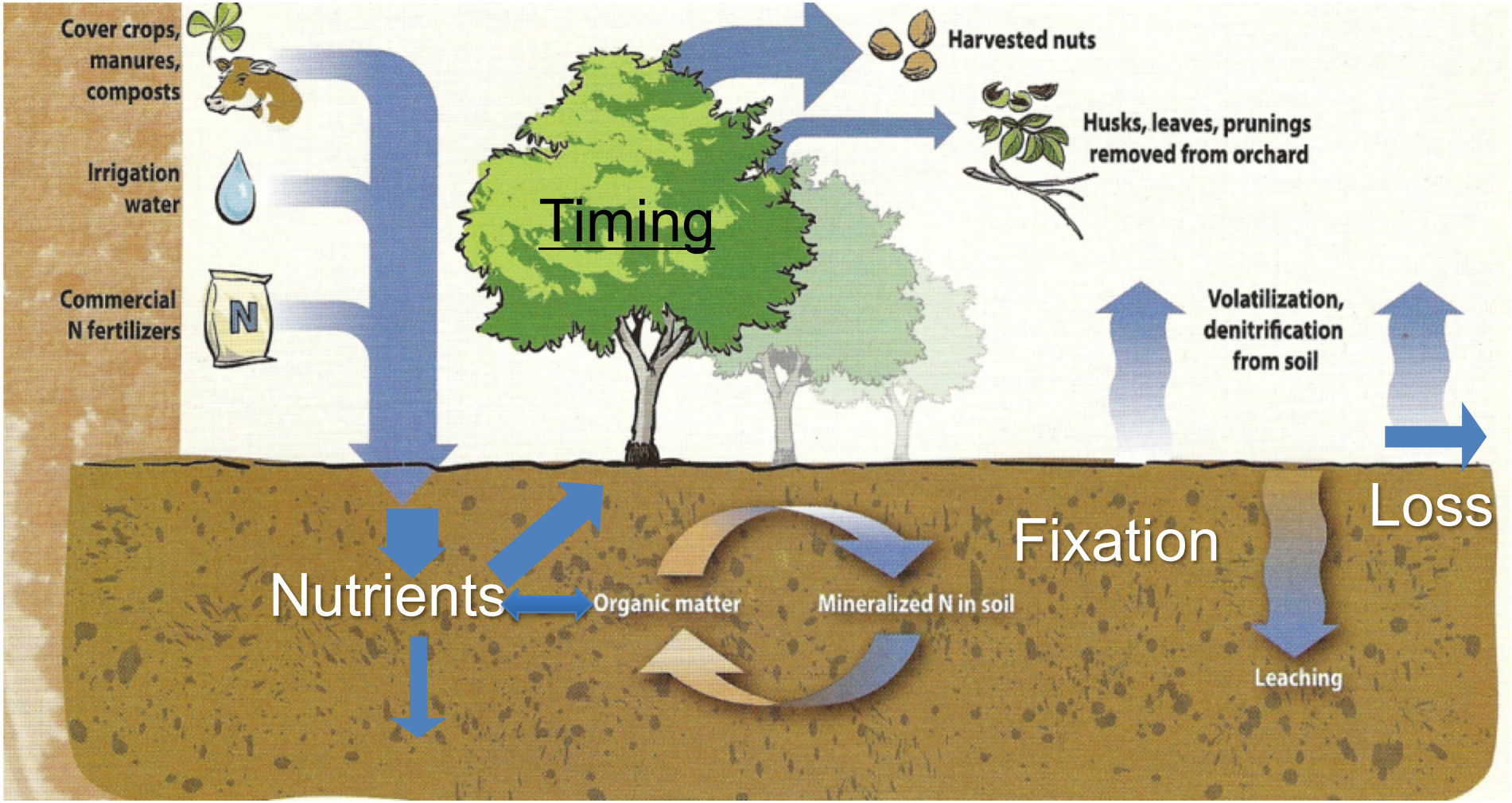
Optimizing N Use in Tree Crops

Supply (Rate) = Demand (Amount and Timing)

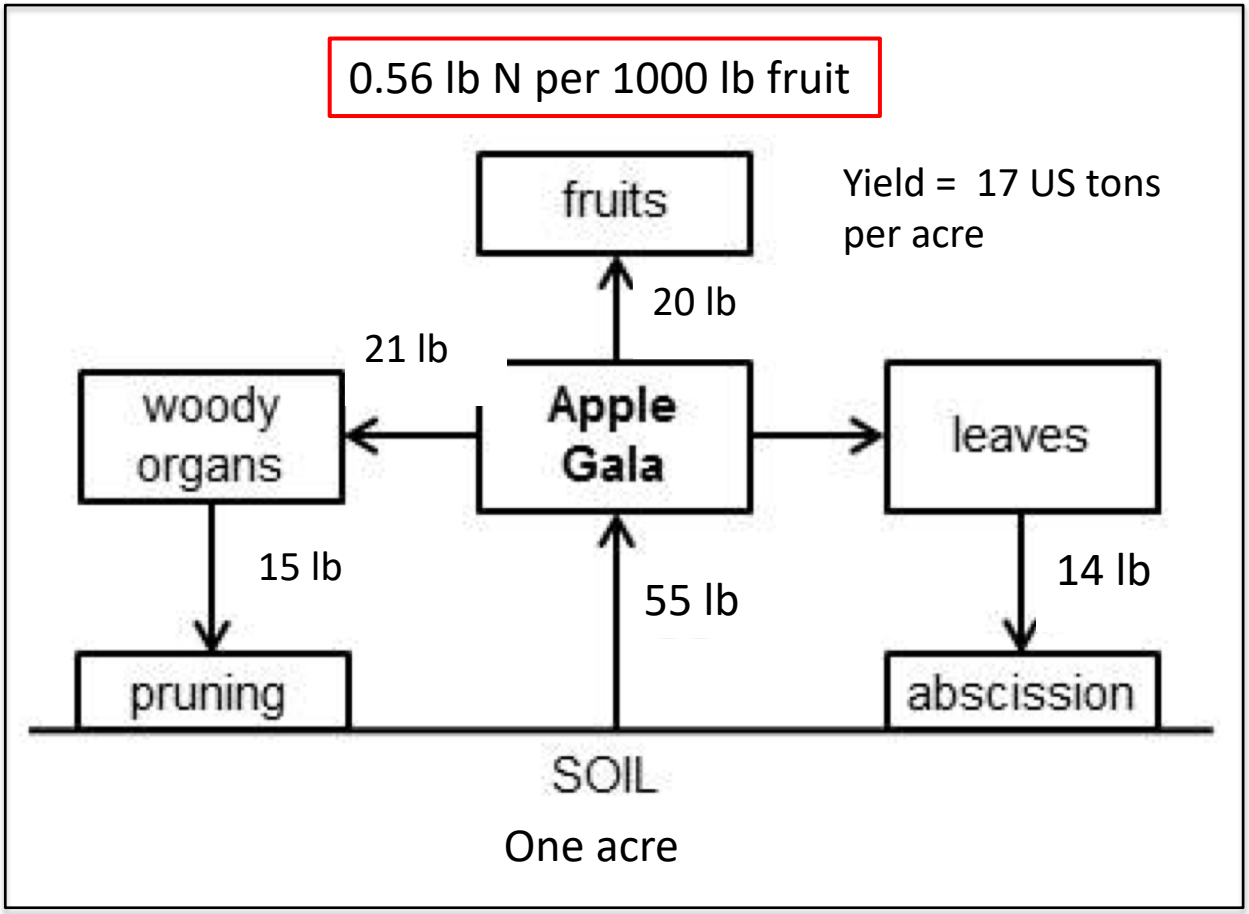


Kathy Kelley-Anderson et al: ANR Pub # 21623

Fruit N Demand

Species	N lbs per 1000 lbs of fruit produced	Source
Apple	0.5-0.6	IFA, 1992;USDA,1963
Citrus	1.1-1.6	Rocuzzo, 2013; Krueger/Arpaia 2010
Cherry (Sweet)	2-2.35	Huguet, 1980
Table Grape	1.3-1.9	Lohnertz, 1991; USDA 1963
Wine Grape	0.8-2	Coombe, 1992; Mullins, 1992
Kiwifruit	1.3-1.8	Smith et al., 1988; Pailly 1992
Walnut (In-shell)	14-20	Weinbaum 1991; Pope 2014
Peach	0.8-1.2	Maragoni and Rombola 1994;USDA 1963
Pistachio	28 (marketable yield)	Siddiqui et al (2013)
French Prune	3 (1000 fresh), 9 (1000 Dry)	Weinbaum, et al., 1994, USDA, 1963
Olives	8	Angelo Rodrigues *et al.,* 2012
Almond	68 (1000 lb kernel), ≈ 16 lb per 1000 lb whole fruit	Muhammad, Saa, Brown et al (2013)

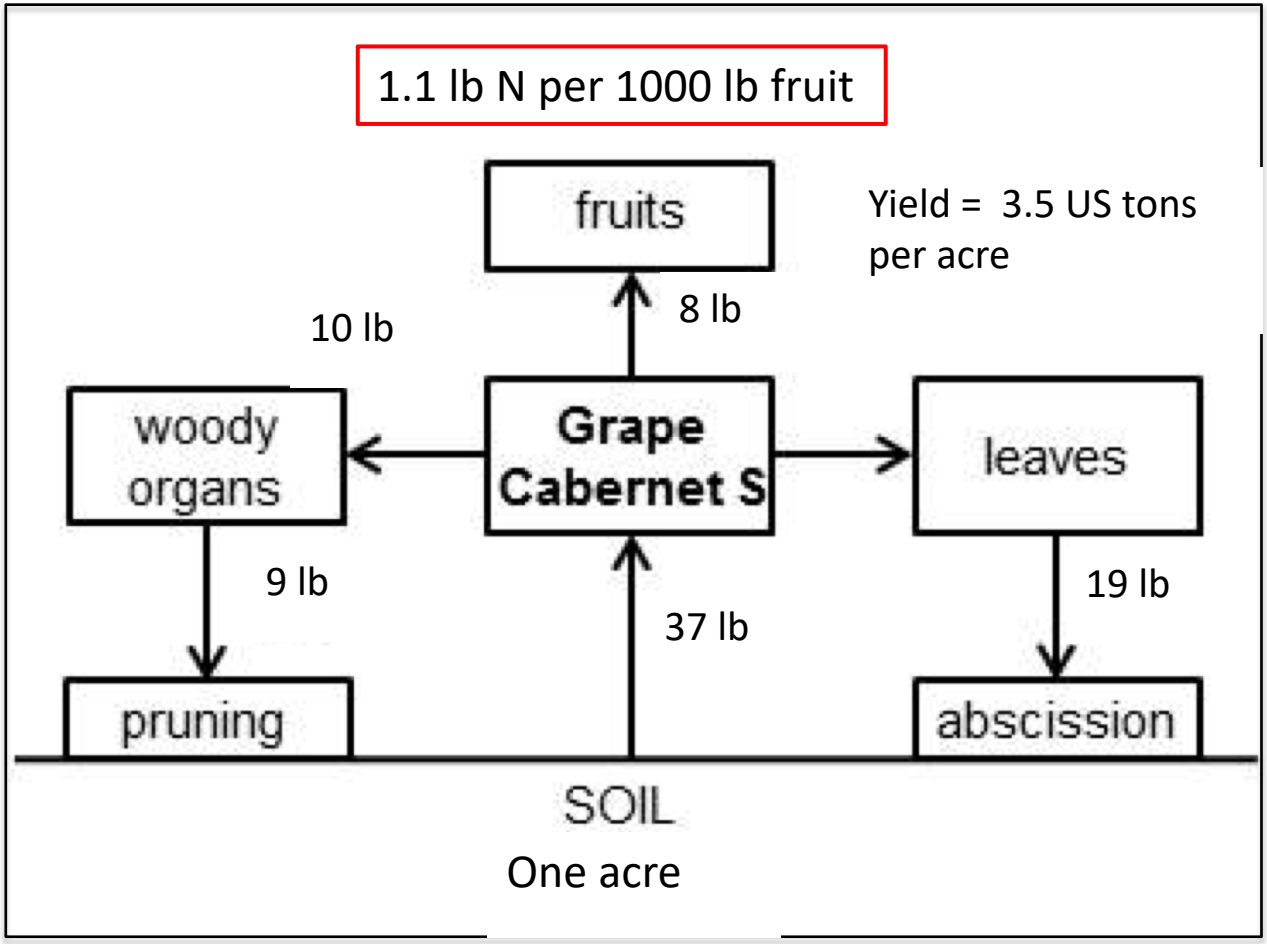
N Accumulation and Partitioning: Apple



Apple

Tagliavini, M. and Scandellari, F. 2013.

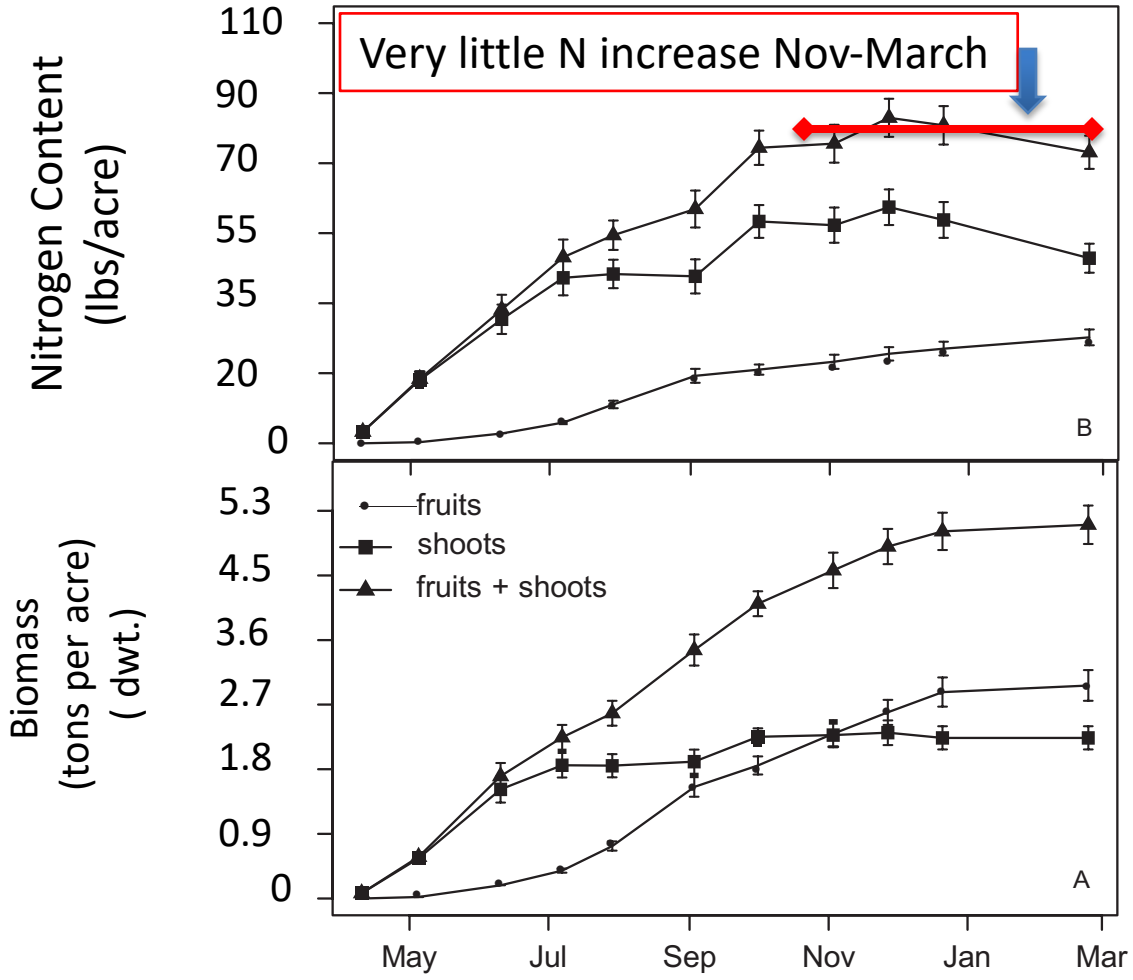
N Partitioning: Grape



Grape ‘Cabernet’

Tagliavini, M. and Scandellari, F. 2013.

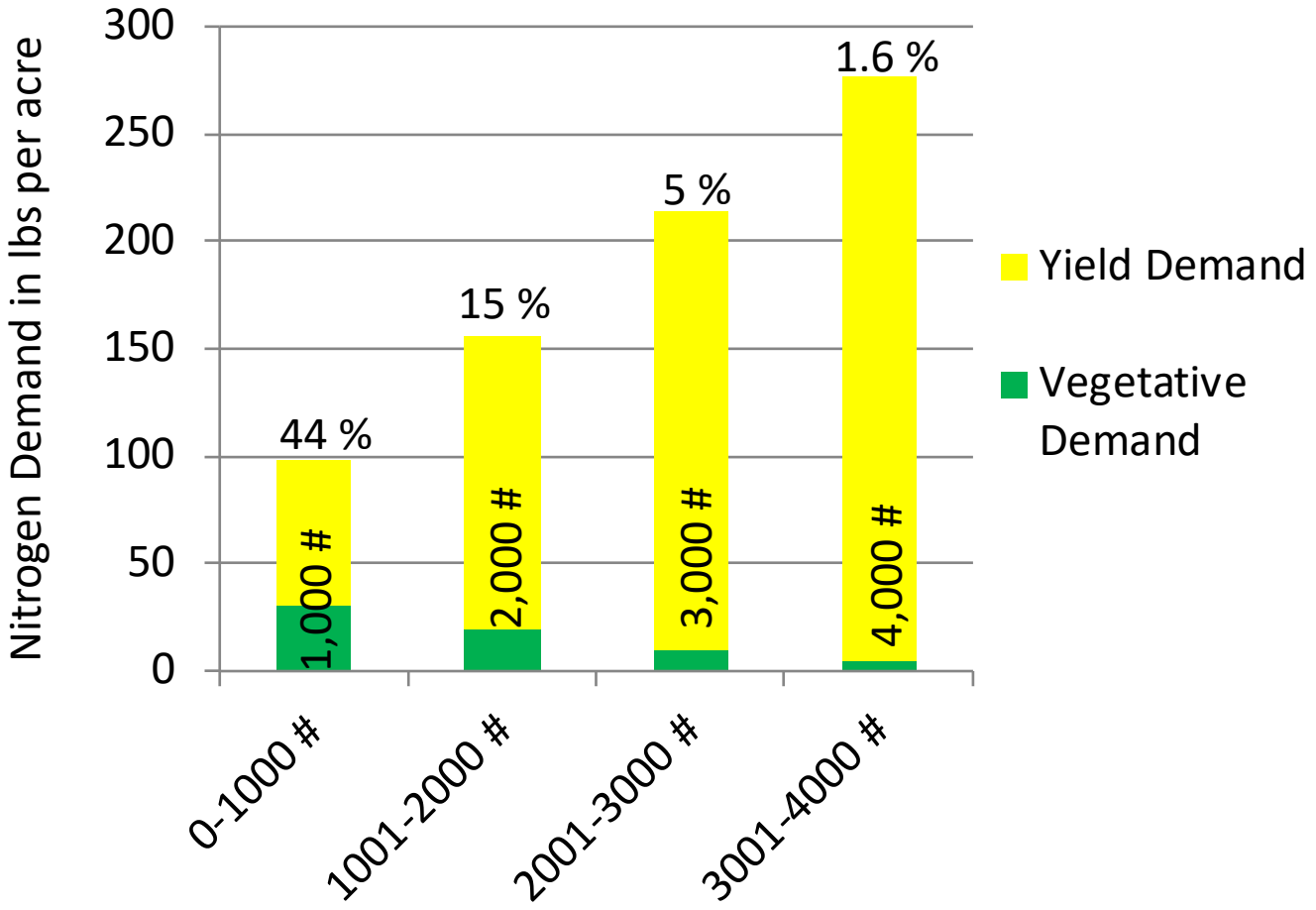
N Demand Timing: Orange



- Fruit and shoots account for majority of N used in a mature orchard.
- 38% of N is used in the leaves.
- Nitrogen uptake occurs from April to November.
- No uptake December to February.

Modified from: Roccuzzo, 2012. Assessing nutrient uptake by field-grown orange trees. European Journal of Agronomy. 41:73-80.

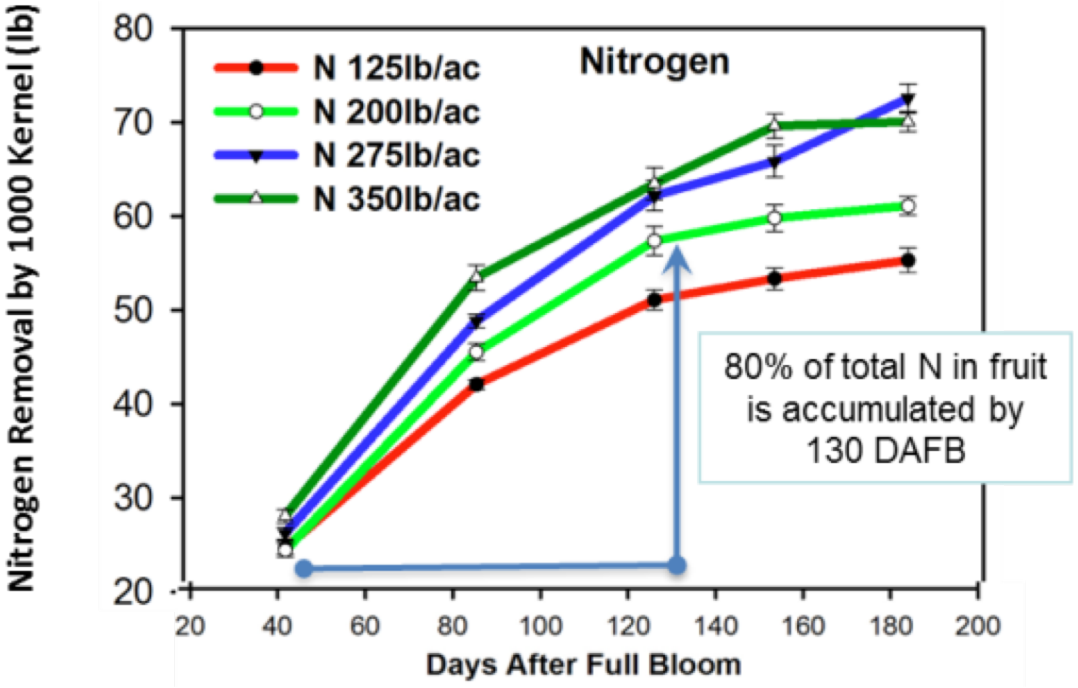
Right Rate: Yield vs. Vegetative Growth in Almonds



The proportion of the annual N budget that goes to vegetation declines as the yield increases above 2,000 lbs.

Right Rate and Timing: Almonds

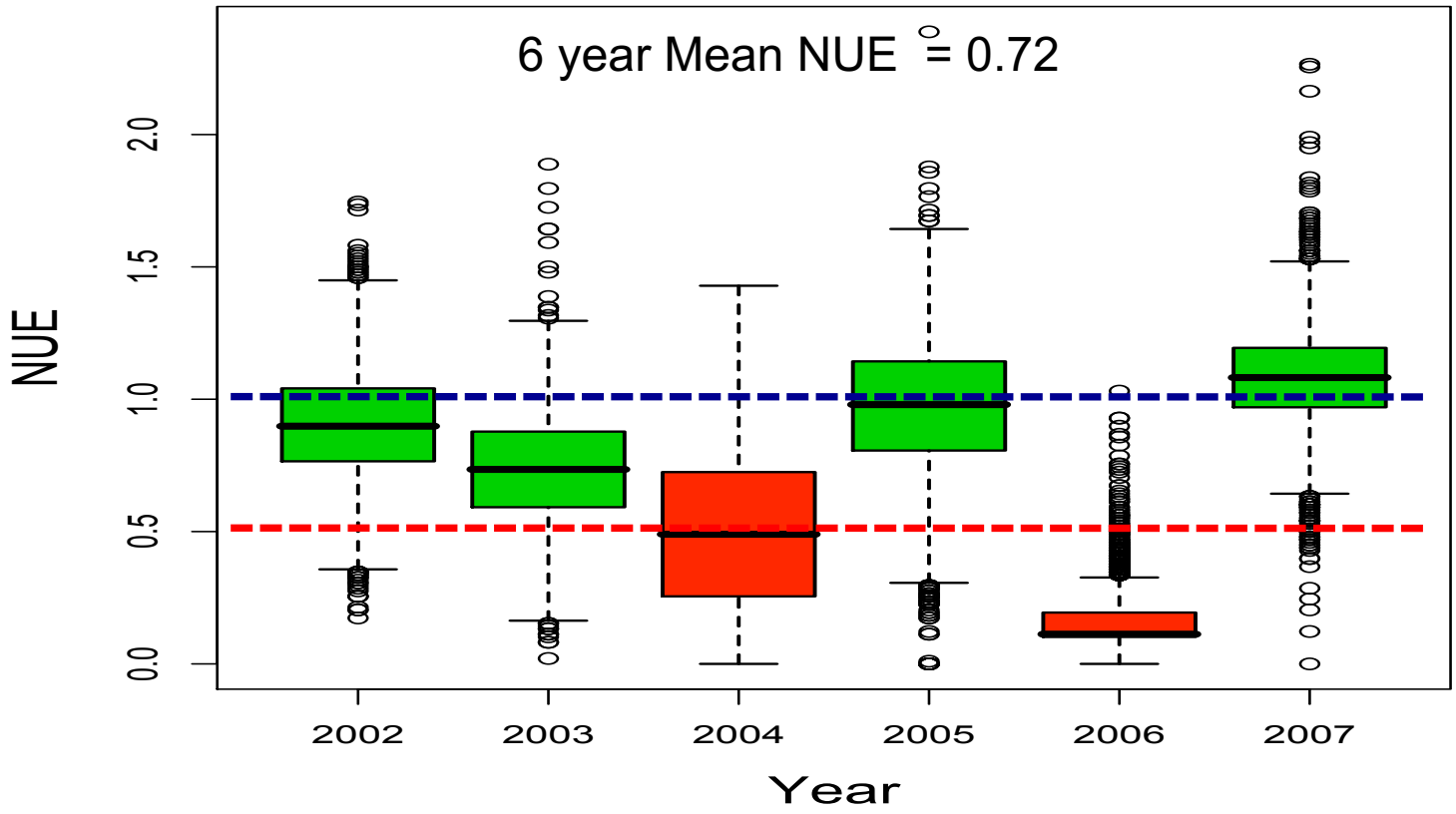
- Applying excess N does not result in greater uptake by fruit, but does increase leaching potential
- There is less vegetative growth when yield is high, even when N is applied in excess.



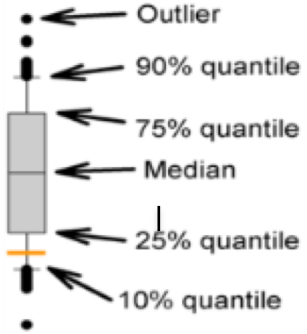
- Increasing N from 275 to 350 lbs did not increase fruit N removal at harvest.
- In plants receiving adequate N, 68 lbs of N is removed in 1000 lbs kernel yield.
- 80% of crop N is accumulated by 130 days after full bloom.

N Use Efficiency: Pistachios

Tree NUE = N removed in harvested fruit / applied N



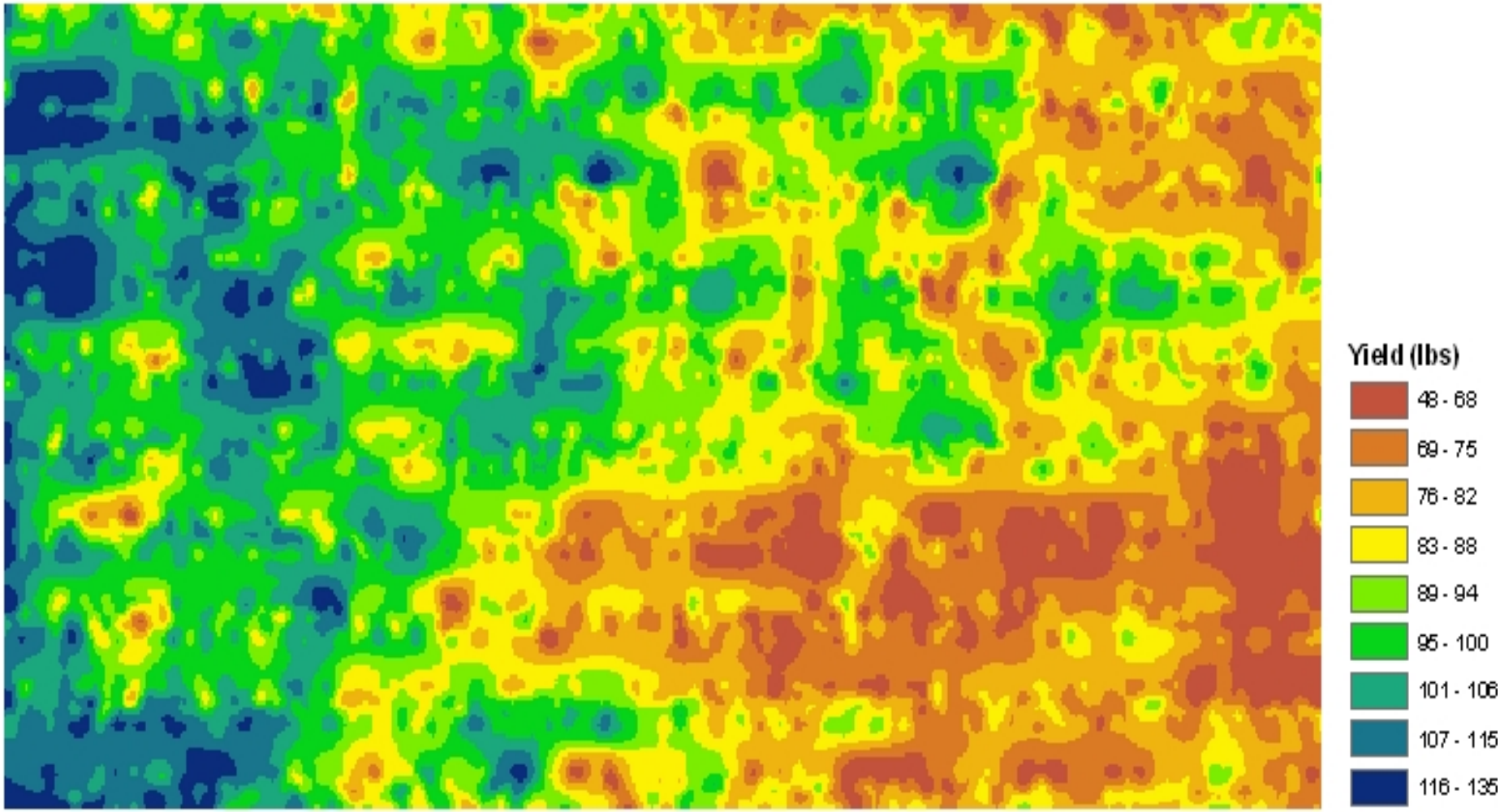
- 42,000 lbs N applied for 6 years to 40 acres
- 26,880 lbs N exported in yield
- $6{,}000_{est}$ lbs N pruning, leaves, and growth
- 9,120 lbs N 'lost' 38 lbs N/acre/year



- 24 yo Pistachio, 5 inch rainfall zone, no deep percolation.
- Silt loam, pH 6.7-7.0, OM 0.6%, 2 ppm NO_3N (100cm).
- Fertigated with five in-seasons split apps.
- 10 yr ave yield = 4,000 lb/acre= 112 lb N acre in exported fruit
- Mean N application 175 lb/acre.

Non-uniform Yield Within Field

Varying yields across 80 acres of Pistachio trees:



Managed as a single plot, large fields will always be non-uniform and less nutrient-efficient than smaller fields.

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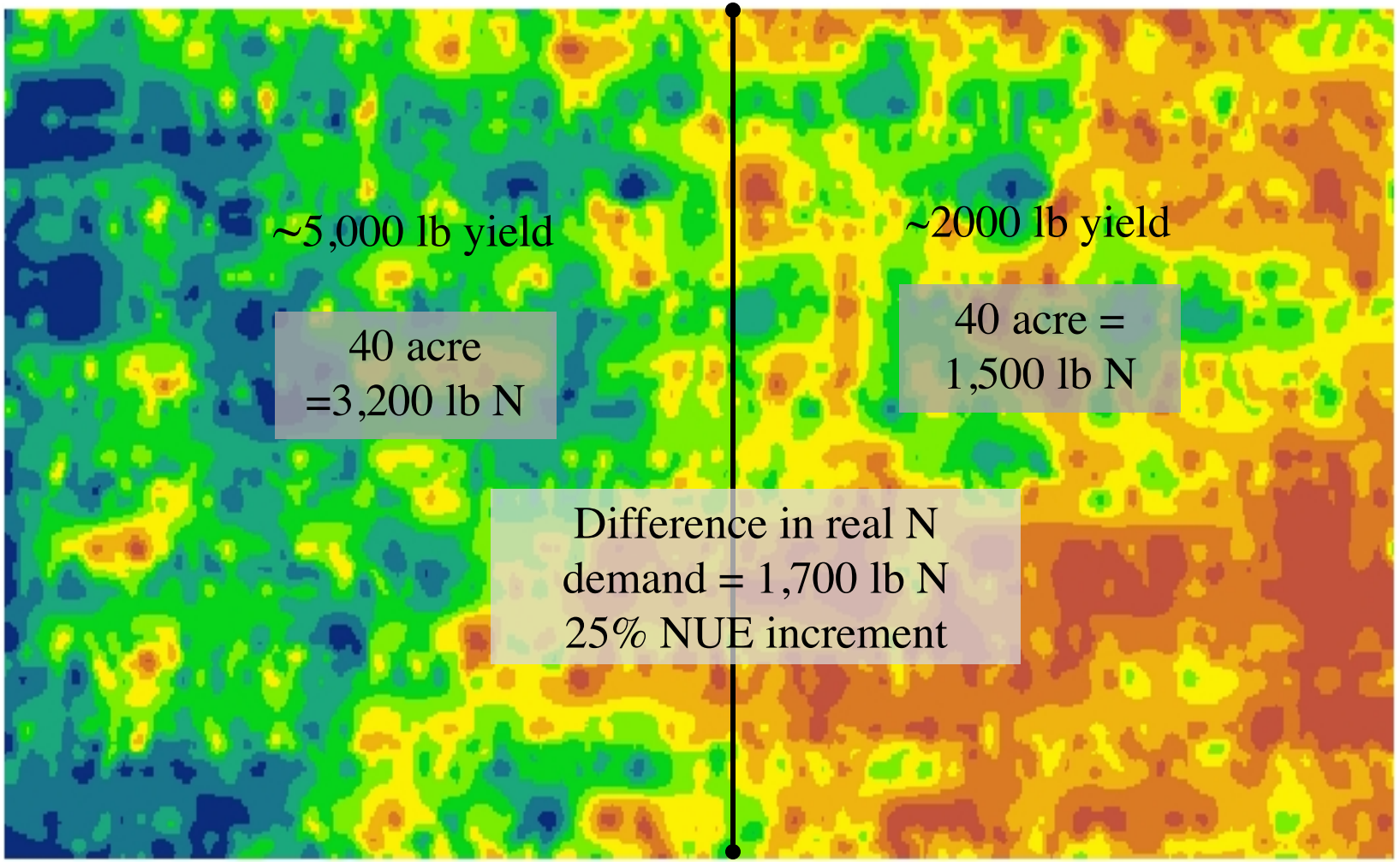

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