



# Research to Support Irrigation and Nutrient Management Decisions in Processing Tomatoes



**Daniel Geisseler**

Nutrient Management Specialist, UC Davis

**Processing Tomato Meeting, Modesto**

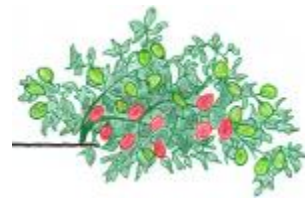
**January 25, 2017**



# Overview

---

- Develop a decision support tool for processing tomatoes based on CropManage
- N mineralization study
- California Fertilization Guidelines





# What is CropManage?

---

- Field-scale web application for managing irrigation and nitrogen
- Developed by UCCE for cool-season vegetables on the Central Coast
- Uses weather data from CIMIS stations
- Calculates crop water need (ET)
- Estimates crop N fertilizer need
- Test version for processing tomatoes is currently being developed by UC ANR





# Tasks

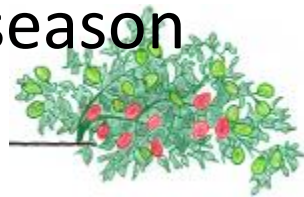
- Collect plant and soil data from commercial farms in the Central Valley
  - 2016:
    - 2 sites near Woodland
    - 3 sites near Stockton
    - 1 site near Huron
    - Variety trial with 15 varieties
  - 2017: Collect data from additional sites
- Develop CropManage
- Compare CropManage recommendation with growers' practices
  - Replicated trial at UC Davis
- Outreach, training





# Data collected

- Evapotranspiration (ET)
  - Canopy development
    - Infrared picture
    - Handheld NDVI analyzer (Greenseeker)
    - Aerial photographs
  - ET estimates from Tule stations
- N uptake
- N input
  - Residual soil nitrate
  - Nitrogen mineralized during growing season
  - Fertilizer

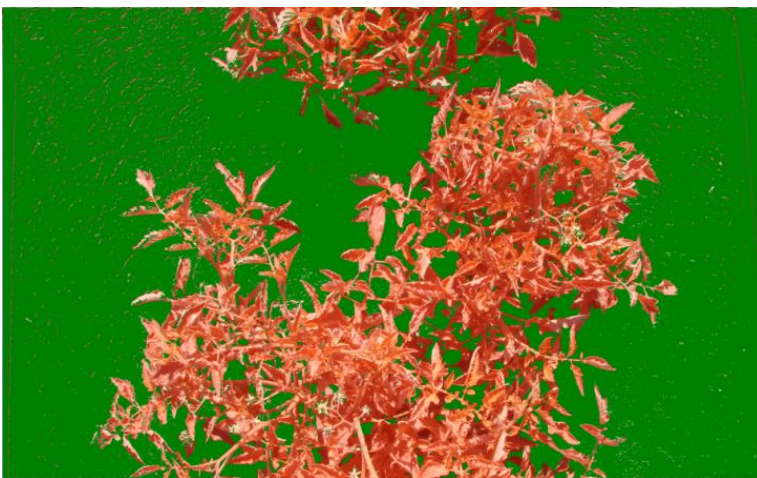




# Canopy development

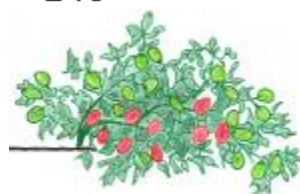
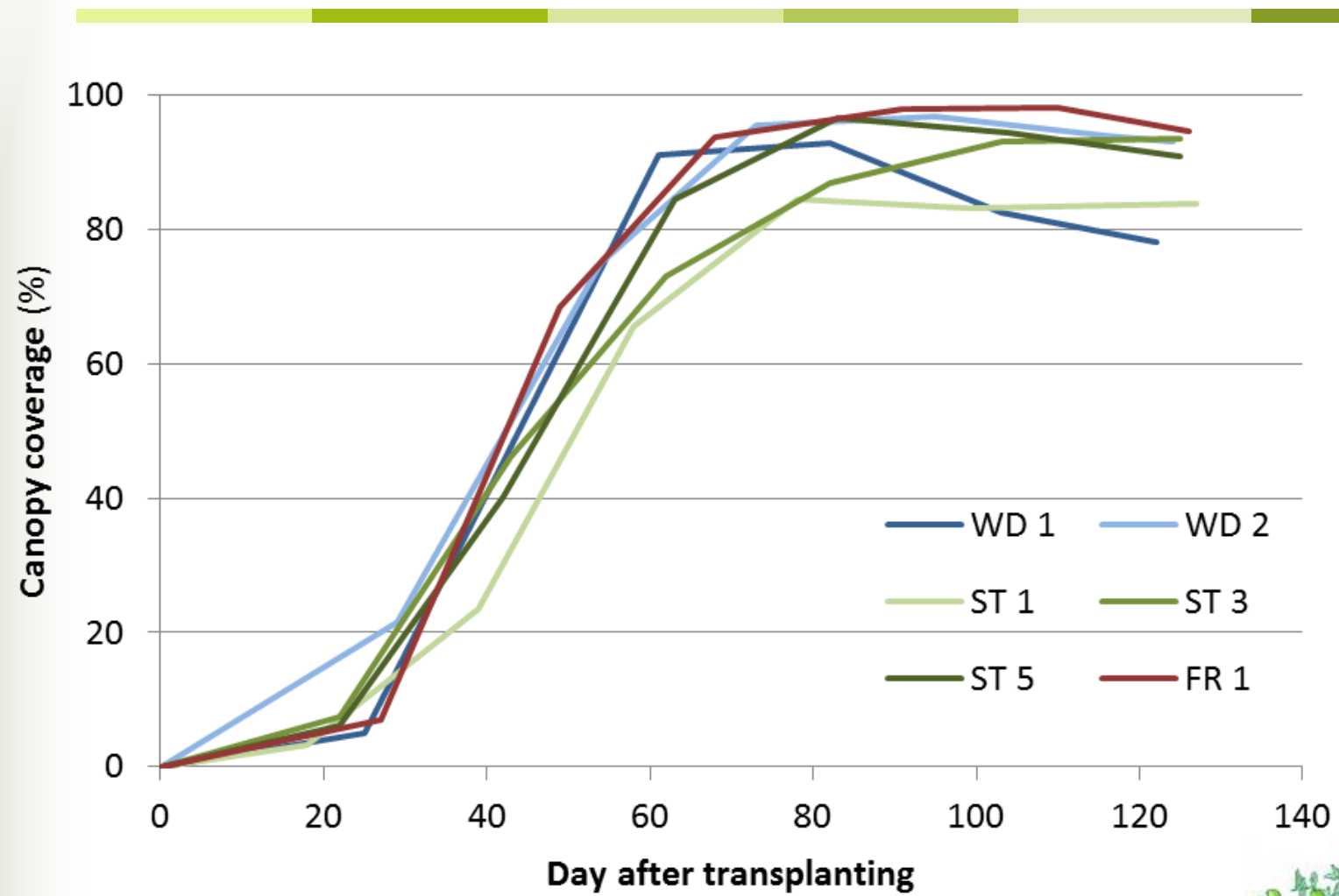


40% canopy coverage



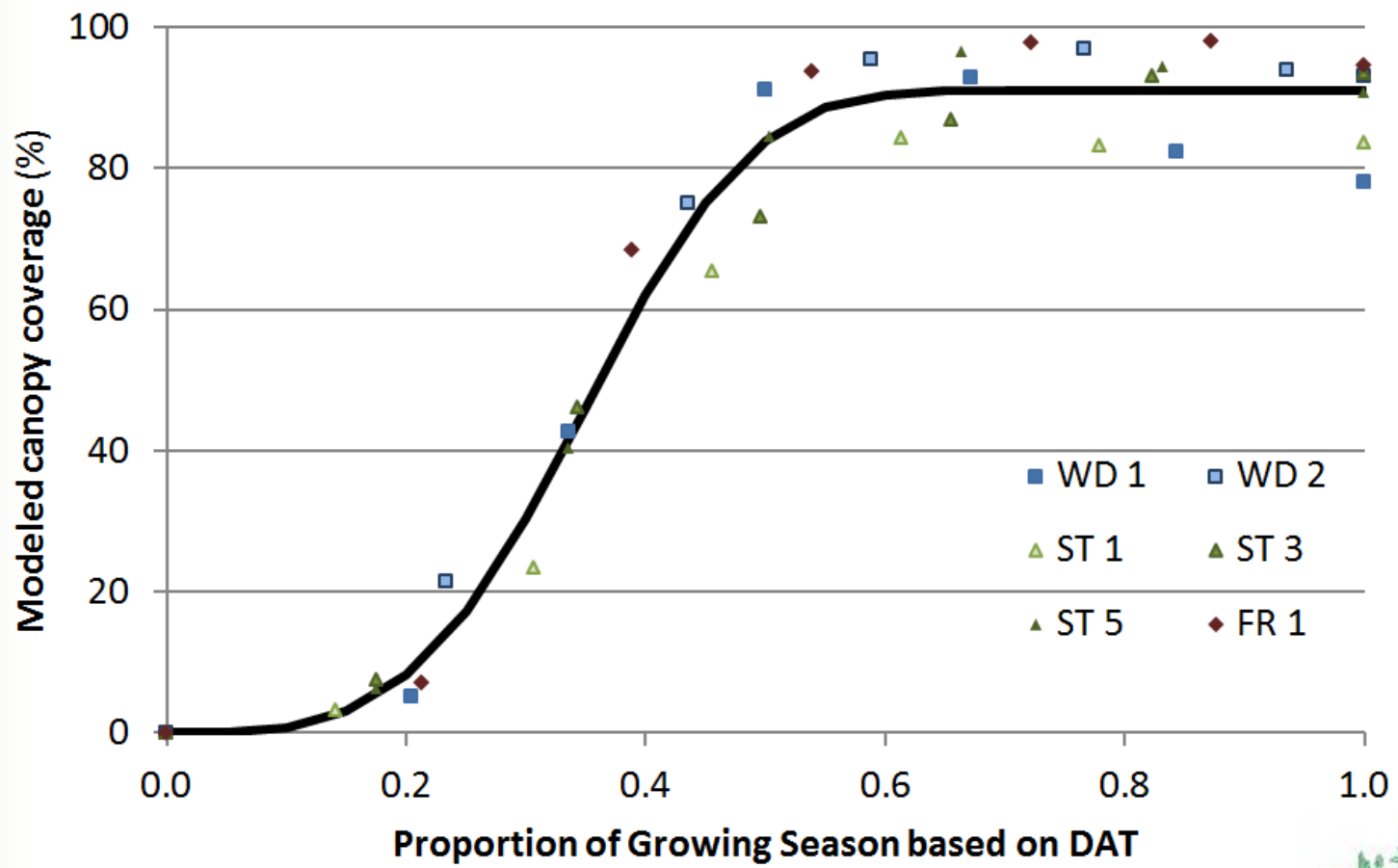


# Canopy coverage





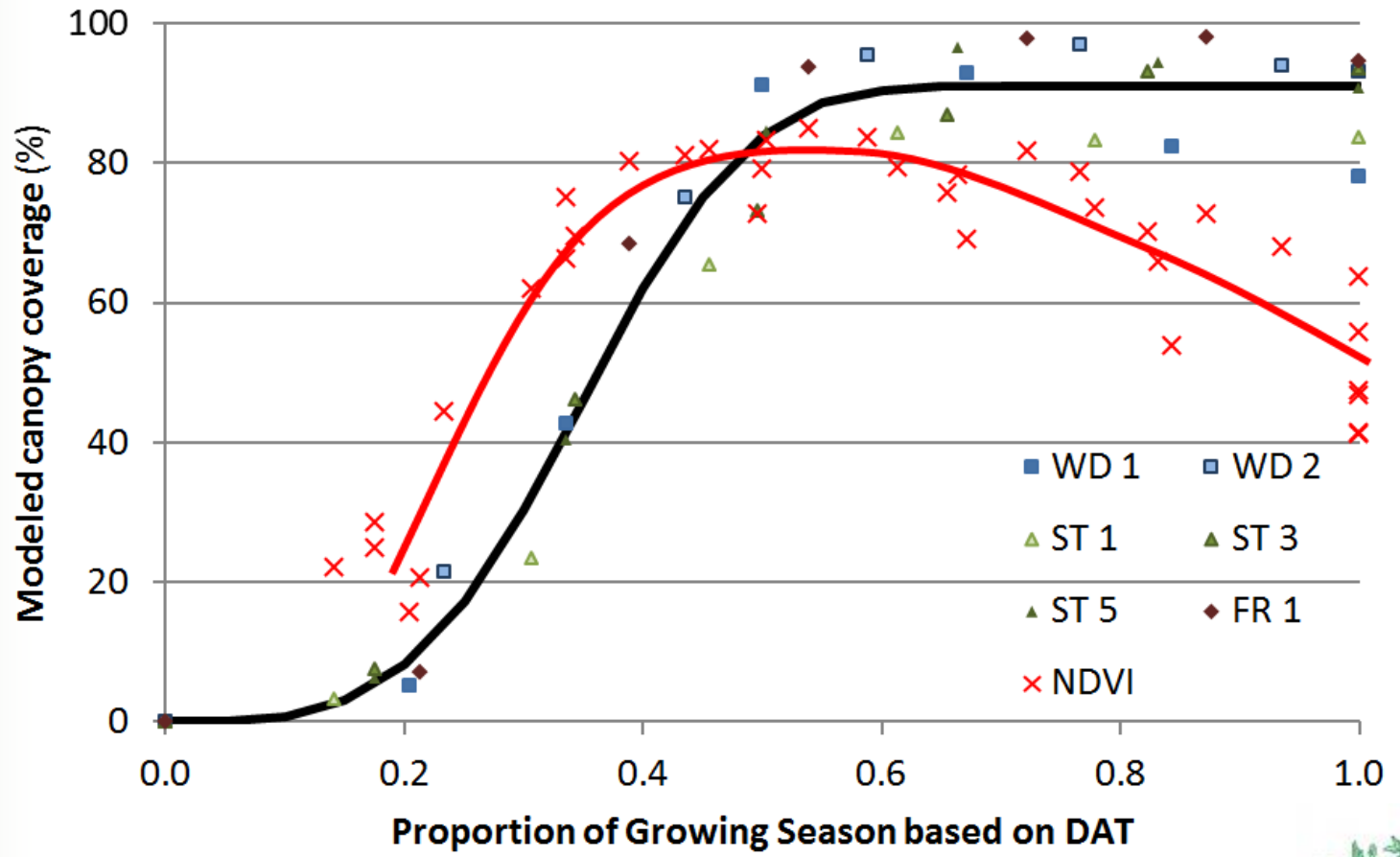
# Modeled canopy coverage







# Canopy coverage vs. NDVI



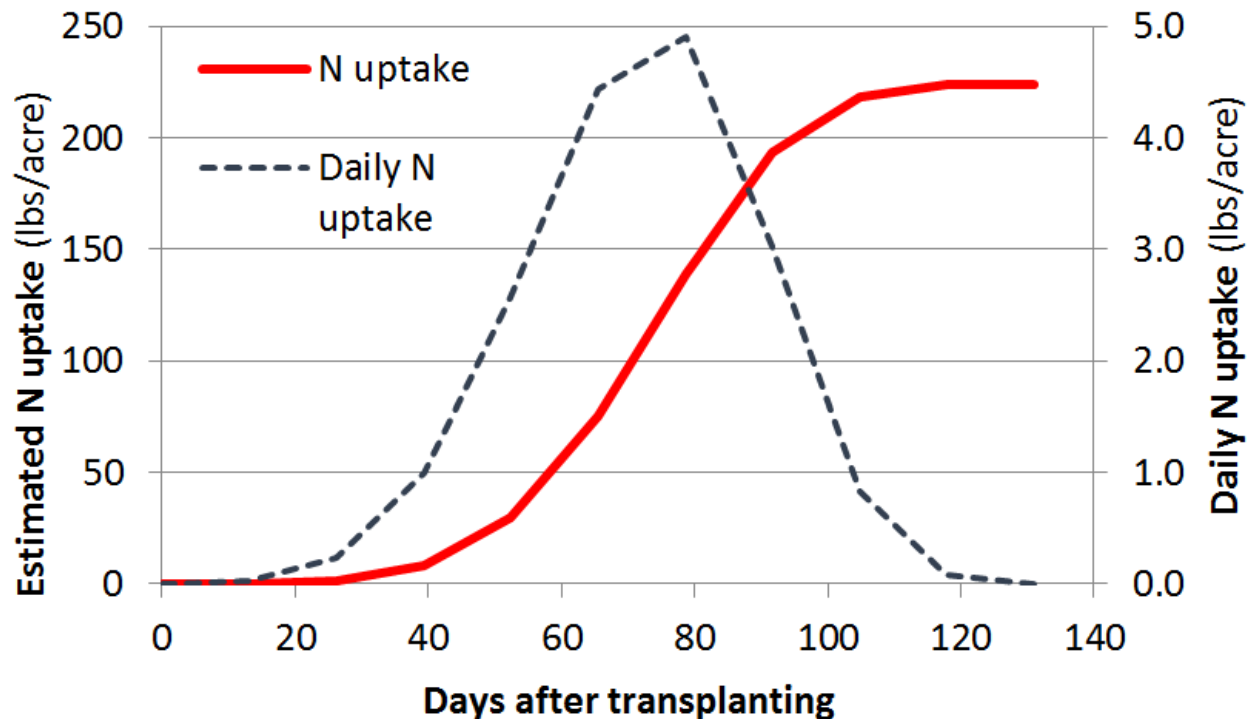


# Seasonal N uptake

⇒ N in tomatoes: 2.99 lbs/ton

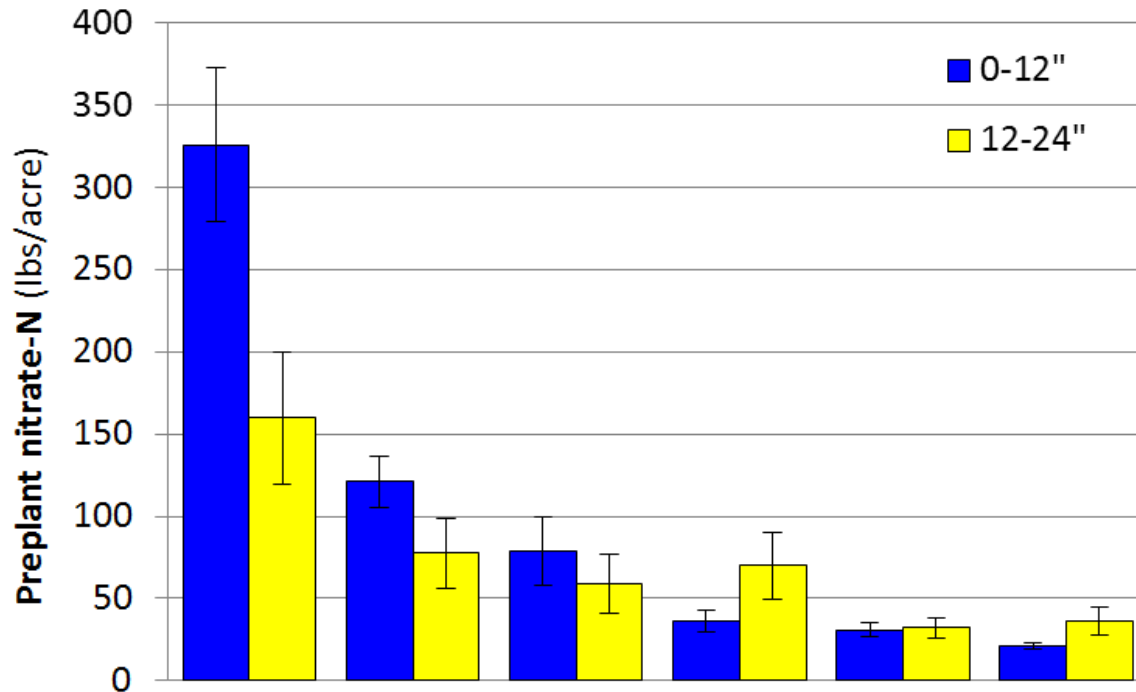
⇒ N in vines: 33% of total N

For a 50-ton total yield:





# Residual soil nitrate I

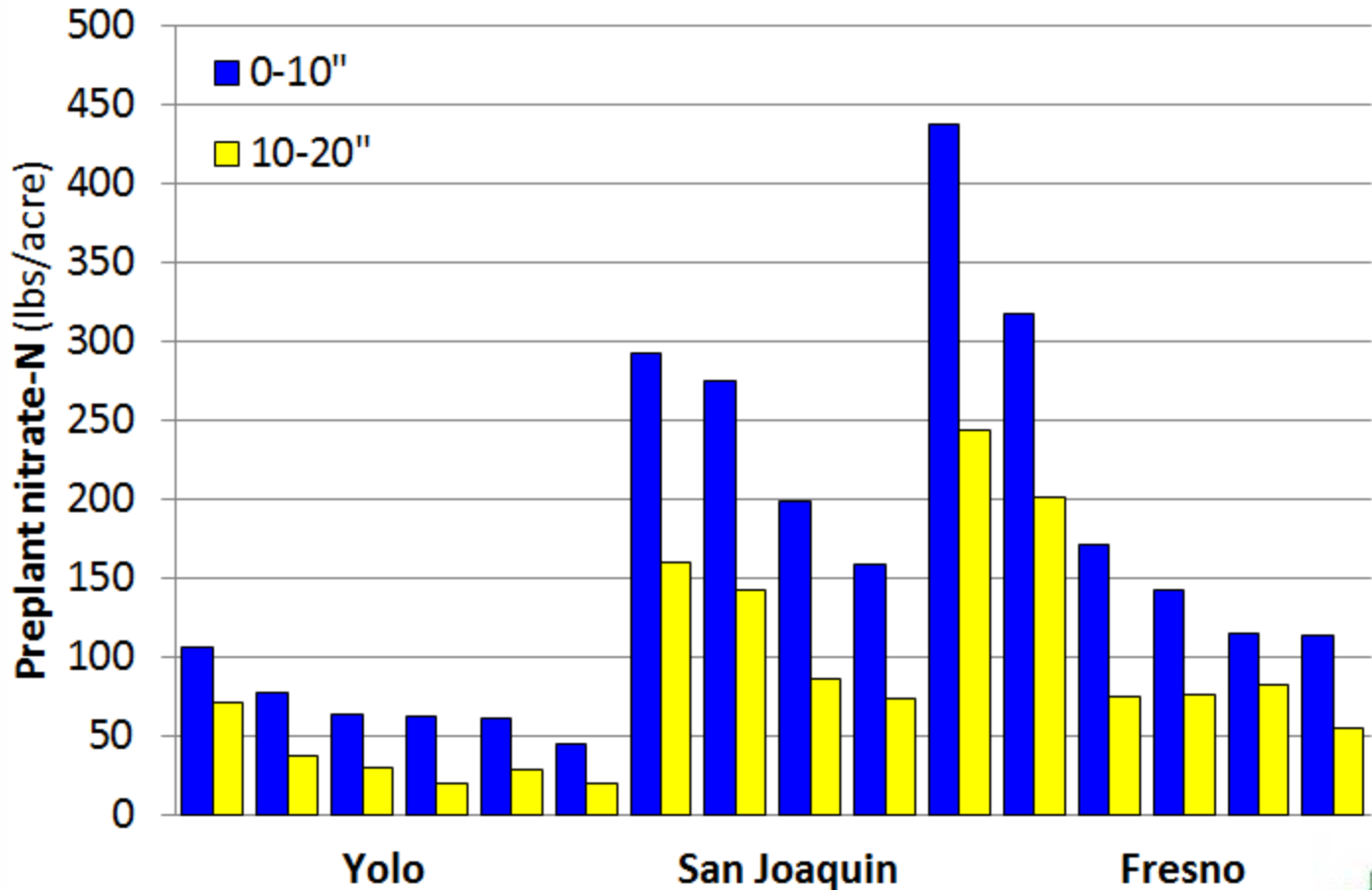


- Pre-plant nitrate-N highly variable
- Needs to be taken into account



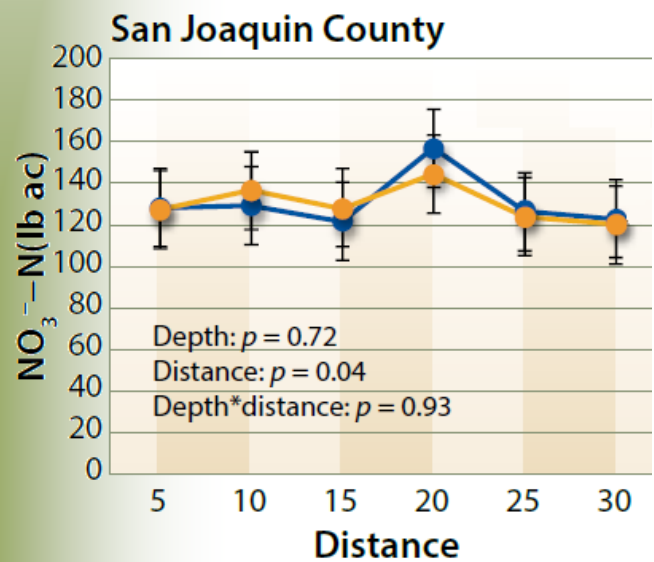
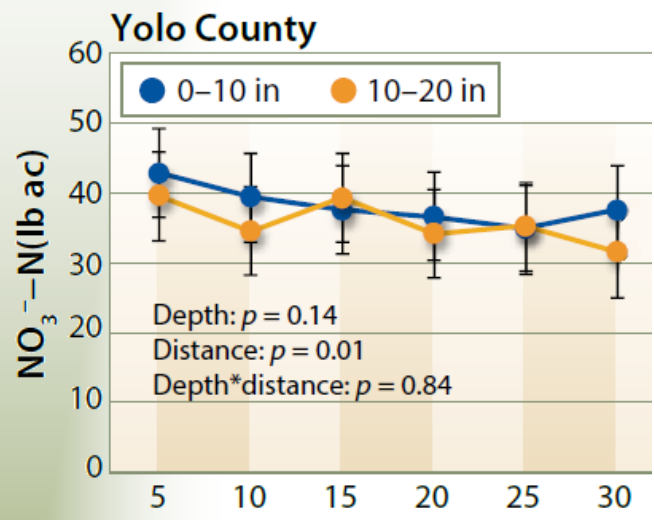


# Residual soil nitrate II





# Sampling in drip irrigated fields



## Recommendation:

- At each location in the field, take three cores at 5", 10", and 20" from center.
- Pool samples

## Our experience:

- 5" too close to tape
- 20" almost on the shoulder

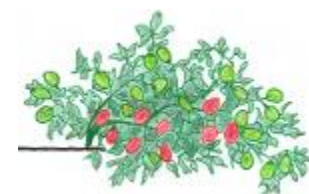
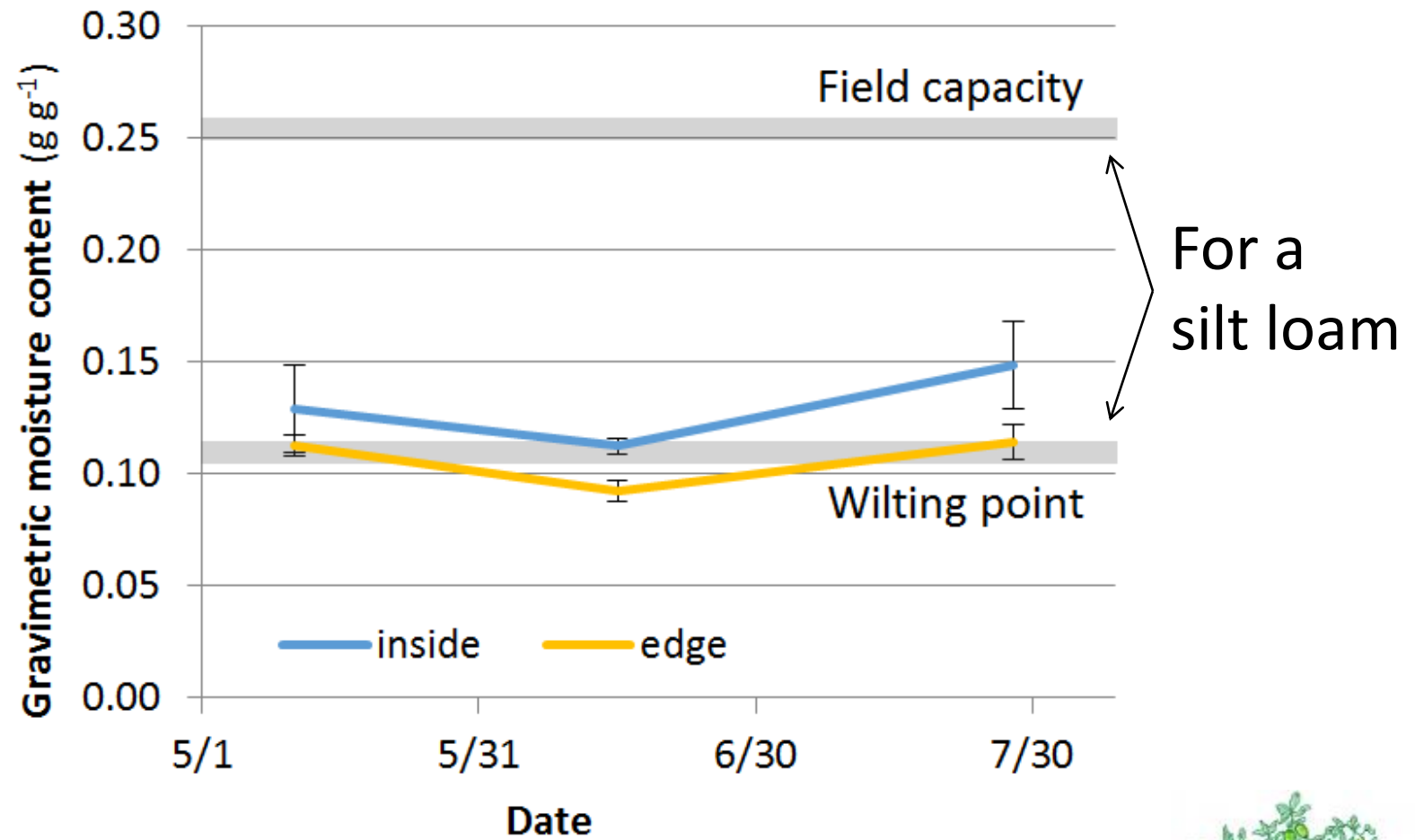
## Our approach:

- Take two cores at 7.5" and 15"



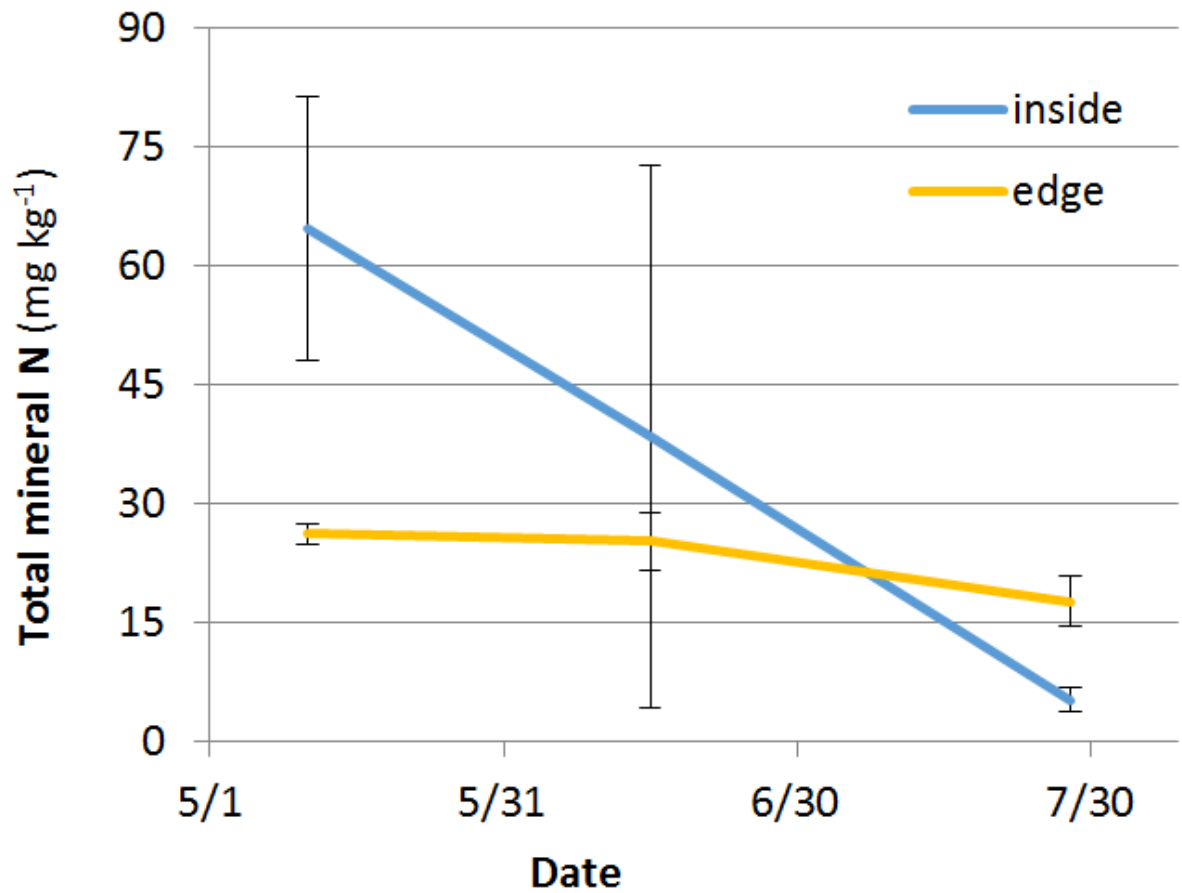


# Soil moisture in the top 6 inches of the profile



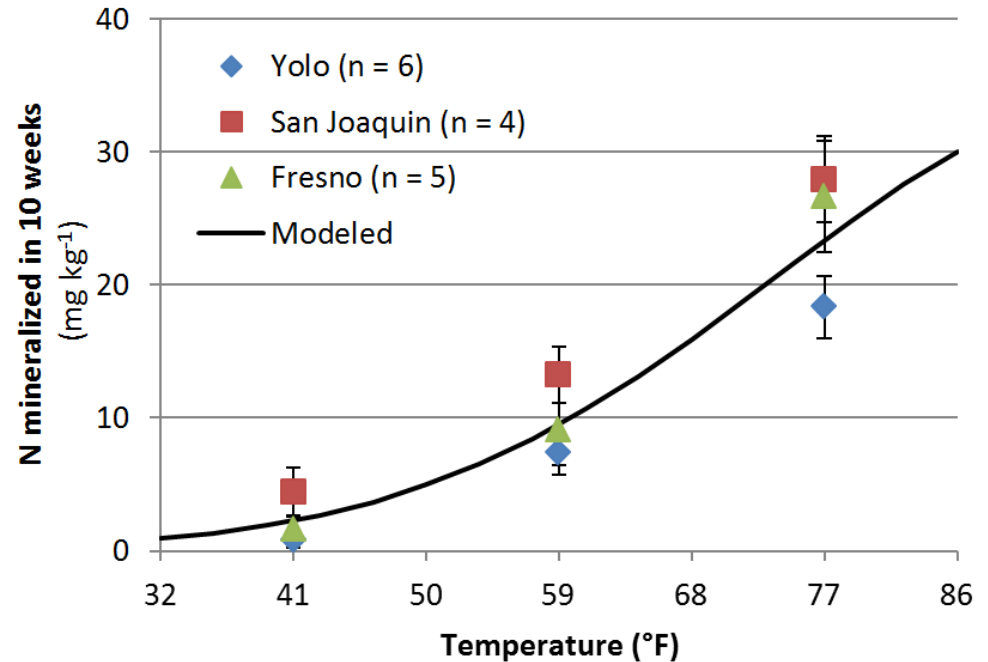
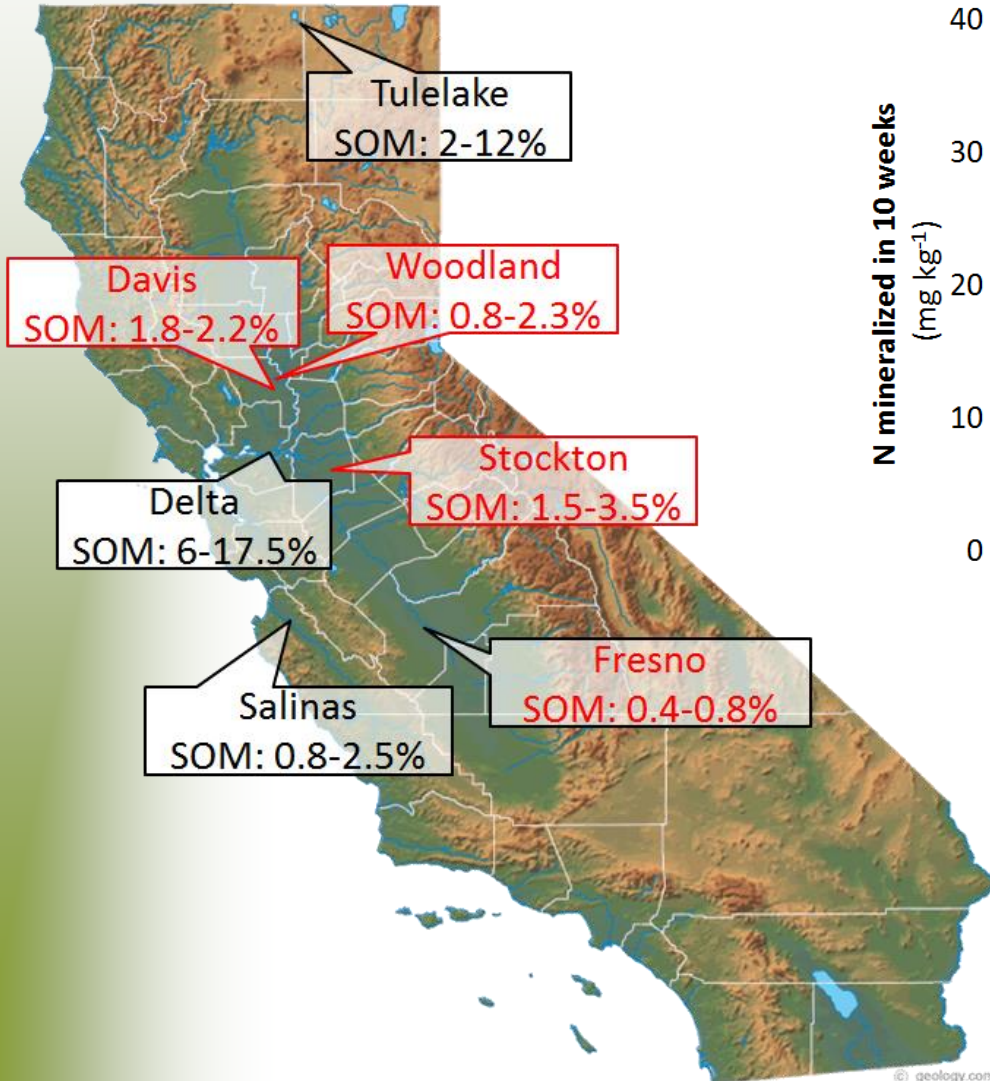


# Nitrate concentration in the top 6 inches of the profile





# Soil N mineralization rates

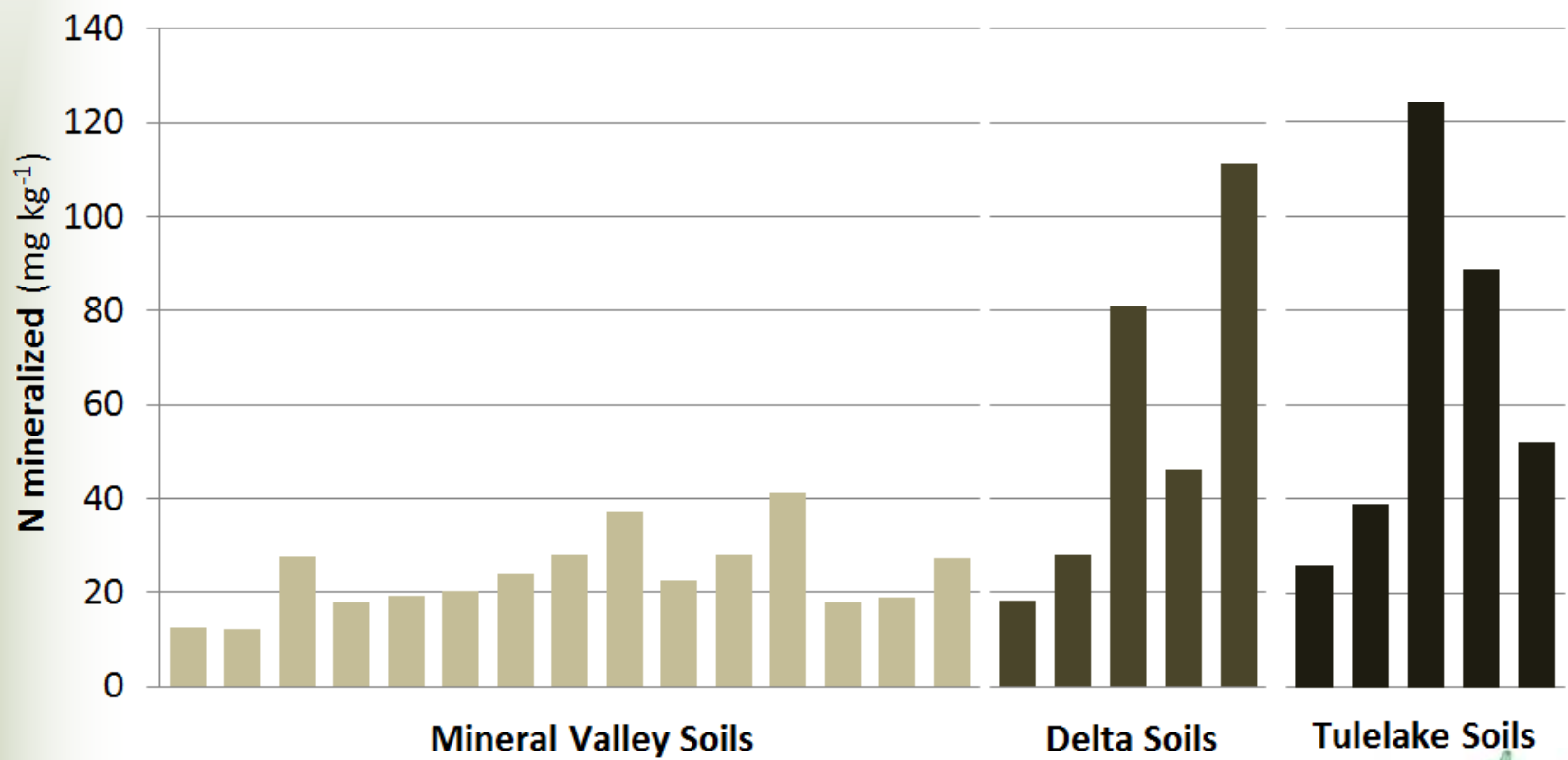






# N mineralization

10 weeks at 77 °F and optimal moisture content

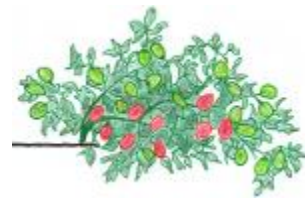
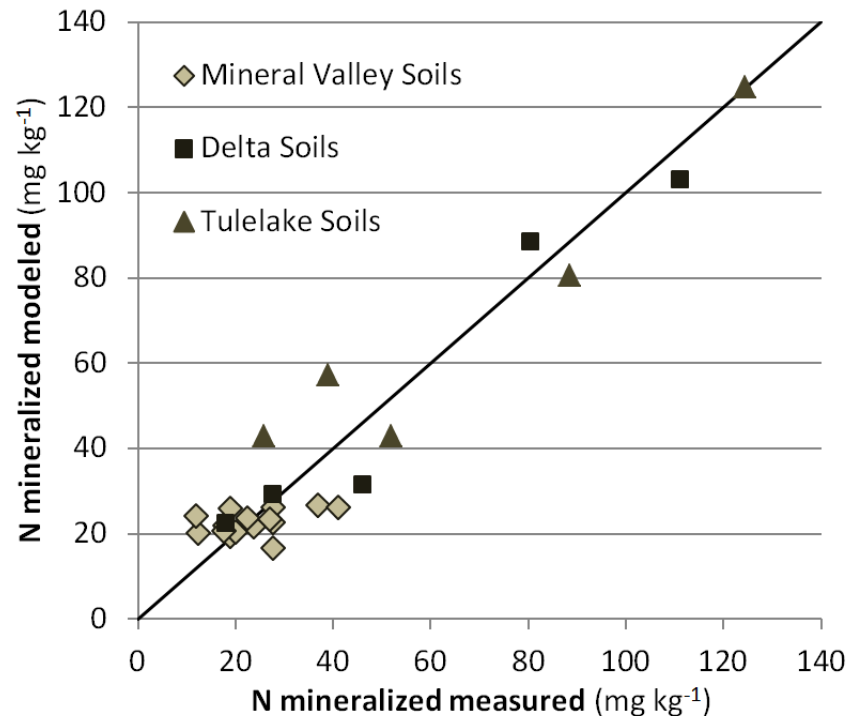




# Estimating N mineralization

Soil properties included in model:

- Total C and N
- Particulate organic C





# Fertilization guidelines

A collaboration between



## California Fertilization Guidelines

These guidelines are based on research results from studies carried out in California and elsewhere. For an optimal fertilization program, site-specific information needs to be taken into account. A discussion about site-specific adjustments can be found [here](#).

### Additional Information

#### Soil Sampling

Soil Test Sampling Instructions

Sampling for Soil Nitrate Determination

Soil Sampling in Orchards

#### Plant Tissue Sampling

Field Crops and Vegetables

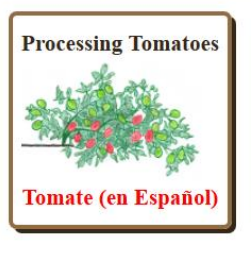
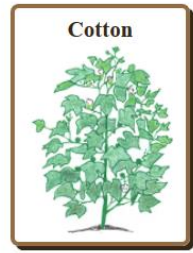
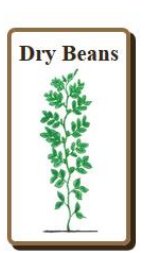
Orchards and Vineyards

#### Resources, Links

Nitrogen Partitioning and Seasonal Uptake Curves

A Discussion about Site-Specific Adjustments

### Field crops and vegetables





# Fertilization guidelines

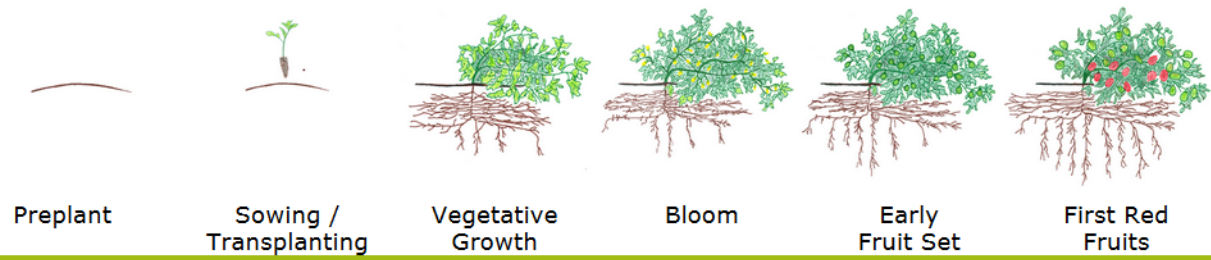
A collaboration between



- Guidelines Home
- Acknowledgments
- Additional Information:**
- Tomato Nitrogen Uptake and Partitioning
- Tomato Production in California
- Tomato Nitrogen Management Brochure
- FREP Database



## California Fertilization Guidelines Processing Tomatoes



**Nitrogen (N)**

Soil Test  Leaf Analysis

Preplant N  Starter N  Soil Applied N  Foliar N

**Phosphorus (P<sub>2</sub>O<sub>5</sub>)**

Soil Test

Preplant P  Starter P

**Potassium (K<sub>2</sub>O)**

Soil Test

Preplant K  Starter K

**Soil Applied N**

**Application Rate**

For drip-irrigated processing tomatoes, Hartz and Bottoms<sup>[N4]</sup> found that a seasonal rate of approximately 175 lbs N/acre is adequate to maximize fruit yields in most soils. Contact your local [farm advisor](#) for more information.

Krusekopf and coworkers<sup>[N10]</sup> carried out a study in the Central Valley in ten furrow irrigated fields. A response to N fertilization was observed in only four fields. In the responsive fields, no significant yield increase with sidedress N application rates above 100 lbs/acre

- Links:**
- UCCE Vegetable Research & Information Center
  - UC Vegetable Crops Nutrient Management
  - UC Integrated Pest Management online
  - California Tomato Research Institute
  - California Tomato Growers Association (CTGA)



# Fertilization guidelines

A collaboration between

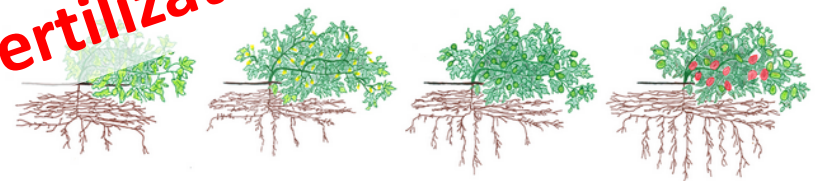


<https://apps1.cdfa.ca.gov/FertilizerResearch/docs/ProcessingTomatoes>  
or just google: California Fertilization Guidelines

- Guidelines Home
- Acknowledgments
- Additional Information:
  - Tomato Nitrogen Uptake and Partitioning
  - Tomato Production California
  - Tomato Nitrogen Management Brochure
  - FREP Database



## California Fertilization Guidelines Processing Tomatoes



	Preplant	Sowing / Transplanting	Vegetative Growth	Bloom	Early Fruit Set	First Red Fruits
<b>Nitrogen (N)</b>	Preplant N	Starter N	Soil Test	Soil Applied N	Foliar N	Leaf Analysis
<b>Phosphorus (P<sub>2</sub>O<sub>5</sub>)</b>	Preplant P	Starter P	Soil Test	Soil Applied P	Foliar P	Leaf Analysis
<b>Potassium (K<sub>2</sub>O)</b>	Preplant K	Starter K	Soil Test	Soil Applied K	Foliar K	Leaf Analysis

- Links:
  - UCCE Vegetable Research & Information Center
  - UC Vegetable Crops Nutrient Management
  - UC Integrated Pest Management online
  - California Tomato Research Institute
  - California Tomato Growers Association (CTGA)



# Acknowledgement

---

- CDFA Fertilizer Research and Education Program (FREP)
- California Tomato Research Institute
- UC ANR California Institute for Water Resources
- Growers
- Gene Miyao, Brenna Aegerter, Tom Turini, Michael Cahn, Amber Vinchesi, Tim Hartz
- Kelley Liang, Irfan Ainuddin, Patricia Lazicki, Ken Miller

