



Dynamics of plant-available N in the soil profile of drip- irrigated processing tomatoes

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**Sacramento Valley Processing Tomato
Production Meeting**

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Content

- N sources and uptake during the growing season



- N turnover in soil after incorporation of residues





Acknowledgement

- UC Agricultural and Natural Resources (UC ANR)
- CDFA Fertilizer Research and Education Program (CDFA-FREP)
- California Tomato Research Institute
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- Growers
- Suzette Turner, Kelley Liang, Irfan Ainuddin, Ken Miller





Sources of crop-available N

- Fertilizer N
- Residual soil nitrate present in spring
- N mineralized from soil organic matter during the season
- N in the irrigation water
- Organic amendments
- Cover crops





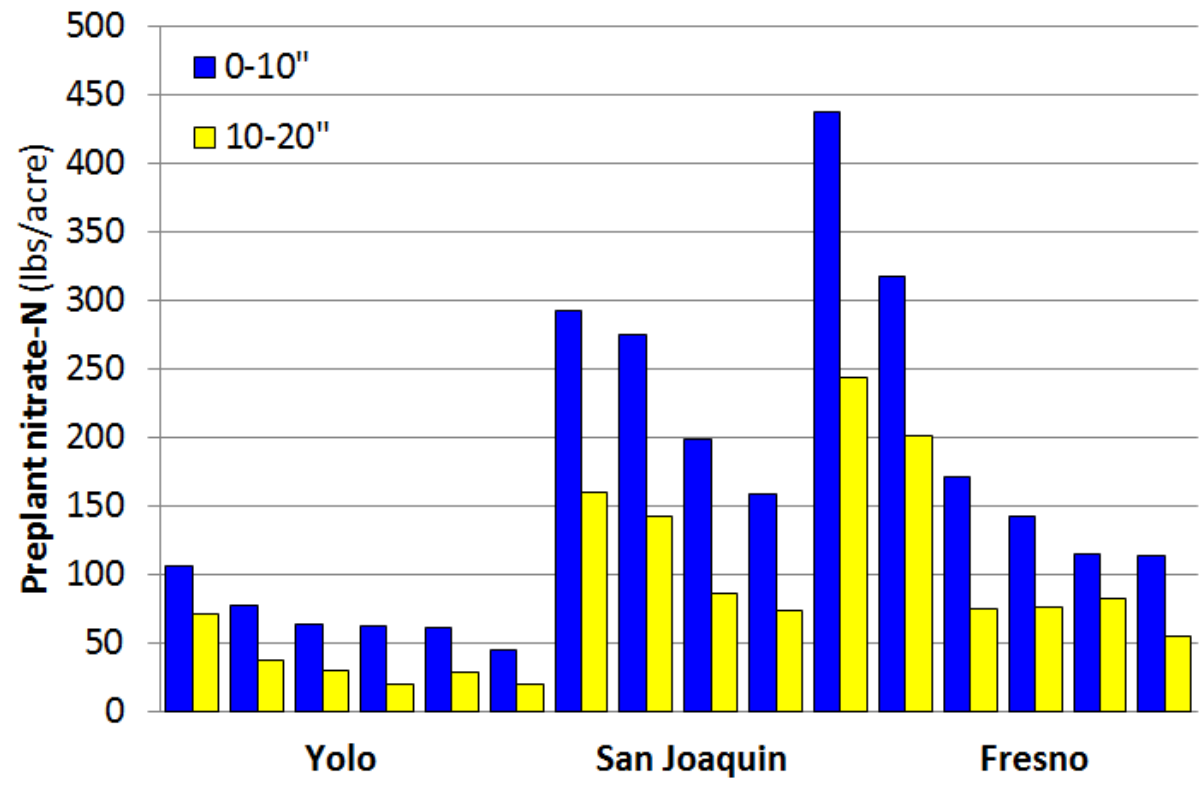
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Residual soil nitrate





Sources of crop-available N

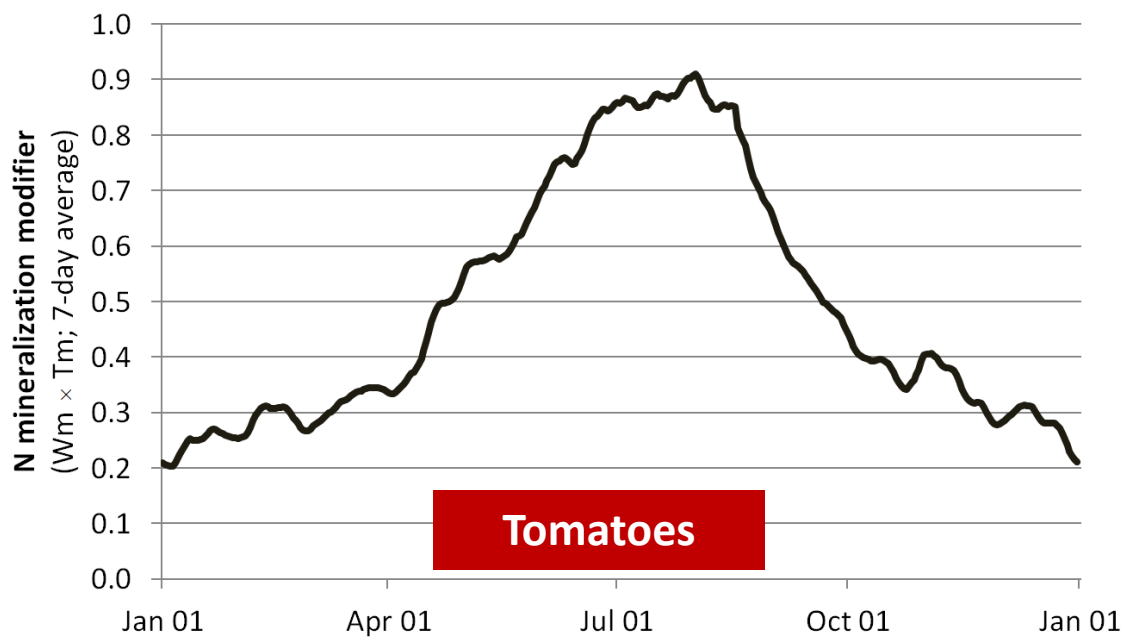
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N mineralization throughout the year

Approximately 30-50 lb/ac is mineralized during a 4-month growing season





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- **N in the irrigation water**
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Sources of crop-available N

- Fertilizer N
 - Residual soil nitrate present in spring
 - N mineralized from soil organic matter during the season
 - N in the irrigation water
 - **Organic amendments**
 - **Cover crops**
- Not included in today's presentation





Processing tomato N calculator: Input



Geisseler Lab



Nutrient Management

Nitrogen calculator for processing tomatoes

Field-Specific Input

Planting date:

Expected harvest date:

Expected Yield: tons/acre

Residual nitrate in 1st foot: ppm Nitrate-N

Residual nitrate in 2nd foot: ppm Nitrate-N

Nitrate in irrigation water: ppm Nitrate-N

Estimated total irrigation: acre-inches

Starter/preplant fertilizer: lbs N/acre

http://geisseler.ucdavis.edu/Tomato_N_Calculator.html





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Geisseler Lab



Nutrient Management

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Display Results/Changes

Planting date:

Expected harvest date:

Expected Yield:

Residual nitrate in 1st foot:

Residual nitrate in 2nd foot:

Nitrate in irrigation water:

Estimated total irrigation:

Starter/preplant fertilizer:

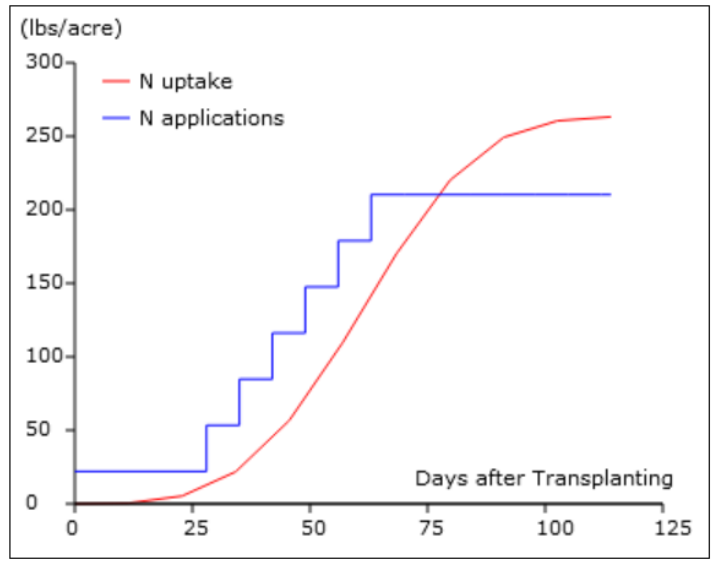
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Processing tomato N calculator: Output

Nitrogen Uptake and Applications



The graph and the calculations are based on N uptake data from commercial fields in the Central Valley. Weather conditions, management and variety selection all can affect N uptake and availability. It is therefore **important to monitor the N status of the field during the season with soil or leaf analyses**. More information about soil and leaf sampling can be found [here](#).

Nitrogen Budget

Estimated N uptake:	<input type="text" value="261 lbs/acre"/>
In-season N mineralization:	<input type="text" value="39 lbs/acre"/>
Available residual nitrate:	<input type="text" value="95 lbs/acre"/>
Nitrate in irrigation water:	<input type="text" value="0 lbs/acre"/>
Starter N applied:	<input type="text" value="22 lbs/acre"/>
Assumed fertilizer N use efficiency:	<input type="text" value="80%"/>
In-season fertigation N needed:	<input type="text" value="131 lbs/acre"/>

Suggested In-Season Fertigations

First fertigation:	<input type="text" value="after 4 weeks"/>
Number of weekly fertigations:	<input type="text" value="6 times"/>
Last fertigation:	<input type="text" value="after 9 weeks"/>
Amount of N applied each time:	<input type="text" value="22 lbs/acre"/>



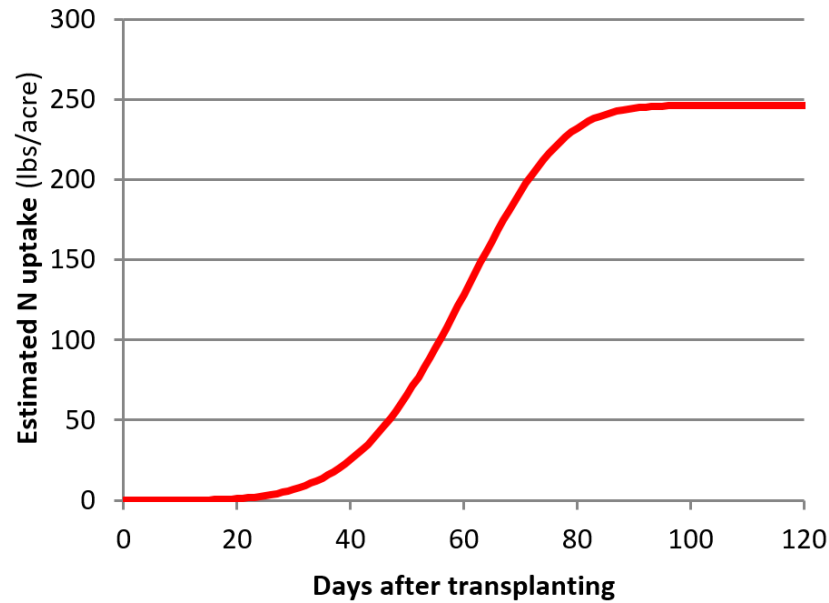


Expected N uptake

⇒ N in tomatoes: 3 lbs/ton

⇒ N in vines: 33% of total N

For a 55-ton total yield:





Field trial at UC Davis 2017/18

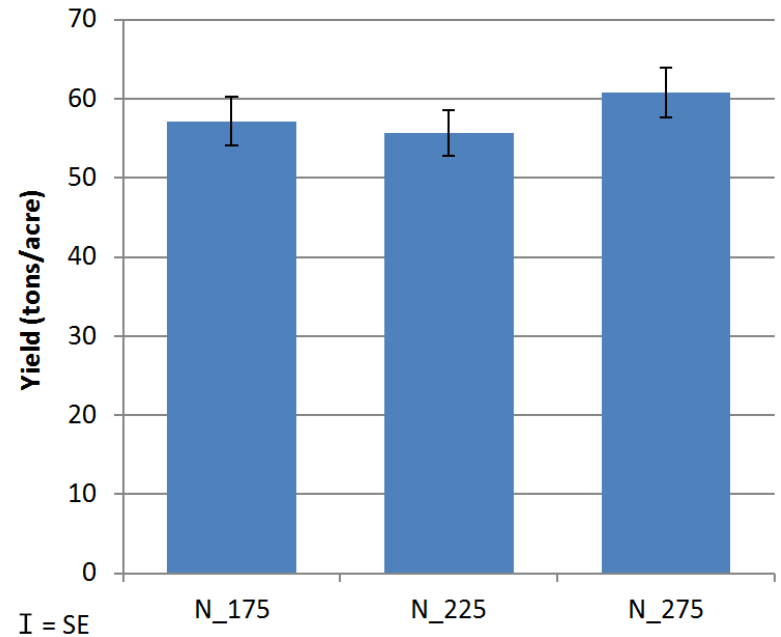
- 3 nitrogen treatments:
 - N_175: Optimal N minus 50 lbs N/acre
 - N_225: Optimal N
 - N_275: Optimal N plus 50 lbs N/acre
- Irrigation in all treatments was 100% ET
- 5 replicates
- Plot size: 3 beds x 200 feet





Marketable yield

- Average marketable yield: 58 tons/acre
- No statistically significant differences among treatments





Measured N uptake

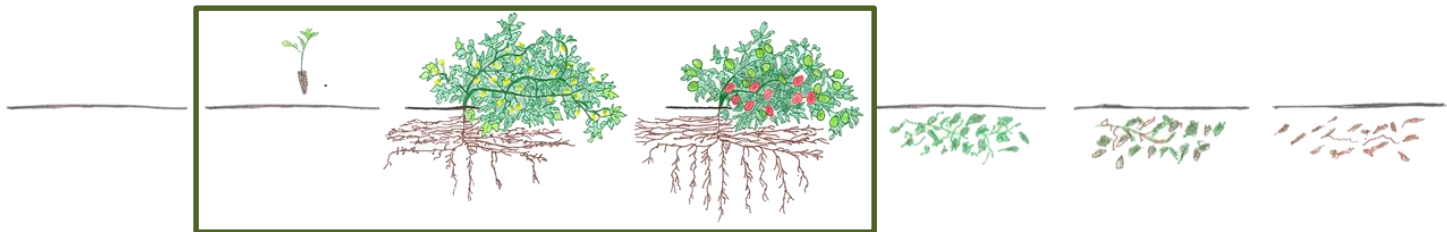
Treatment	N in fruits		% of total	N in vines		Total N (lbs/acre)
	(lbs/ton)	(lbs/acre)		(lbs/acre)	(lbs/acre)	
N_175	2.59	148	39%	94	242	
N_225	2.99	166	38%	102	269	
N_275	3.07	187	42%	133	319	





Measured N uptake

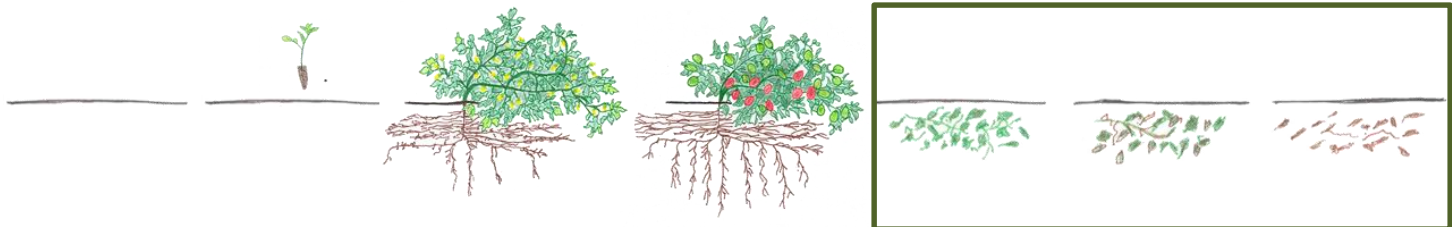
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Factors affecting decomposition and N mineralization

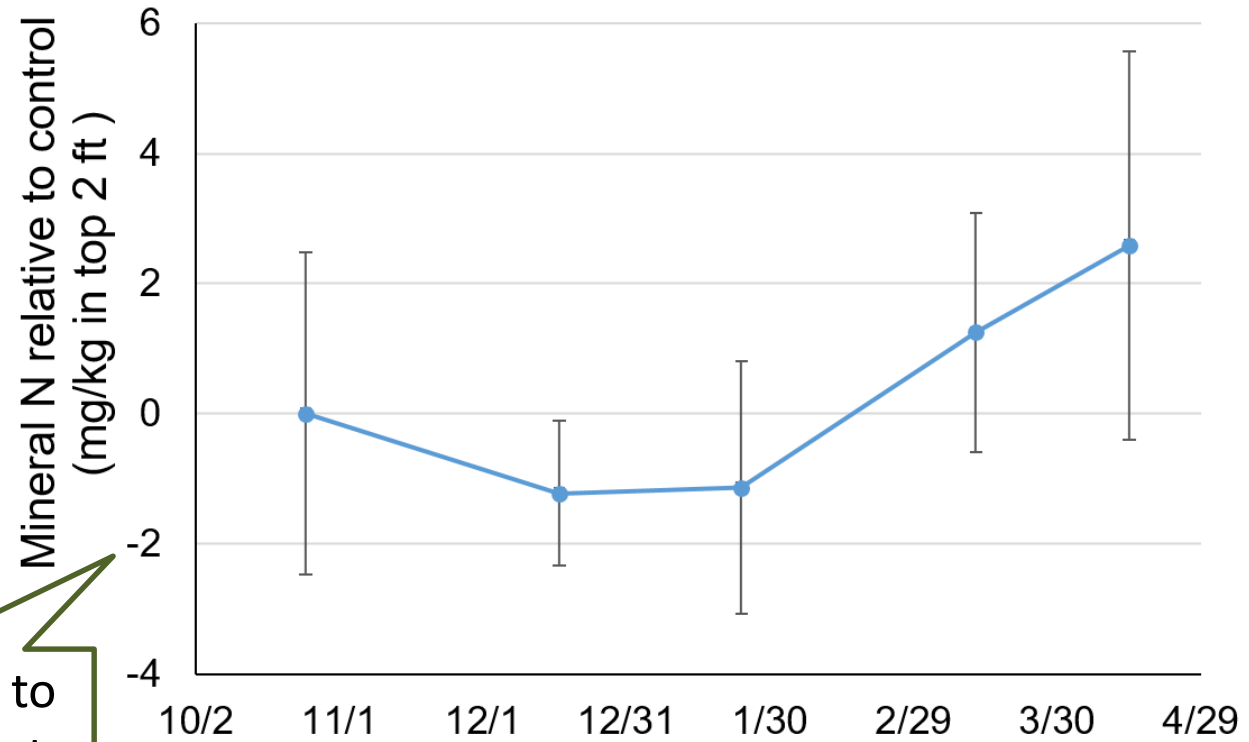
- Soil temperature
- Soil moisture
- Residue nitrogen content; C to N ratio
- Residue management
- Residue moisture



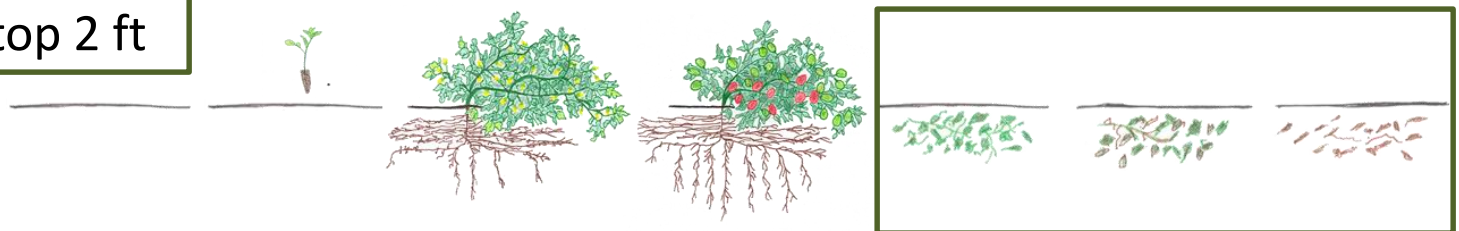


Change in soil nitrate during the winter

Results from a field trial:



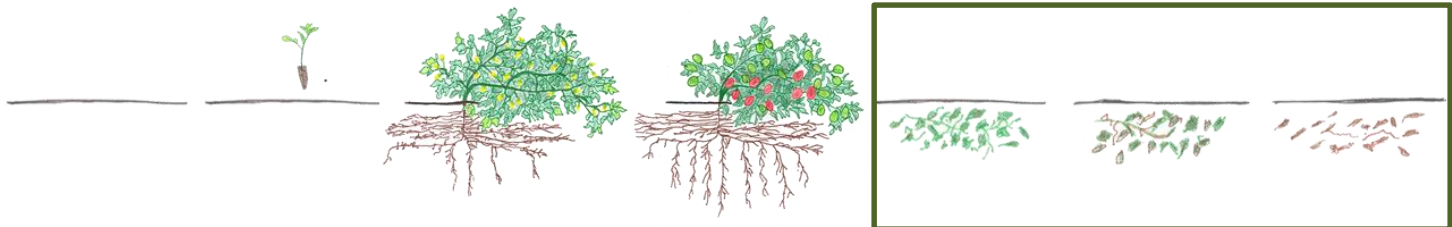
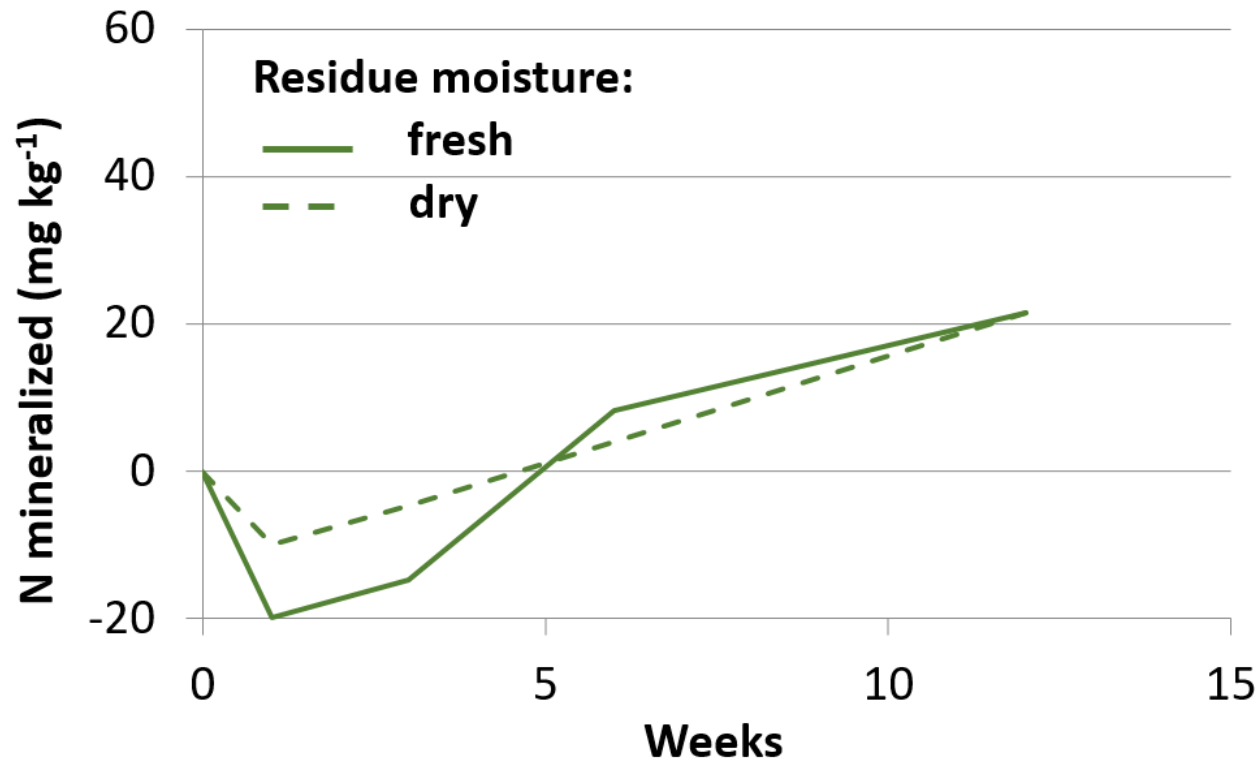
Multiply by 8 to convert mg/kg to lb/ac in top 2 ft





Nitrogen mineralization

Results from a lab incubation:





Conclusions

- Non-fertilizer N can be considerable contribution to plant available-N
- Plants adjust N uptake to N availability
 - ⇒ Not all of the “excess” N is at risk of being leached
- One third of N in aboveground biomass left in the field as residues
- Little N is mineralized from tomato residue during winter

