Research to Support Irrigation and Nutrient Management Decisions in Processing Tomatoes

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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

Day after transplanting

Canopy coverage (%)

WD 1  WD 2
ST 1  ST 3
ST 5  FR 1
Modeled canopy coverage

![Graph showing modeled canopy coverage against the proportion of the growing season based on DAT. The graph includes data points for WD 1, WD 2, ST 1, ST 3, ST 5, and FR 1.]
Canopy coverage vs. NDVI

The graph shows the modeled canopy coverage (%) against the proportion of the growing season based on DAT. Different symbols represent different data points or conditions, such as WD1, WD2, ST1, ST3, ST5, and FR1, with NDVI marked as crosses.

The black curve represents a smooth trend, while the red curve shows a different trend. The data points are distributed across the graph, indicating variations in canopy coverage and growing season proportions.
Seasonal N uptake

- N in tomatoes: 2.99 lbs/ton
- N in vines: 33% of total N

For a 50-ton total yield:
• Pre-plant nitrate-N highly variable
• Needs to be taken into account
Residual soil nitrate II

Lazcano et al., 2015
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”

Lazcano et al., 2015
Soil moisture in the top 6 inches of the profile for a silt loam.
Nitrate concentration in the top 6 inches of the profile
Soil N mineralization rates

- **Tulelake**: SOM: 2-12%
- **Davis**: SOM: 1.8-2.2%
- **Woodland**: SOM: 0.8-2.3%
- **Delta**: SOM: 6-17.5%
- **Stockton**: SOM: 1.5-3.5%
- **Salinas**: SOM: 0.8-2.5%
- **Fresno**: SOM: 0.4-0.8%

Graph showing N mineralized in 10 weeks vs. Temperature (°F):
- **Yolo (n = 6)**
- **San Joaquin (n = 4)**
- **Fresno (n = 5)**
- Modeled line

N mineralized in 10 weeks (mg kg⁻¹)

Temperature (°F): 32-86
N mineralization

10 weeks at 77 °F and optimal moisture content

- Mineral Valley Soils
- Delta Soils
- Tulelake Soils
Estimating N mineralization

Soil properties included in model:

• Total C and N
• Particulate organic C
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.

Field crops and vegetables

- Alfalfa
- Barley
- Dry Beans
- Broccoli
- Carrot
- Cauliflower
- Celery
- Corn
- Cotton
- Lettuce
- Onion
- Potato
- Rice
- Strawberries
- Tomato (en Español)
- Processing Tomatoes
- Fresa (en Español)
California Fertilization Guidelines

Processing Tomatoes

**Nitrogen (N)**
- Preplant N
- Starter N

**Phosphorus (P\textsubscript{2}O\textsubscript{5})**
- Preplant P
- Starter P

**Potassium (K\textsubscript{2}O)**
- Preplant K
- Starter K

**Soil Applied N**

**Application Rate**

For drip-irrigated processing tomatoes, Hartz and Bottoms\textsuperscript{[N4]} 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.

Kruselkopf and coworkers\textsuperscript{[N10]} 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.
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