Managing fertility in drip-irrigated processing tomatoes

How are drip-irrigated tomatoes different ?

✓ Higher yield expectations = higher nutrient removal

each ton of fruit contains about:

3 lb N

1 lb P_2O_5 equivalent

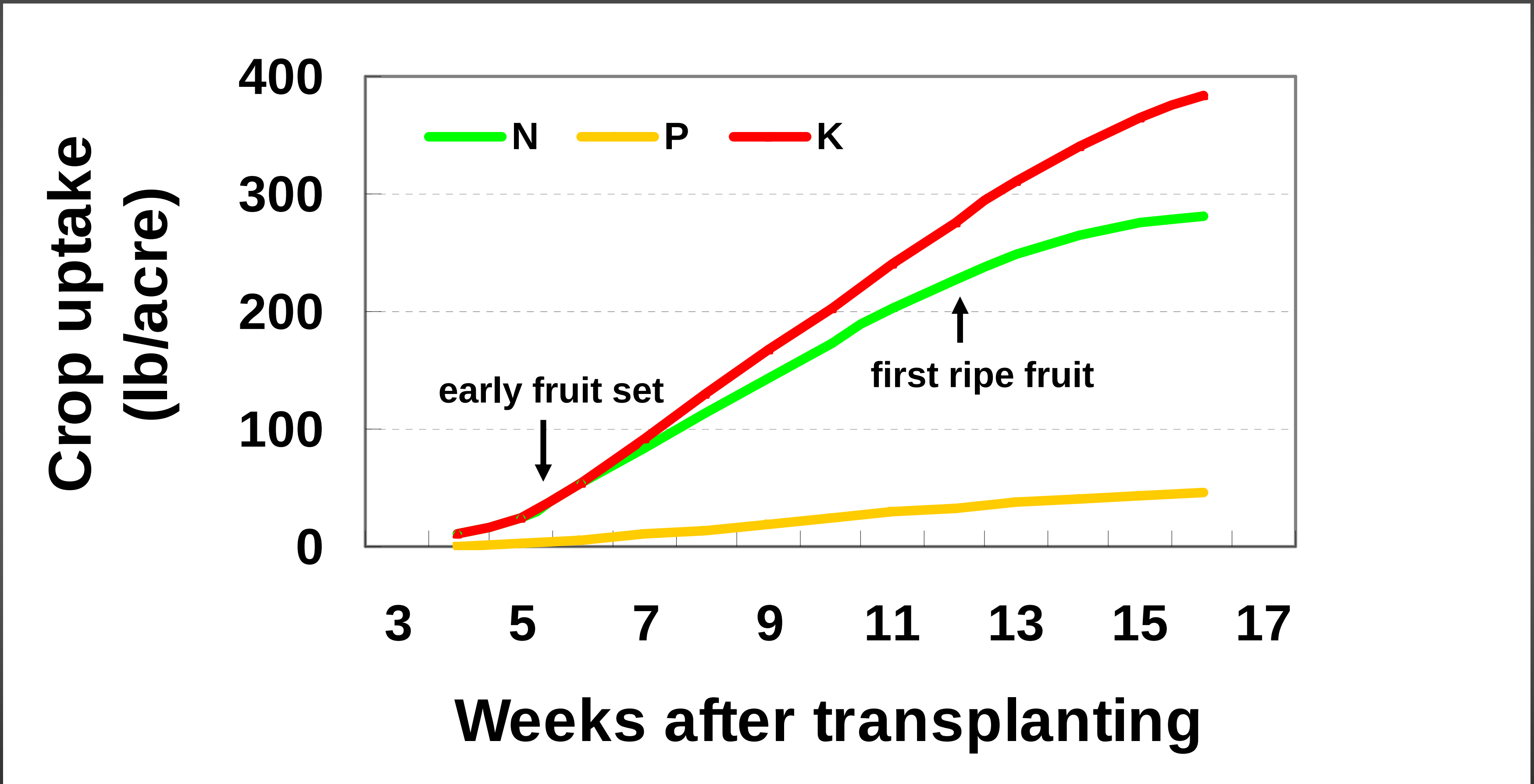
5-6 lb K_2O equivalent

Bottom line :

P and K fertilization requirements likely to increase with drip irrigation, and N requirement may increase as well

Nutrient uptake is predictable :

For a 60 ton / acre crop …



Mean of 4 high-yield fields, 2007-08 field survey

Nutrient budget for high yield processing tomato :

	lb / acre	
Nutrient	total	in fruit
N	220 - 280	160 - 200
P_2O_5	80 - 100	50 - 70
K_2O	300 - 450	250 - 350

Lower fertilizer rates = soil ‘mining’

Soil testing for available phosphorus :

'Olsen' test appropriate for soils with pH > 6.0

- **less than 10 PPM P - crop response guaranteed**
- **10 - 20 PPM P - crop response likely**
- **more than 20 PPM P - crop response unlikely**

Soil sample where the roots are !

P fertilization:

When:

preplant or at transplanting

How:

get at least some P close to the transplant to support early growth

How much:

soil test between 10-20 PPM – fruit removal rate (50-70 lb P_2O_5/acre)

soil test < 10 PPM – at least the crop uptake rate (> 80 lb P_2O_5/acre)

Soil testing for available potassium :

- ‘exchangeable’ K test (ammonium acetate extraction) is appropriate for all soils

Soil sample where the roots are !

Soil test K interpretation :

- less than 150 PPM K - yield response likely with K fertigation
- 150-250 PPM K, and K is less than 3 % of cation charges
  - yield response possible, fruit color improvement likely
- above 250 PPM K, and K is more than 3 % of cation charges
  - yield response unlikely, fruit color improvement possible

Potassium effects on fruit color :

- ✓ Uneven ripening (‘yellow shoulder’) associated with low K availability
- ✓ Eliminating yellow shoulder requires more K than maximizing yield does, is probably not economical

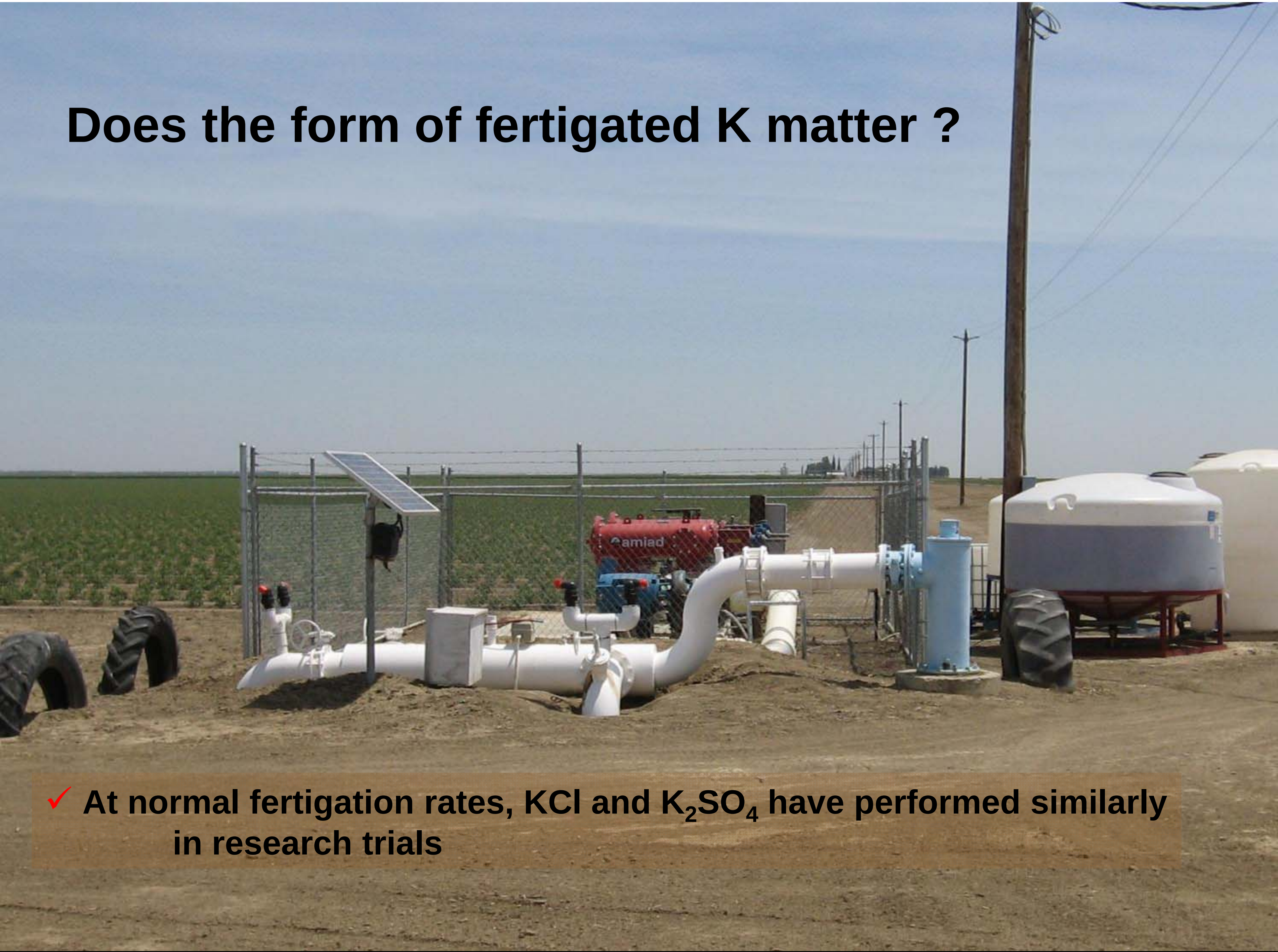
Potassium effects on soluble solids concentration :

- ✓ High soil K availability may marginally increase soluble solids, but it is not economical to increase fruit solids concentration by K fertilization

K fertilization :
When: during fruit set
How: fertigation
How much: first 100 lb K_2O /acre will be the most effective *

*** anything less than what is removed with fruit reduces long-term soil K supply**

Does the form of fertigated K matter ?



✓ **At normal fertigation rates, KCl and K_2SO_4 have performed similarly in research trials**

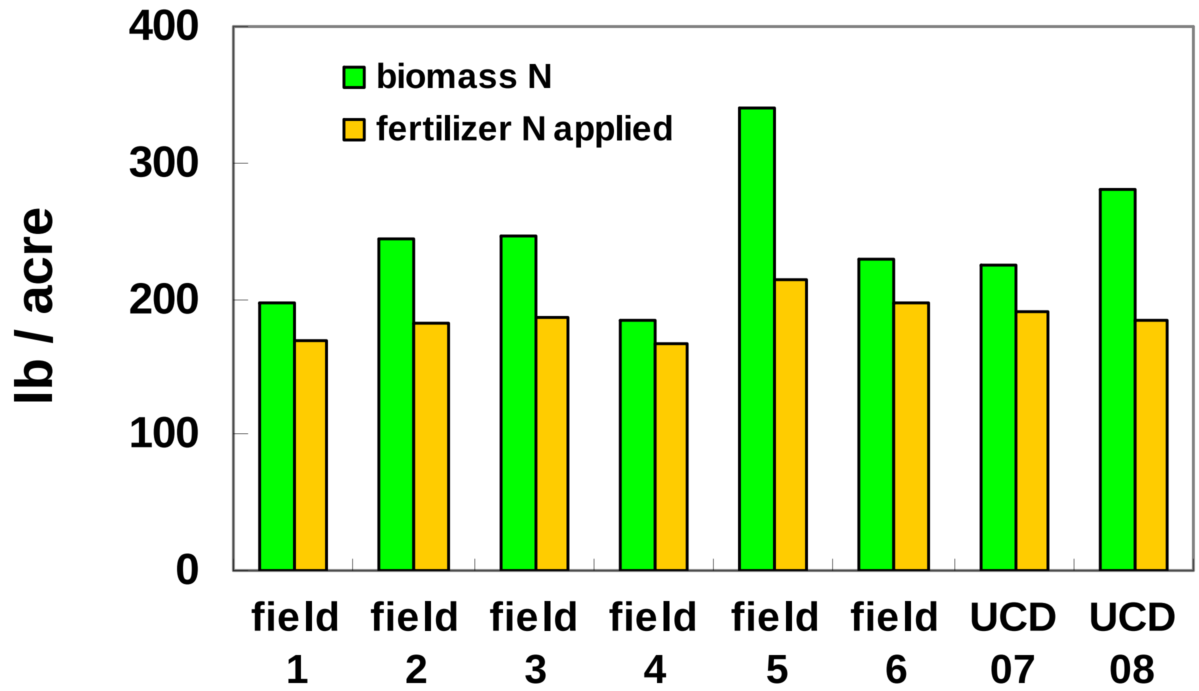
What is a reasonable N fertigation template ?

Growth stage	Duration (weeks)	N fertigation rate *no more than* (lb/acre/week)
2 weeks post-transplant - early fruit set	2-3	10
early fruit set - full bloom	3-4	30-35
full bloom - early red fruit	2-3	20-25
early red fruit - harvest	4-5	not usually necessary

= approximately 200 lb N/acre

Not all crop N comes from fertilizer :

2007-08 processing tomato field survey :



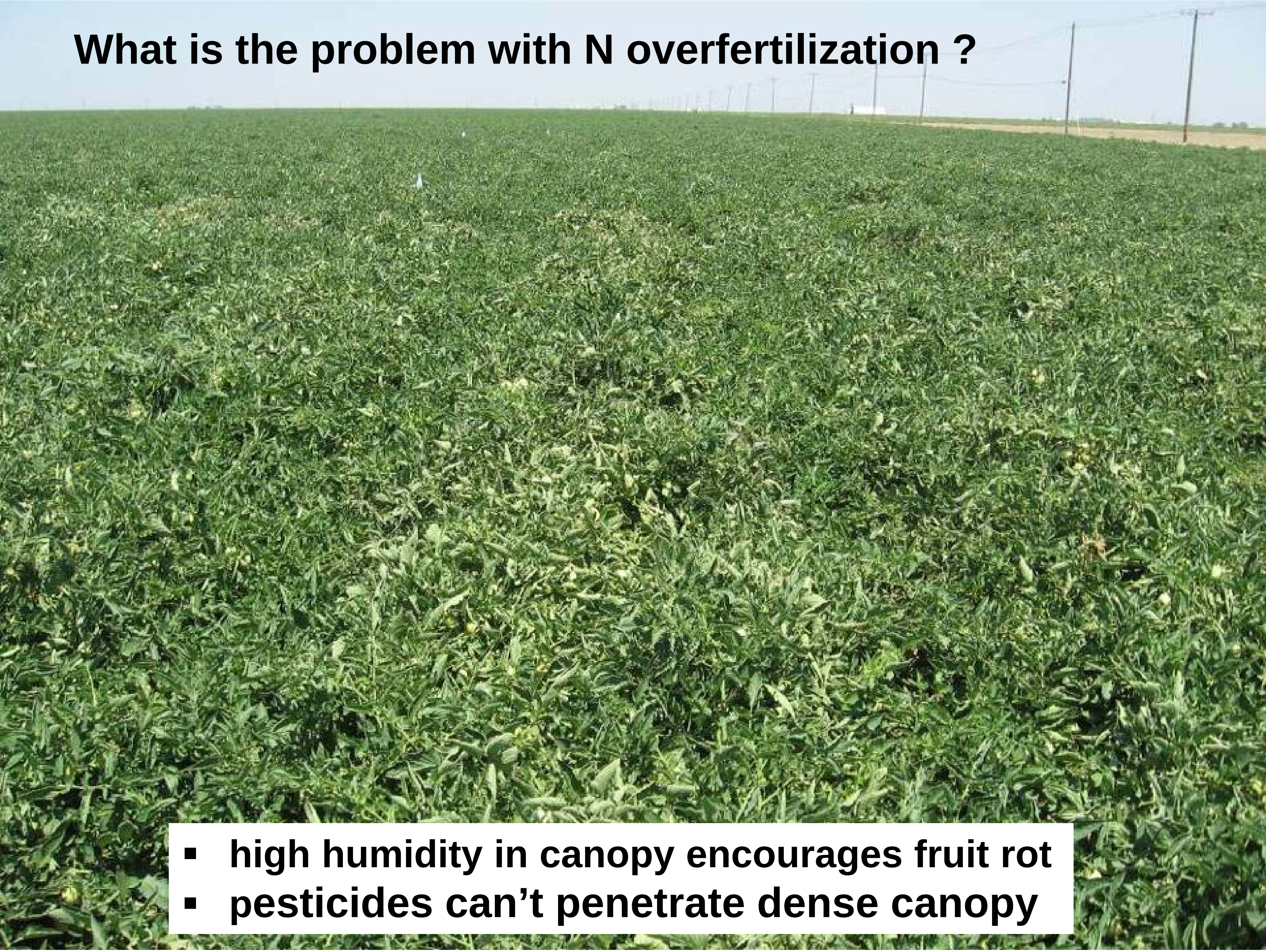
Sources of non-fertilizer N :

- **soil residual nitrate**
- **mineralized soil organic nitrogen**

Bottom line :

seasonal N application of 200 lb N/acre is usually sufficient, even less needed in fields with high residual NO_3-N

What is the problem with N overfertilization ?



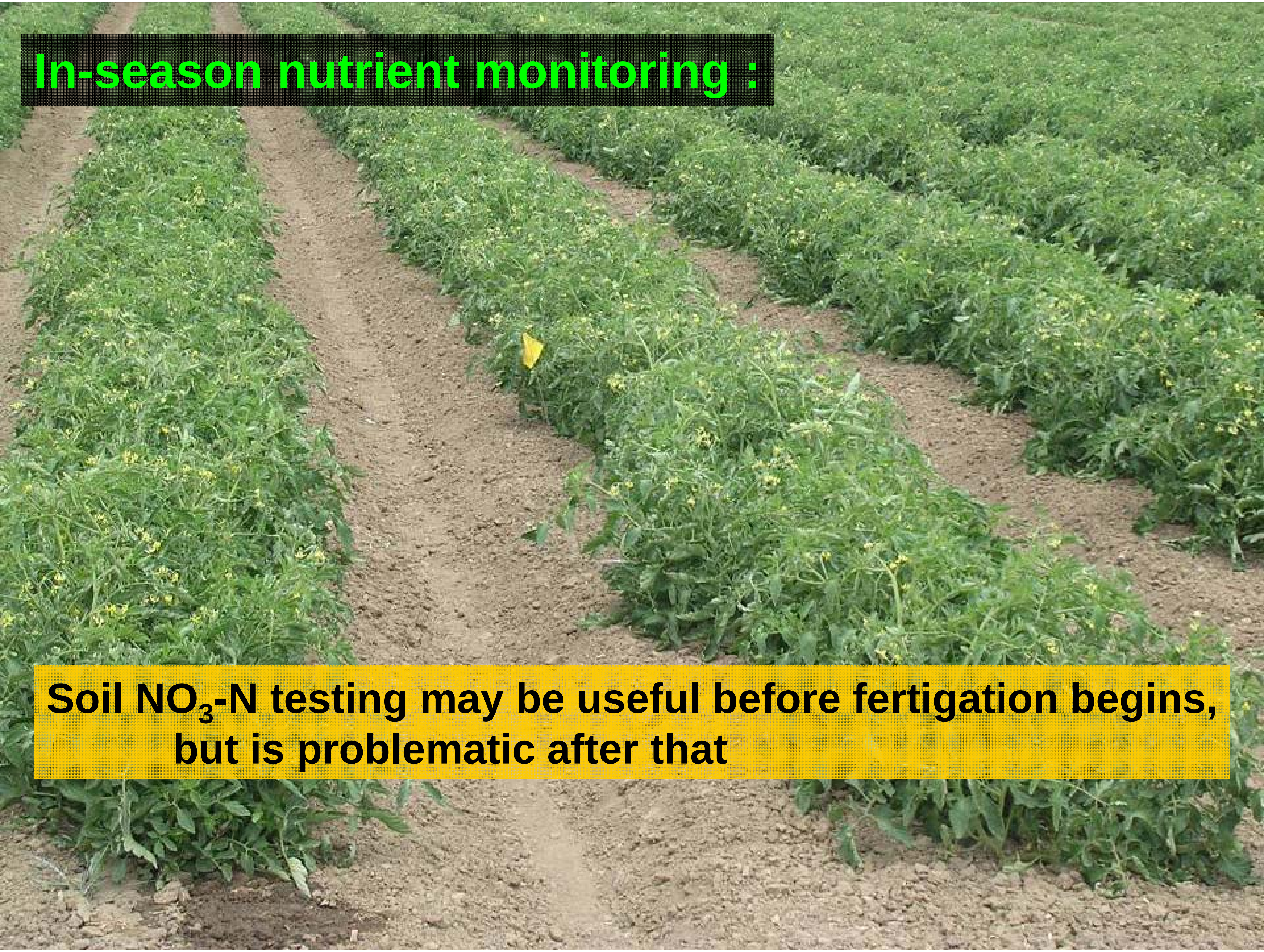
- high humidity in canopy encourages fruit rot
- pesticides can’t penetrate dense canopy

How often to fertigate ?

✓ **no more than weekly fertigation should be required**

Does the form of fertigated N matter ?

- ✓ conversion of urea and NH_4-N to NO_3-N occurs rapidly in warm soil
- ✓ replicated trials generally show no yield or quality differences between N fertilizer products


In-season nutrient monitoring :
Soil NO_3-N testing may be useful before fertigation begins, but is problematic after that


Soil NO_3-N is not uniformly distributed in the soil profile :
Soil NO_3-N (PPM)
13
8
20
7
11
16

Tissue sampling :

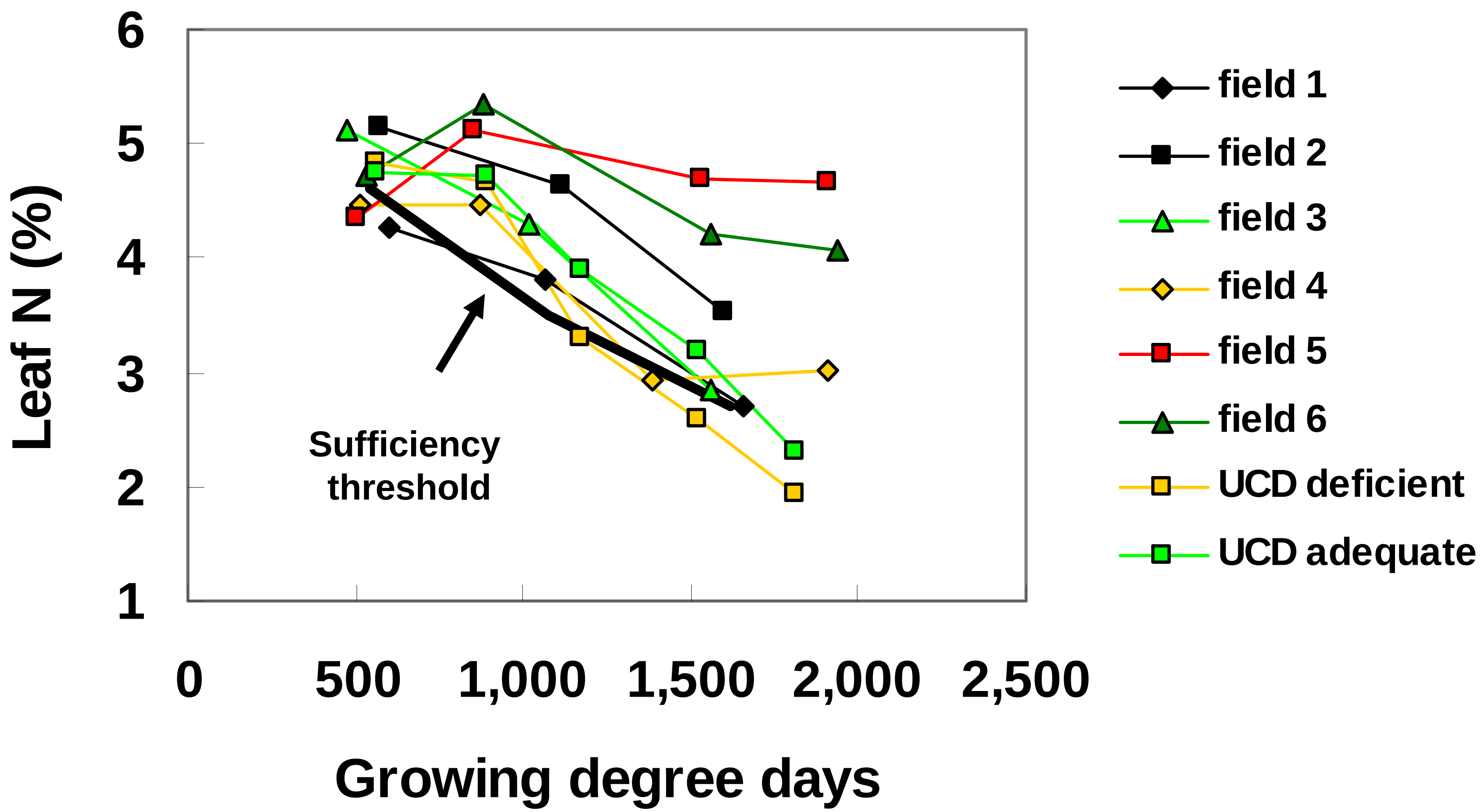
Whole leaves:

- total N, P, K,
  - gives overall nutrient status

Petioles:

- NO_3-N, PO_4-P, K
  - *theoretically* measures ‘recent’ uptake

Whole leaf total N analysis gives useful information :



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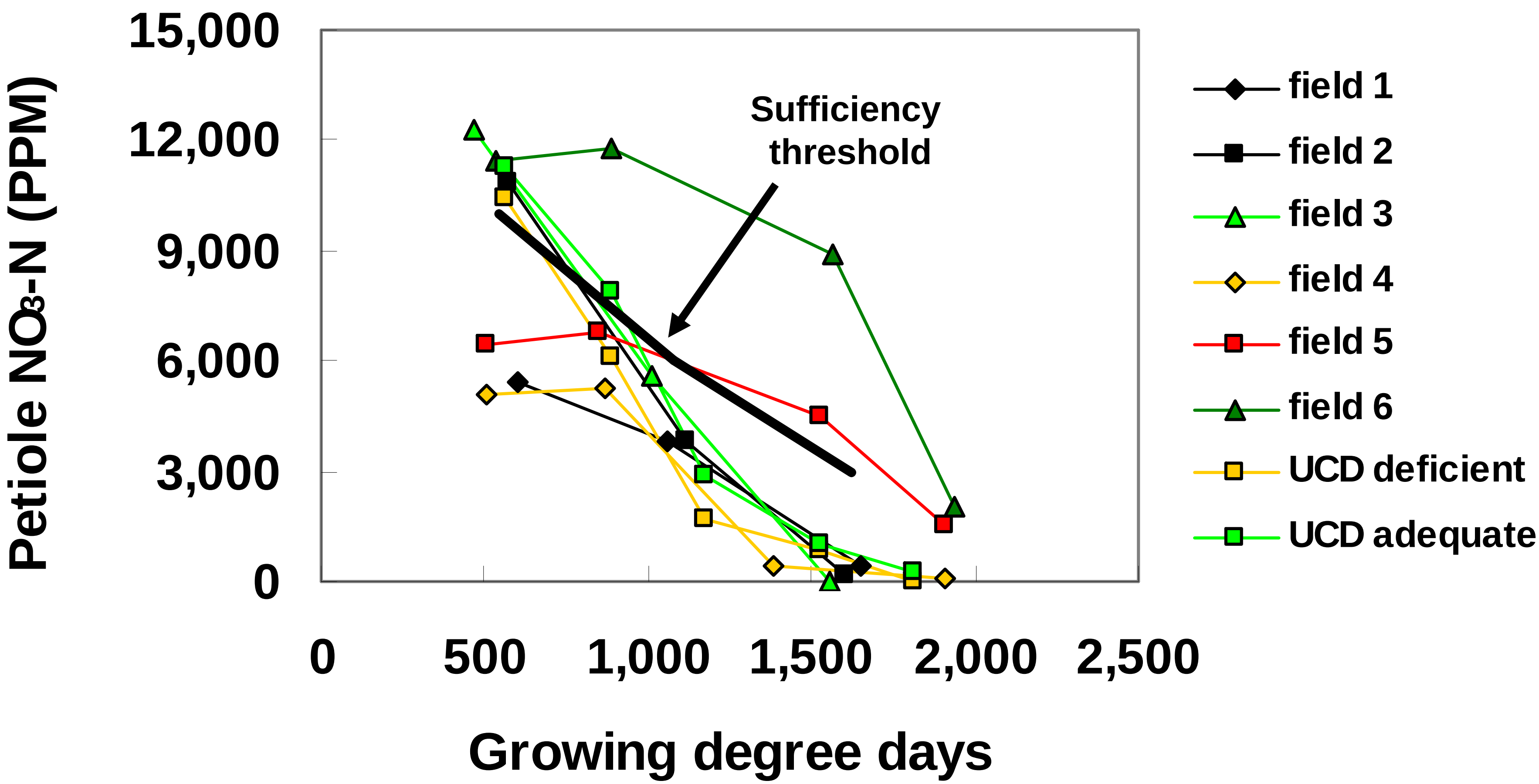
Petiole NO_3-N analysis can be misleading :



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Why is petiole analysis unreliable ?

- Petiole NO_3-N and PO_4-P concentration is governed by the rate at which the plant converts these inorganic compounds into organic compounds, not by the rate at which they are taken up from the soil
- Once fruit development begins, petiole NO_3-N and PO_4-P drops sharply as the plant rapidly converts these inorganic nutrient forms to organic compounds that can be transported to the fruit
- Maintaining high petiole NO_3-N and PO_4-P late in the season often requires excessive fertilization

Drip Irrigation and Fertigation Management of Processing Tomato

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A. Drip Irrigation Management

Drip system design

The standard approach to drip irrigating tomatoes has been to use a buried system which remains in place for a period of years before field renovation. Drip tape is typically buried 10-12 inches deep, one line per 60-66 inch soil bed. In recent years some growers have used "in-furrow" drip systems in which drip tape is laid in every furrow, or every other furrow, after crop establishment. Many factors affect the choice between buried or surface drip systems: system cost, labor availability, crop rotation pattern, soil type, etc. The general experience has been that buried systems offer higher yield potential, but cost more to install and maintain. The main advantage of surface drip, beyond lower initial cost, is that it is mobile, able to be moved each year as the tomato crop is rotated.

Available at :

http://vric.ucdavis.edu/veg_info_crop/tomato.htm