
Soil fertility management for pepper production

Typical nutrient uptake by a bell pepper crop producing 50,000 lb of fruit/acre :

	lbs per acre		
	N	P_2O_5	K_2O
total plant content	200 - 260	40 - 60	240 - 320
fruit content	80 - 110	20 - 30	120 - 180

additional fruit at ≈ 3 lb / ton

Phosphorus requirement for pepper :

Common soil tests for P availability :

Olsen (bicarbonate) test - extraction in sodium bicarbonate at pH 8.5
best method if soil pH > 6.5

Bray test - extraction in dilute acid
useful in acidic soil (pH < 6.5)

Bray values higher than Olsen in most cases

Is P application always necessary ?
What application rate is reasonable ?

Soil P availability requirement :

High **Low**

Lettuce

Pepper

Tomato

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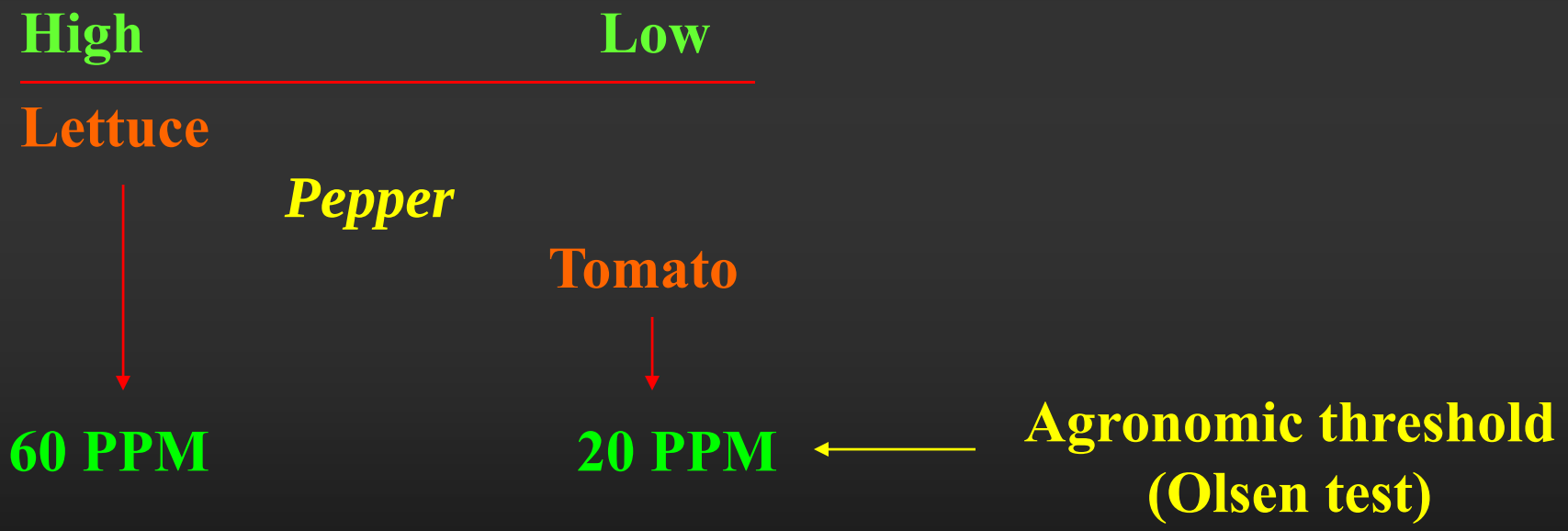
Soil P availability requirement :



Olsen P level	Pepper response to applied P
< 20 PPM	positive response guaranteed
20 - 40 PPM	positive response possible, especially in cold soil
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Application rate ?

- limit application to crop removal rate in fields with high soil P
- rates > 120-150 lb P_2O_5/acre questionable, regardless of soil test level

Nitrogen management :

- **Crop N uptake is predictable by growth stage**

lb N per acre per day:

< 1

4 - 5

< 3

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- **Not all N needs to come from fertilizer application:**
  - **residual soil NO_3-N can be substantial**
  - **soil N mineralization can be up to 1 lb / acre / day**

Excessive N application generally not an agronomic problem, but can be an environmental problem :

- **Environmental targets for N concentration in groundwater is 10 PPM NO_3-N; for surface water may be as low as 1 PPM**
- **Any water that escapes a pepper field is likely to greatly exceed environmental targets**

Irrigation efficiency and N management :

- at common soil NO_3-N levels during the season, one inch of leaching may carry 20-30 lb NO_3-N/acre out of the root zone

- that water may be 10 times the Federal drinking water standard of 10 PPM NO_3-N

Potassium management :

- Crop K uptake is predictable by growth stage

lb N per acre per day:

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4 - 7

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- Crop K uptake is predictable by growth stage

lb N per acre per day:

< 1

4 - 7

< 4

- pepper has a moderately high K requirement (240 - 320 lb K_2O/acre)
- majority of K ends up in fruit
- leaf K declines to 'feed' the fruit; that's why deficiency shows late

Evaluating soil K supply :

- ‘exchangeable’ K, usually expressed as PPM
- K as a % of base exchange

[milliequivalent of K / (meq Ca + Mg + Na + K)] x 100

Soil test K interpretation :

- fields > 200 PPM exchangeable K, and > 3% of base exchange, do not require K fertilization
- soils < 150 PPM, or < 2% of base exchange, should be fertilized
- K fertilization is most effective during fruit set and early fruit development

Crop monitoring options

In-season soil nitrate testing :

- ✓ high root zone soil NO_3-N concentration (> 20 PPM) indicate that additional N application can be postponed

Soil nitrate testing most useful early in the season

Petiole testing as a management tool ?

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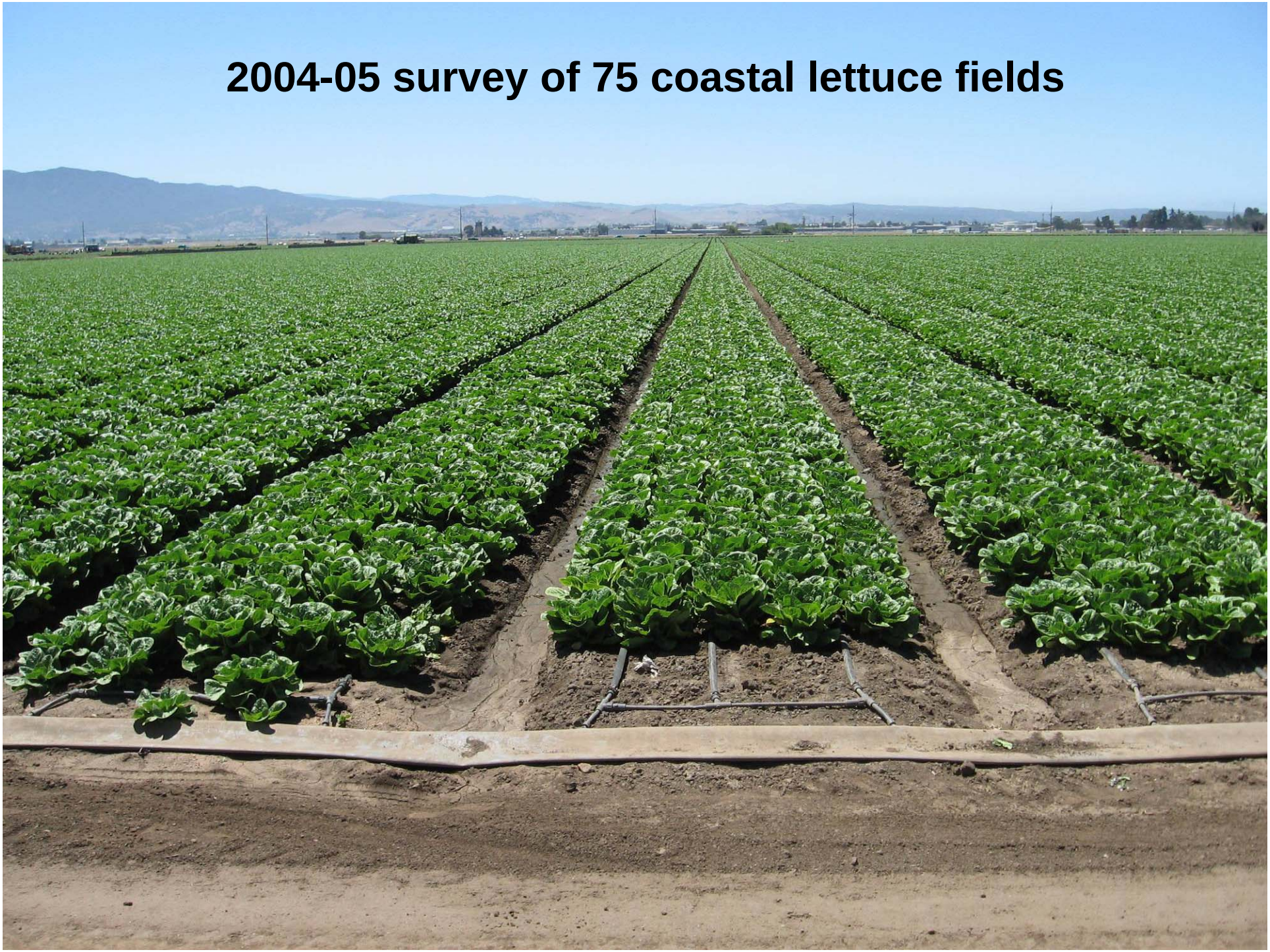
Petiole testing as a management tool ?

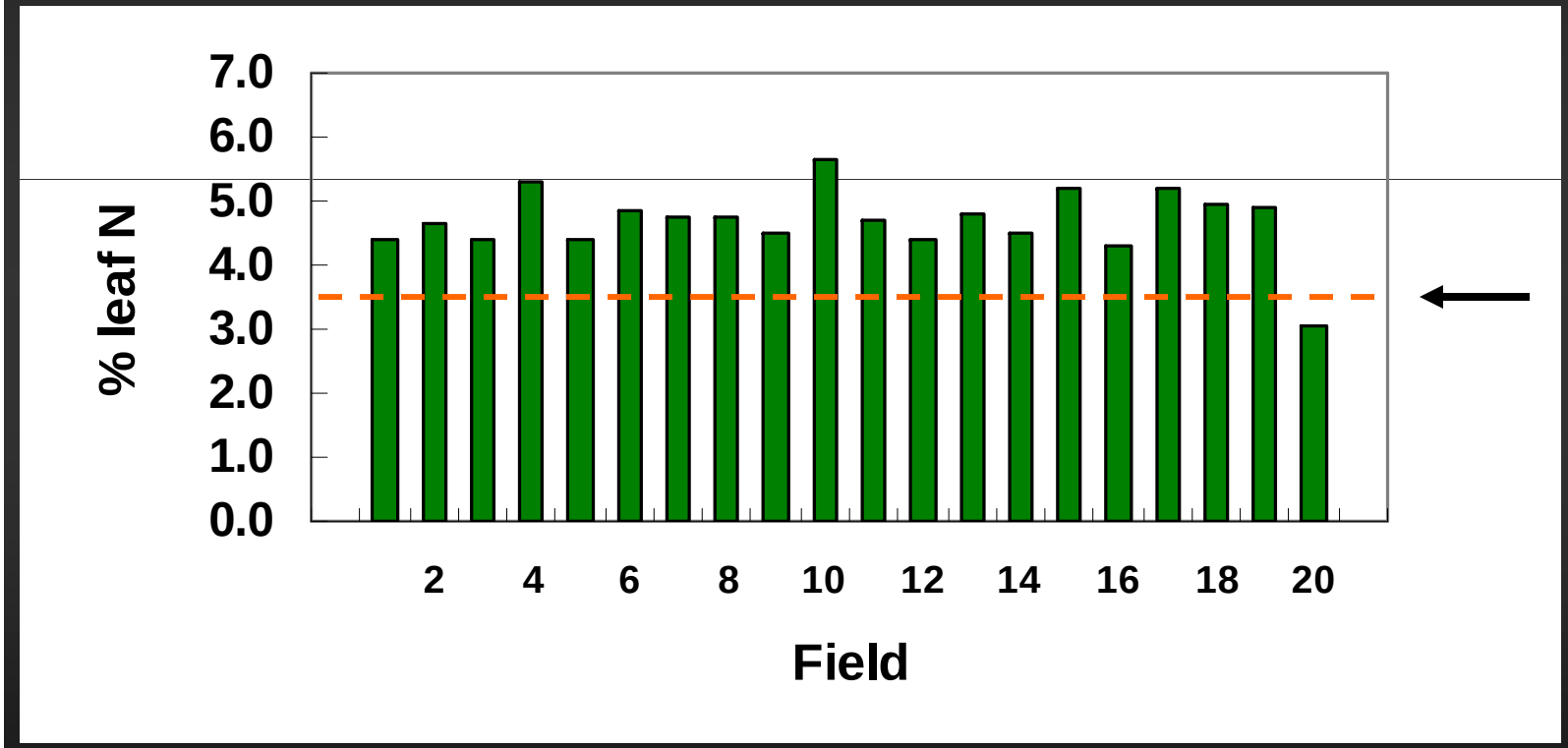
- high NO_3-N or PO_4-P concentration guarantees *current* sufficiency, but does not project far into the future
- lower NO_3-N or PO_4-P concentration *does not prove deficiency*

2004-05 survey of 75 coastal lettuce fields



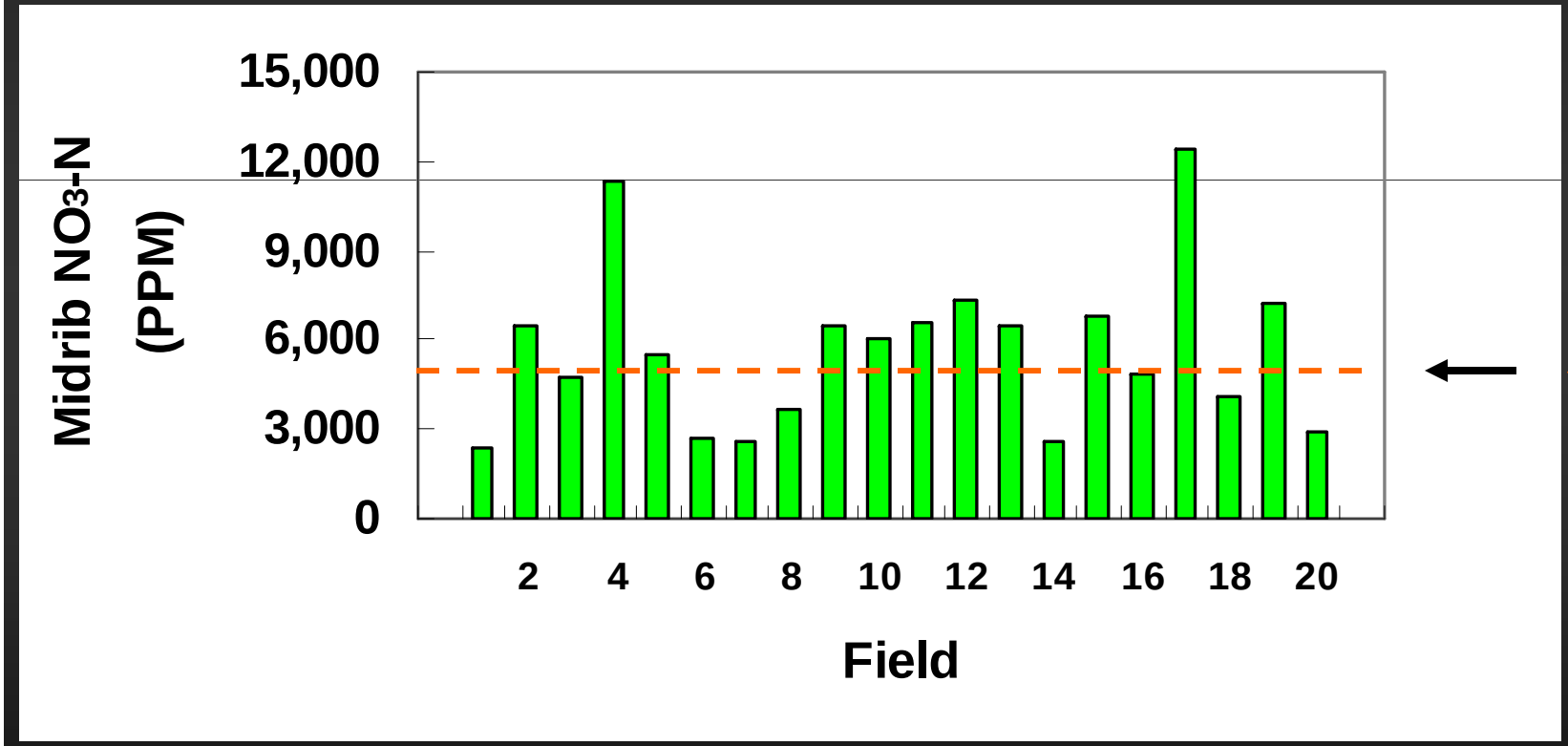
at early heading stage :

Leaf total N of the 20 *highest yielding fields* …



at early heading stage :

Midrib NO_3-N of the 20 *highest yielding fields* …



Tissue sampling in processing tomato :

- ✓ **4 high yield commercial fields**
- ✓ **UCD fertilizer trial**

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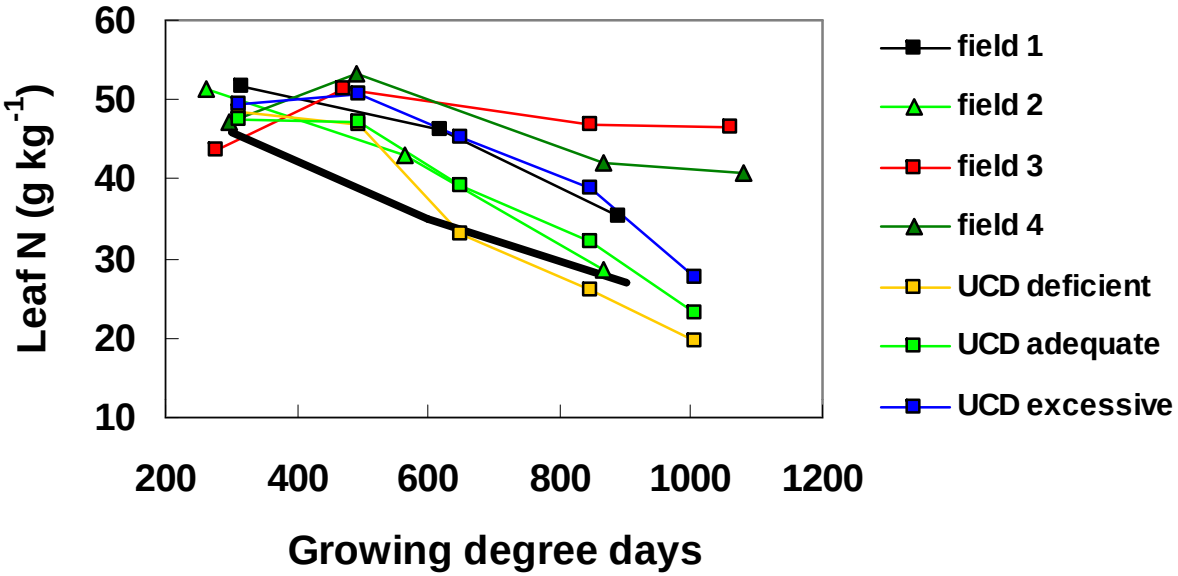

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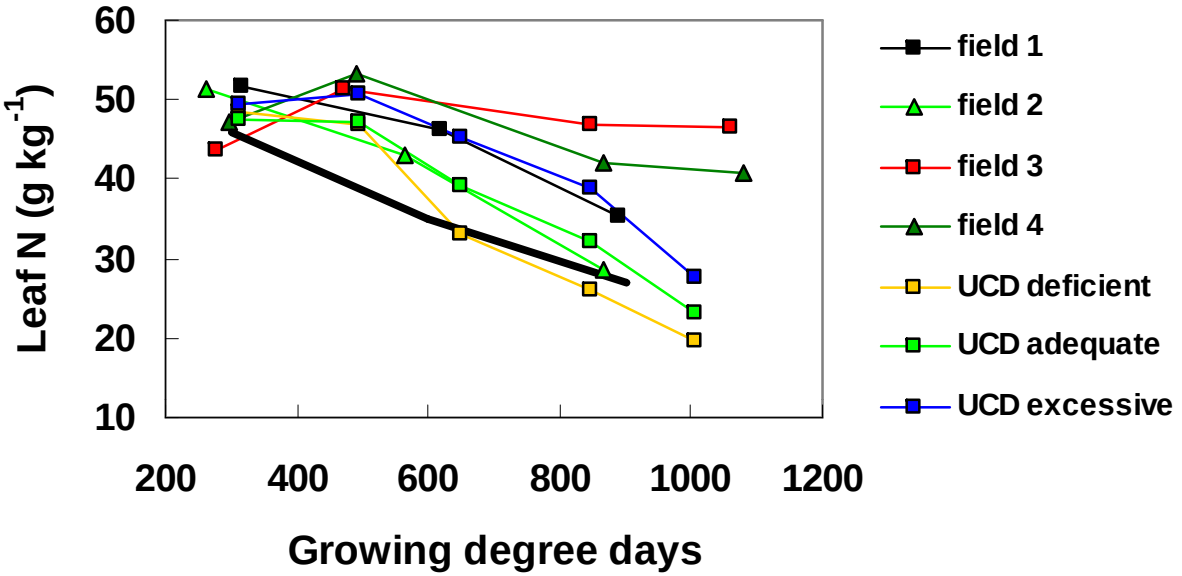
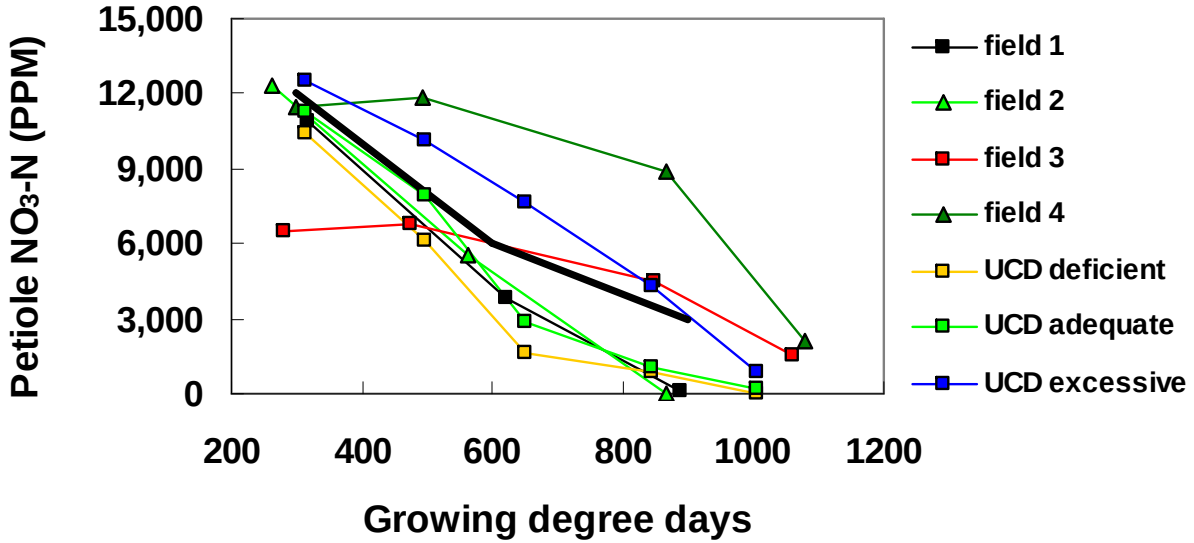
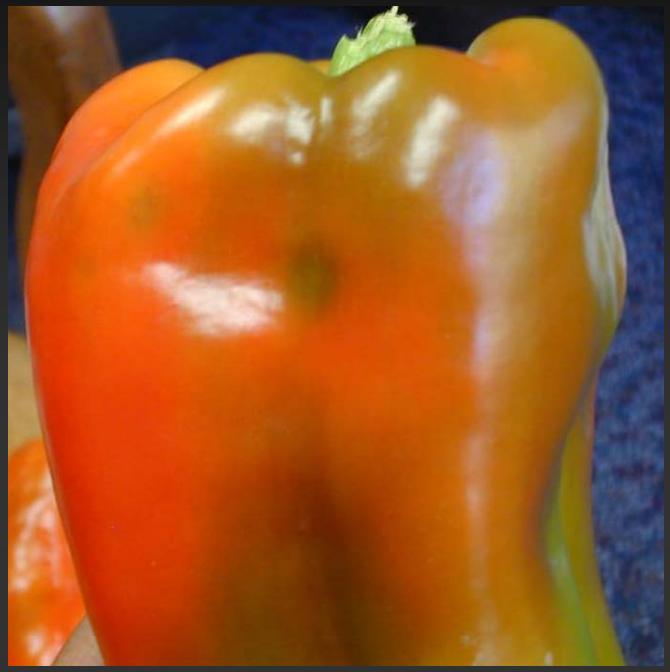
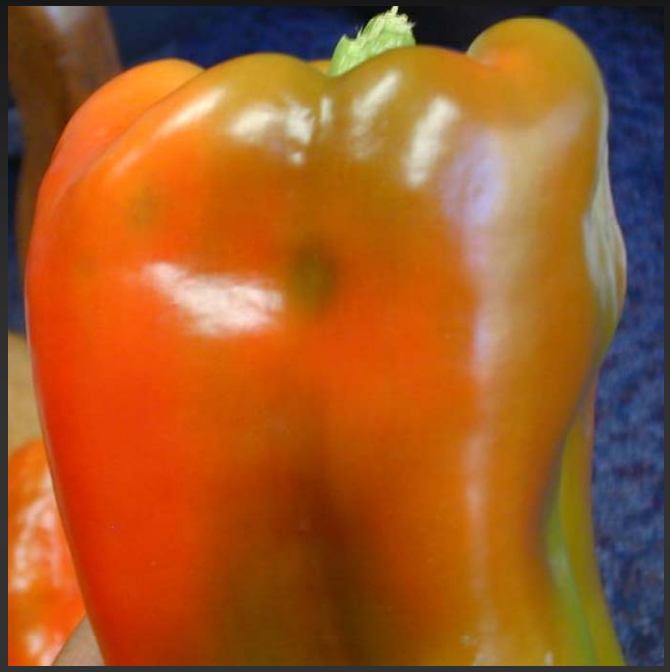






Calcium disorders :

- symptoms develop because insufficient Ca is moved into actively growing cells during fruit development

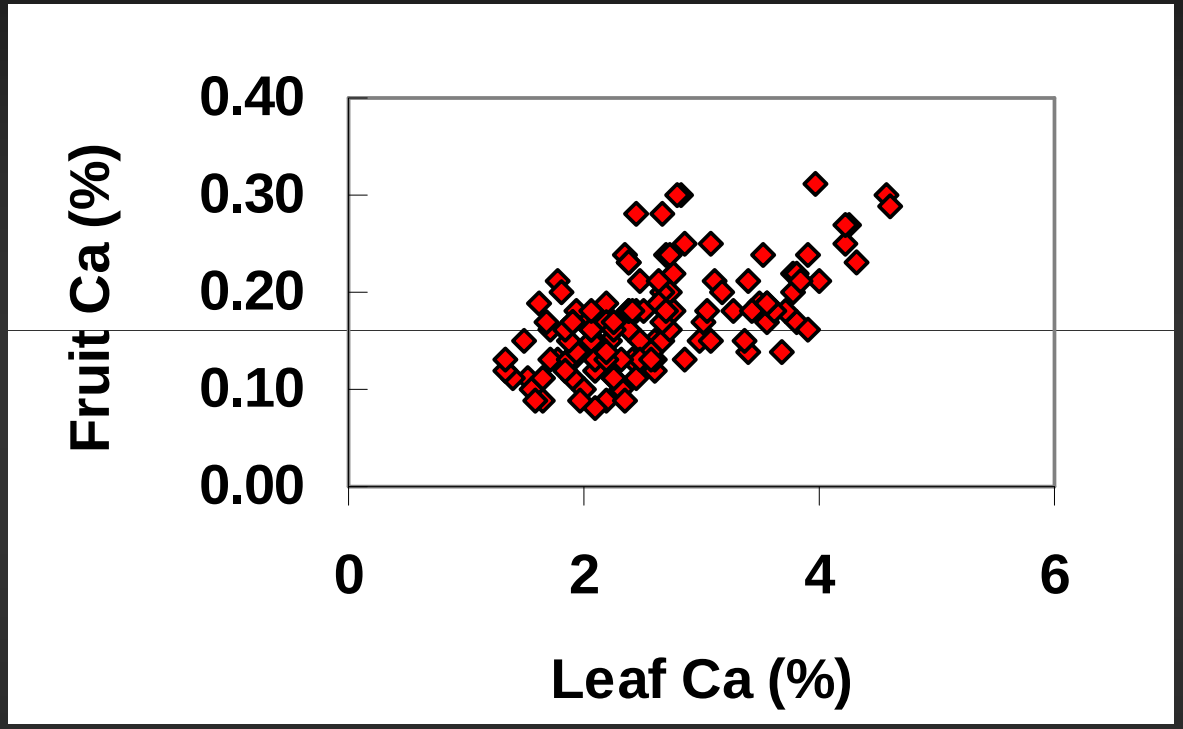


Calcium disorders :

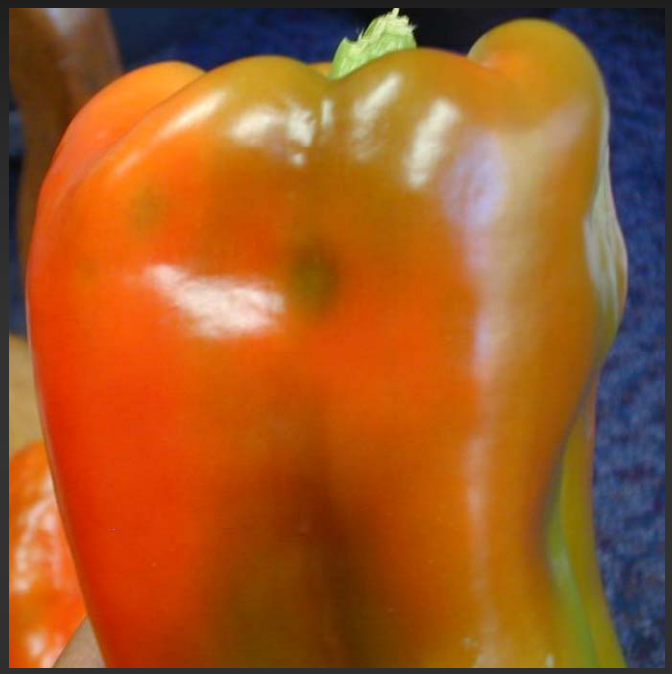
- symptoms develop because insufficient Ca is moved into actively growing cells during fruit development
- origin of the problem is the inefficient way plants move Ca into fruit; soil Ca limitation seldom the primary problem

Calcium doesn't move into fruit easily :

Processing tomato fruit quality survey, 140 fields :



- Ca moves in transpirational flow in xylem, so leaf Ca is high
- Ca does not move in phloem, so fruit Ca is low; surface wax on fruit makes foliar application questionable



What can be done to minimize calcium disorders ?

- ✓ **prevent water stress**
- ✓ **choose adapted varieties**
- ✓ **avoid high ammonium levels during early fruit development**