Renewable Carbon Management

Nutrient Management Using Organic Input Materials

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Agriculture is the Source of >95% Groundwater Nitrate in SJV.

Relative Contribution

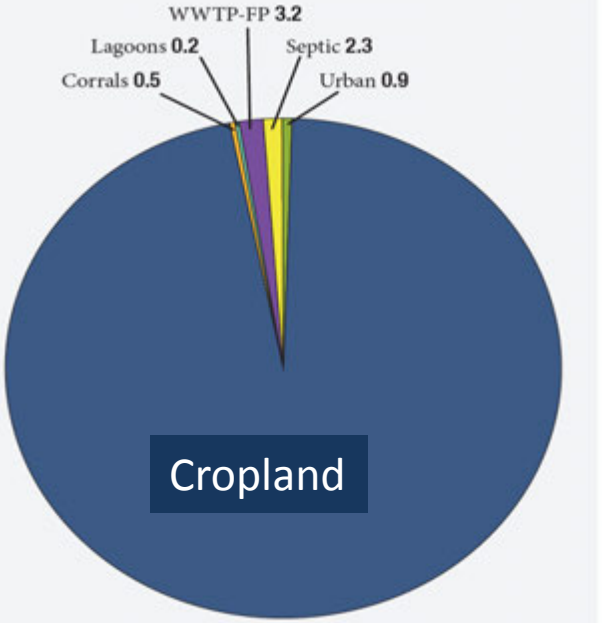
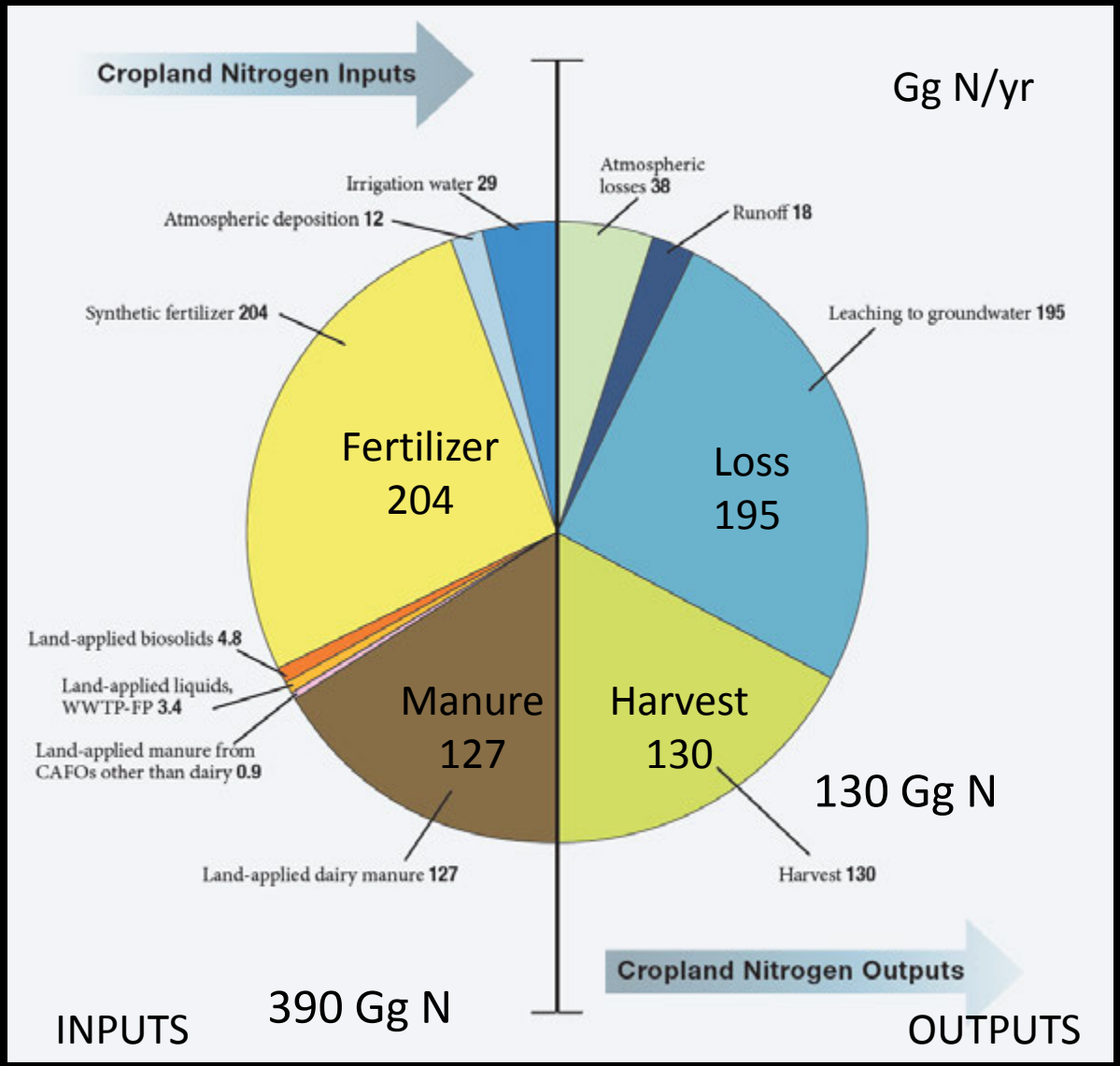


Figure ES-1. Estimated groundwater nitrate loading from major sources within the Tulare Lake Basin and Salinas Valley, in Gg nitrogen per year (1 Gg = 1,100 t).

Total N input in Ca is 3 X N offtake.

Organic matter sources could supply >95% of SJV N, K, P demands.



(http://groundwaternitrate.ucdavis.edu)

Legislative Response: Nutrient Management Plans - ILRP

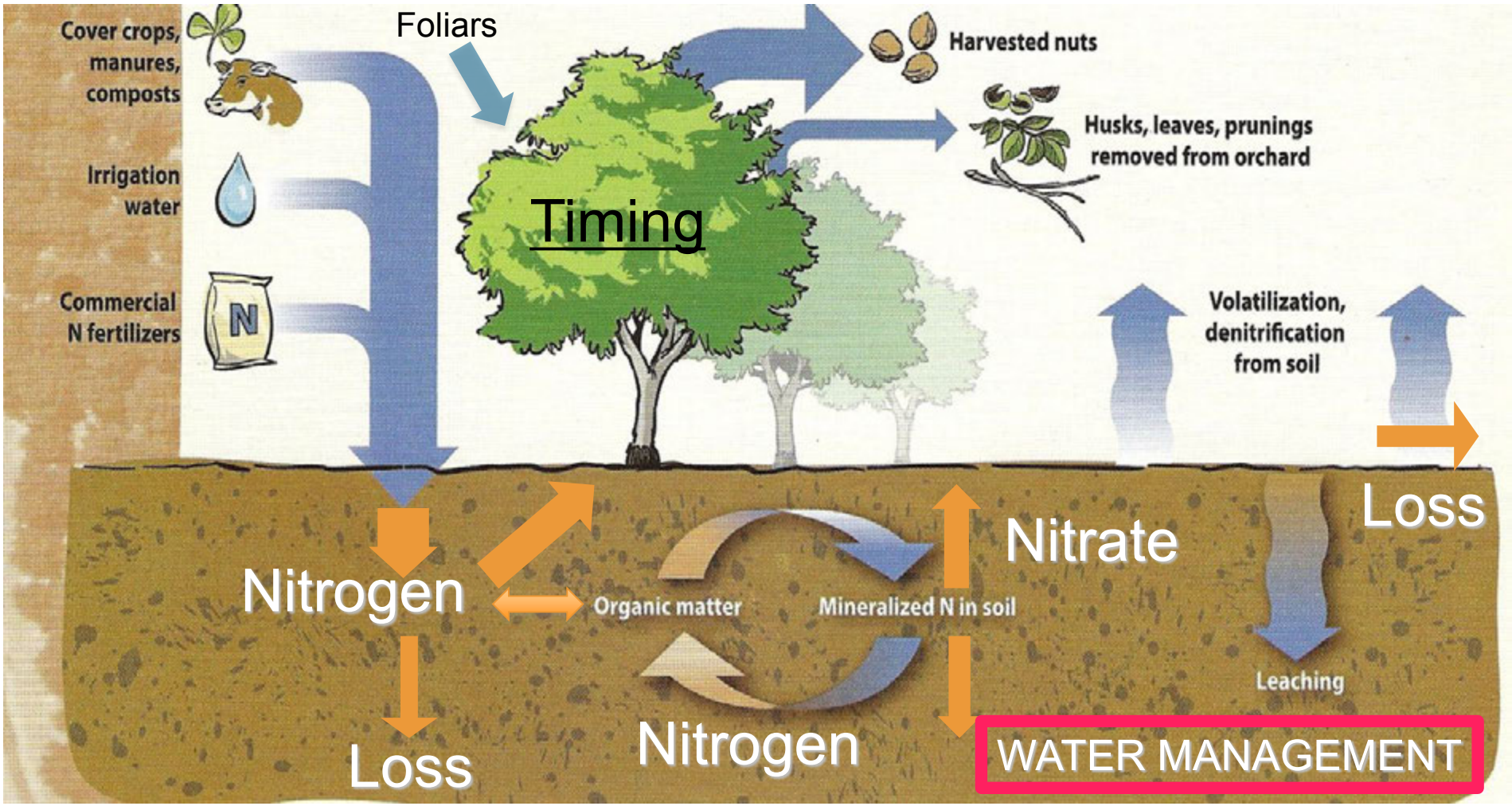
- **Required Nutrient Management Plan for all Individual Fields**
  - Certified Crop Advisor or Grower self certification
  - Training Requirement

- **Application rates will be based upon field specific crop N demand estimations, accounting for all applied N (water, cover crops, OMA).**
  - Replacement of nitrogen exported from the field or incorporated into perennial structures

- **Post Season verification and reporting.**
  - Collated and Managed by Local Water Coalitions
  - Aggregate reporting to Water Board

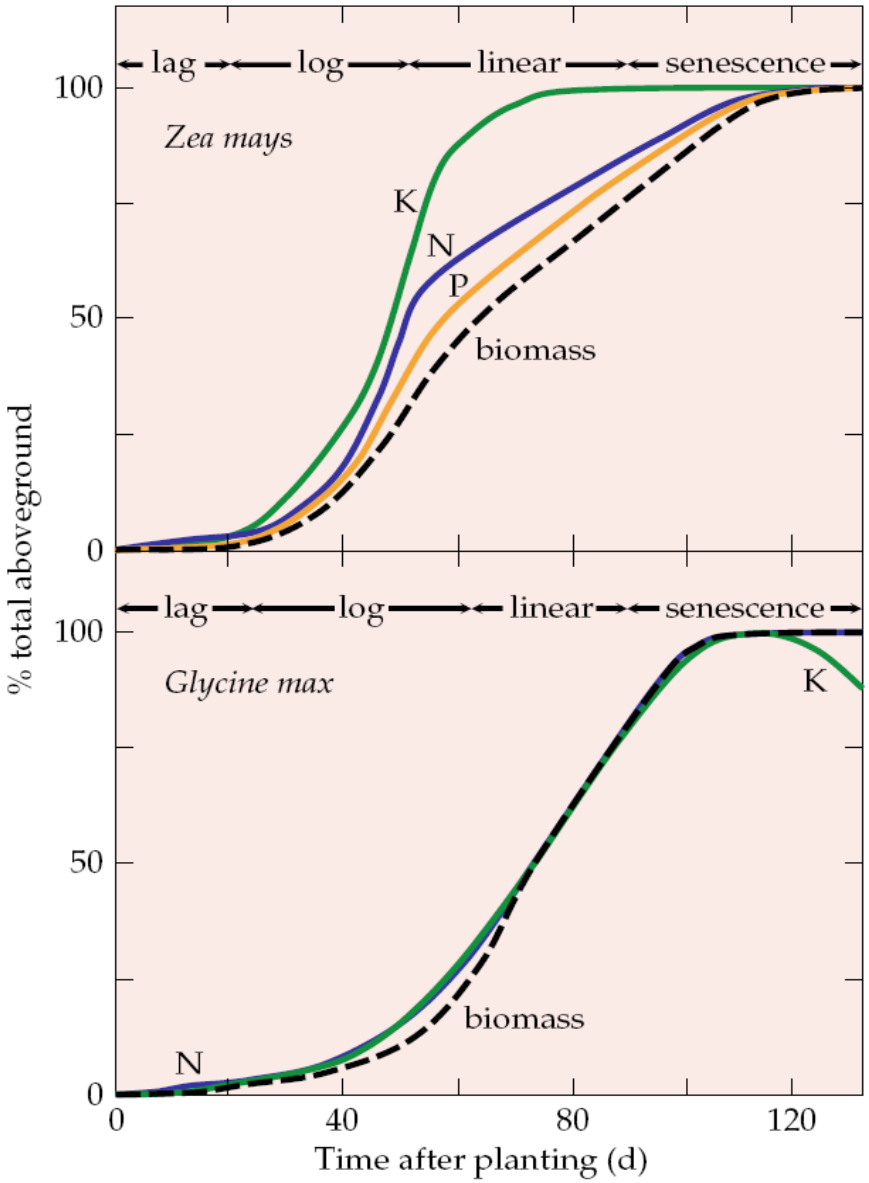
Effectively mandates greater efficiency of nitrogen use and improved management practices.

The Nitrogen Cycle: A balancing act.



Kathy Kelley-Anderson et al; ANR Pub # 216

NUE: Right Rate: Right Timing



Total Demand for N is Largely Driven by Exported Crop, Perennial Organs and Soil C (N) increment.

Timing is determined by crop growth patterns.

Minimizing losses.

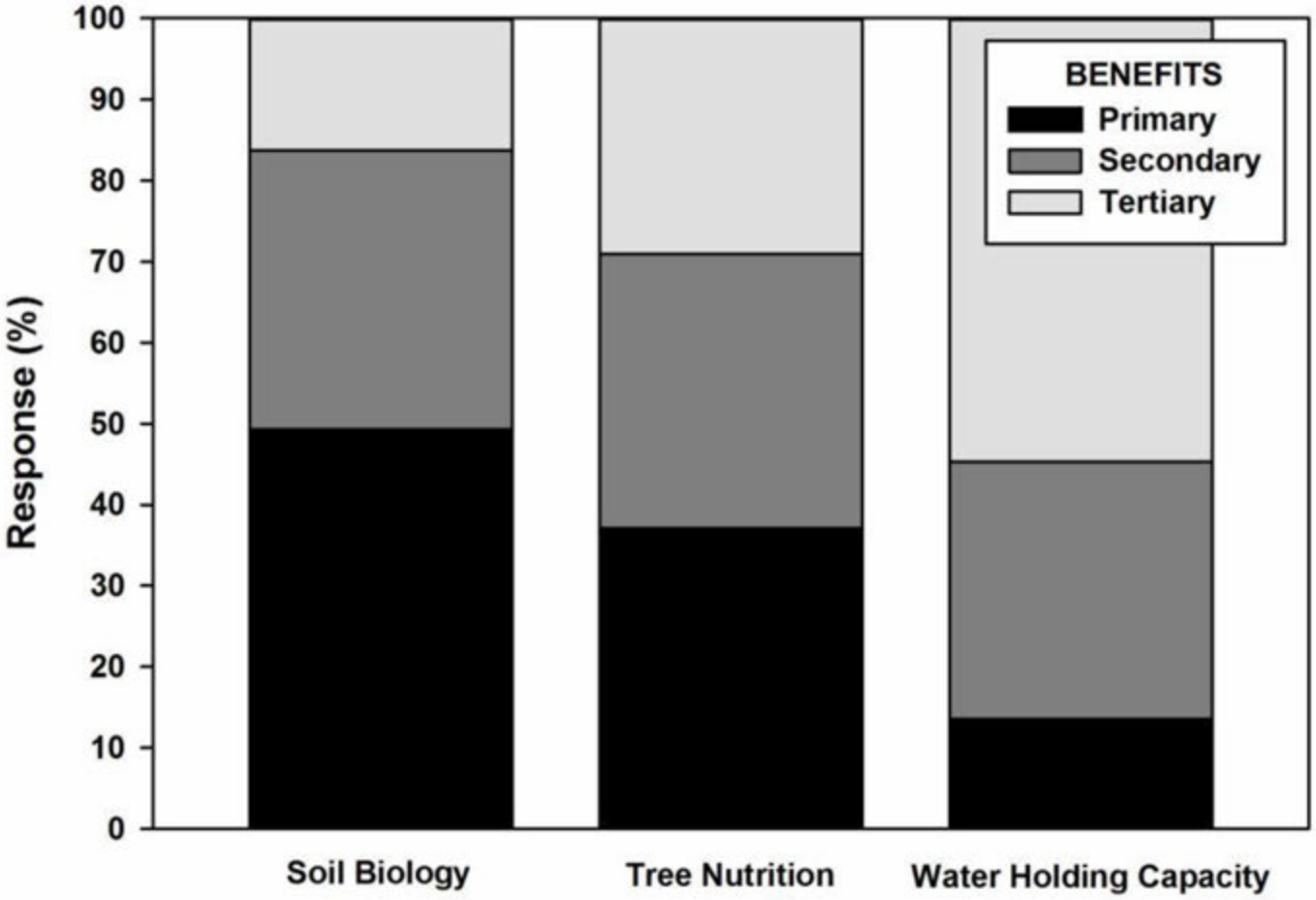
Fernandez et al., Foliar Fertilization, Scientific Principles and Field Practices, 2013

Potential for Organic Matter Amendments to Improve Nutrient Use Efficiency

1. OMA's as a source of nutrients
   - Predictable nutrient content and release characteristics
2. OMA's to improve 'Soil Health', enhance nutrient availability and reduce losses

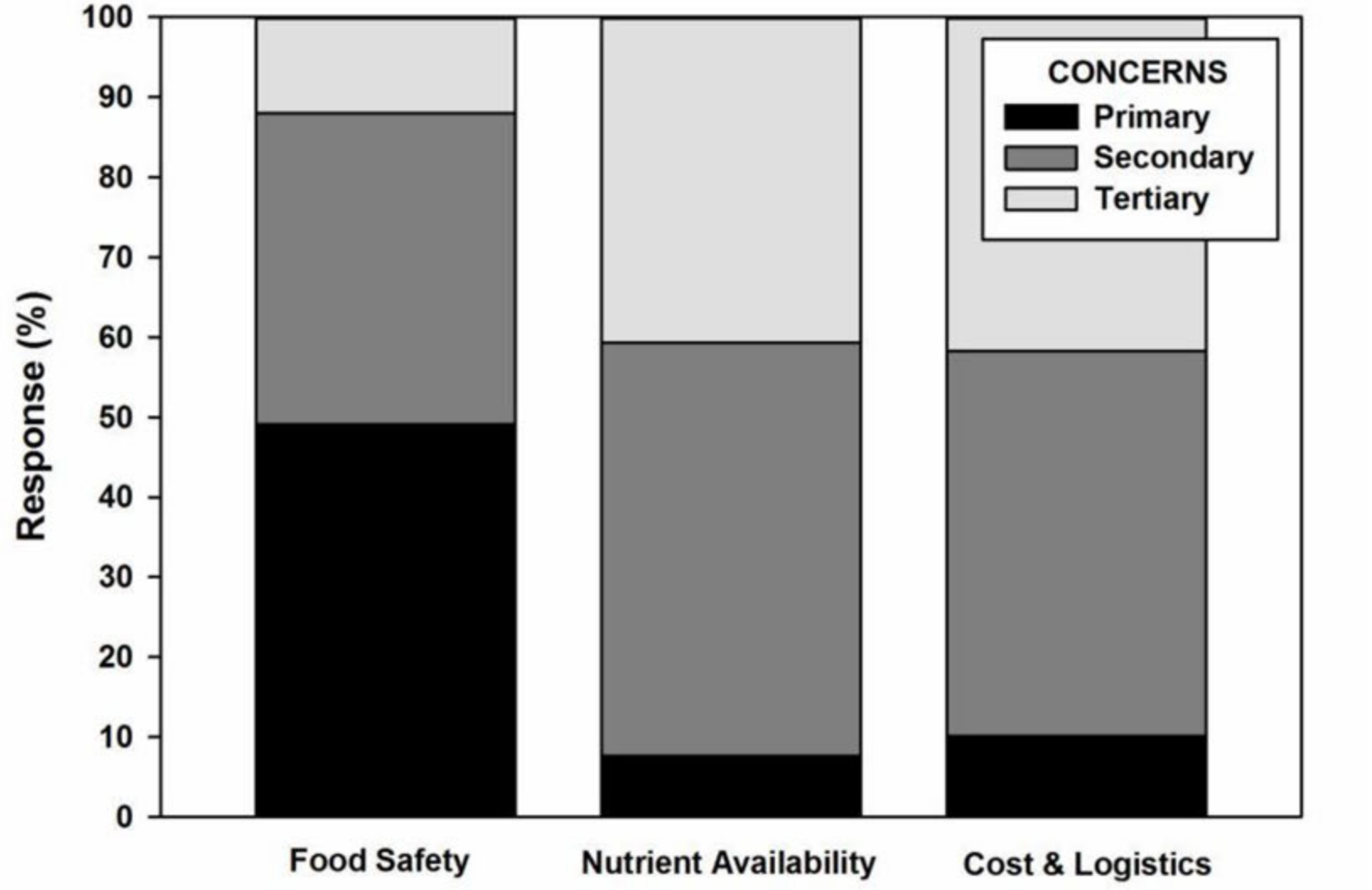
2015 Almond Grower Survey
(27% of Growers, 33% of acreage)

Q1: Grower perceived benefits of OMA



Grower Survey

Q1: Grower concerns with use of OMA



Do Organic Amendments Have a Benefit?

SAFS results across 12 years: (Clarke et al. 1999)

- Organic and 'low input' systems increased SOC, and microbial biomass
- Neither system improved tomato yields compared to conventional management

BIFS results across 14 site ⁝ Years (Andrews et. a. 2002) :

- Cover cropping and/or compost application increased tomato yield by 3%
- Yield increase did not cover additional costs

Manure compost application (up to 10 tons/acre) in a dozen processing tomato fields: (Miyao and Davis. 2014.)

- Yield responses observed in about half of the fields
- Response was primarily the result of nutrient supply, not biological effects

Tim Hartz

Take Home

- Significant potential source of nutrients (N, K, P, Micros)
- Significant grower ‘belief’ in the benefits of Organic Matter inputs

Consistency, Compatibility, Cost, Creativity

Policies, Incentives, Research, Education