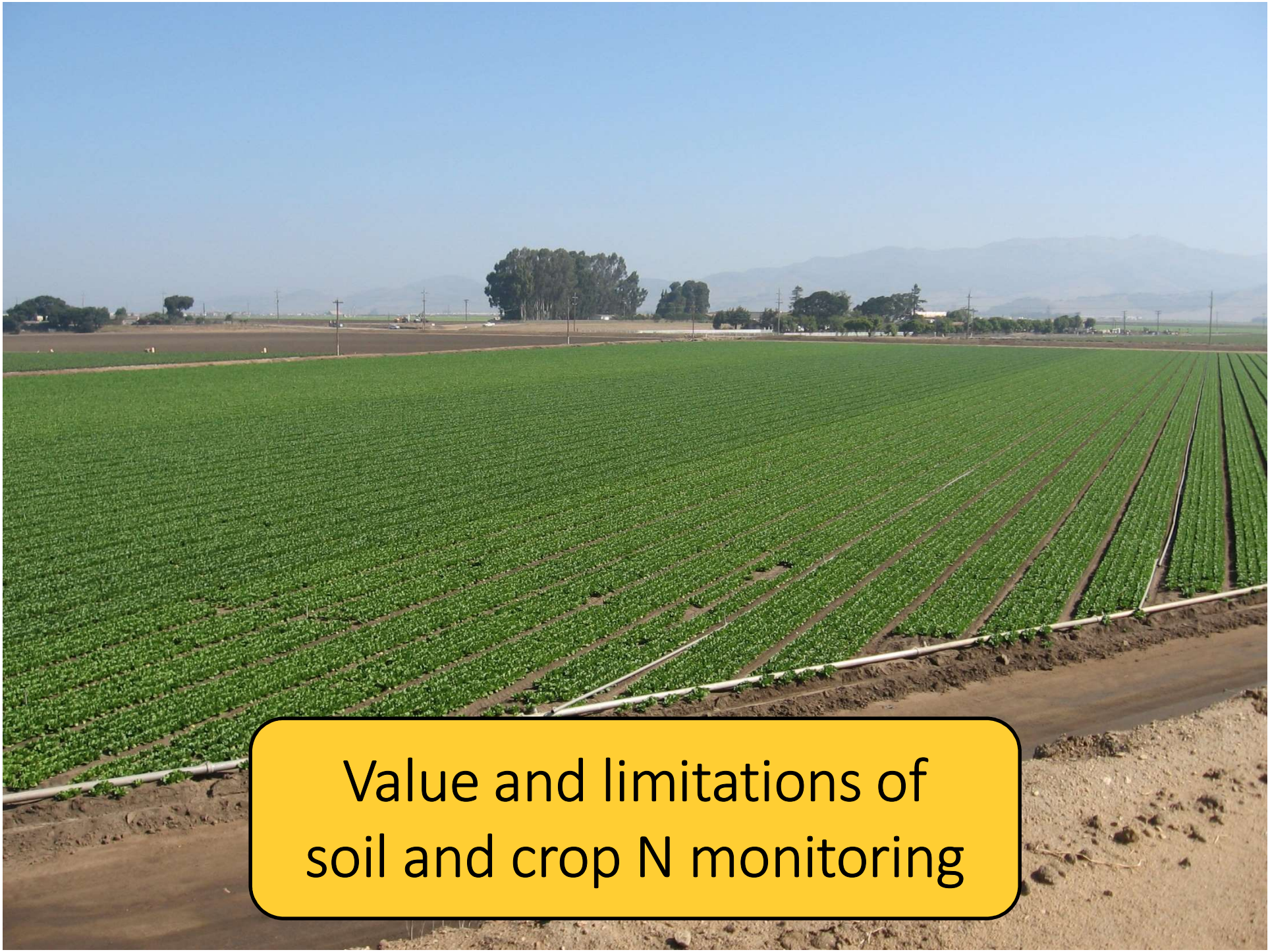

Value and limitations of
soil and crop N monitoring

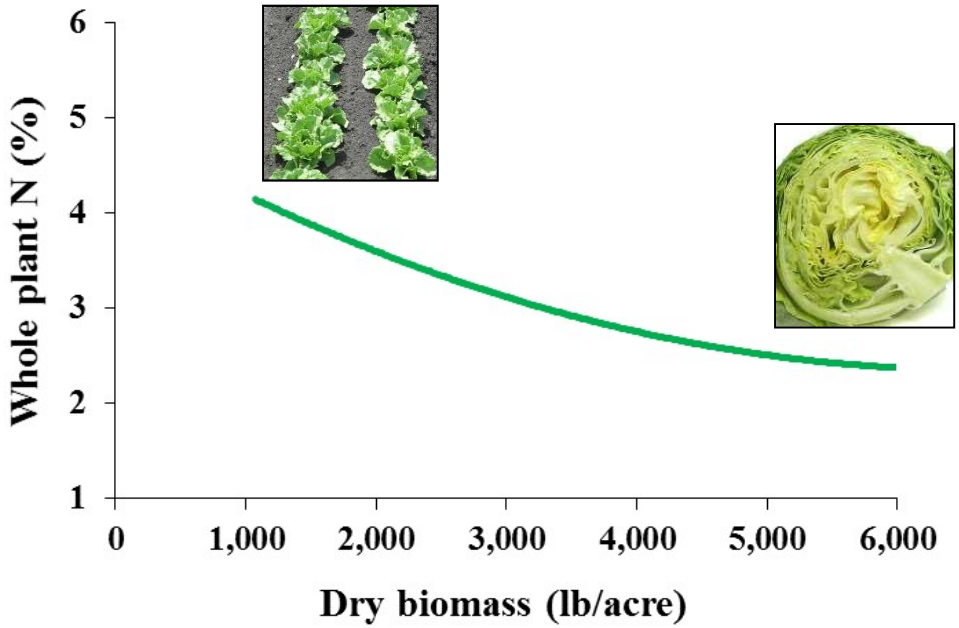
Soil or plant monitoring ?

- Plant monitoring for confirmation of current crop N status
- Soil monitoring for N fertilizer management

Plant ‘critical N’ concentration:

- Whole plant N concentration needed to maintain maximum growth rate

Critical N for lettuce:



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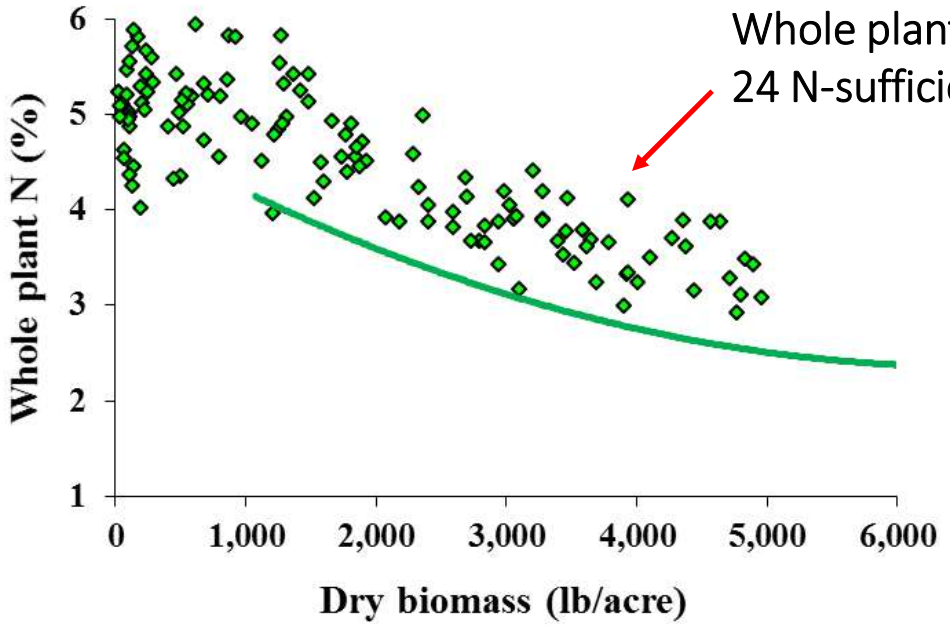
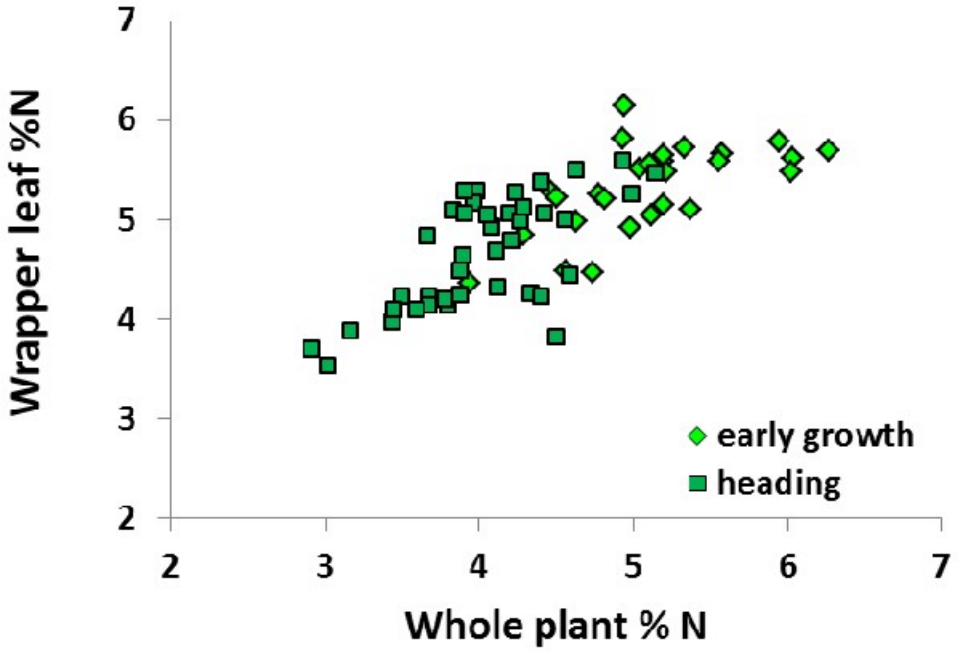
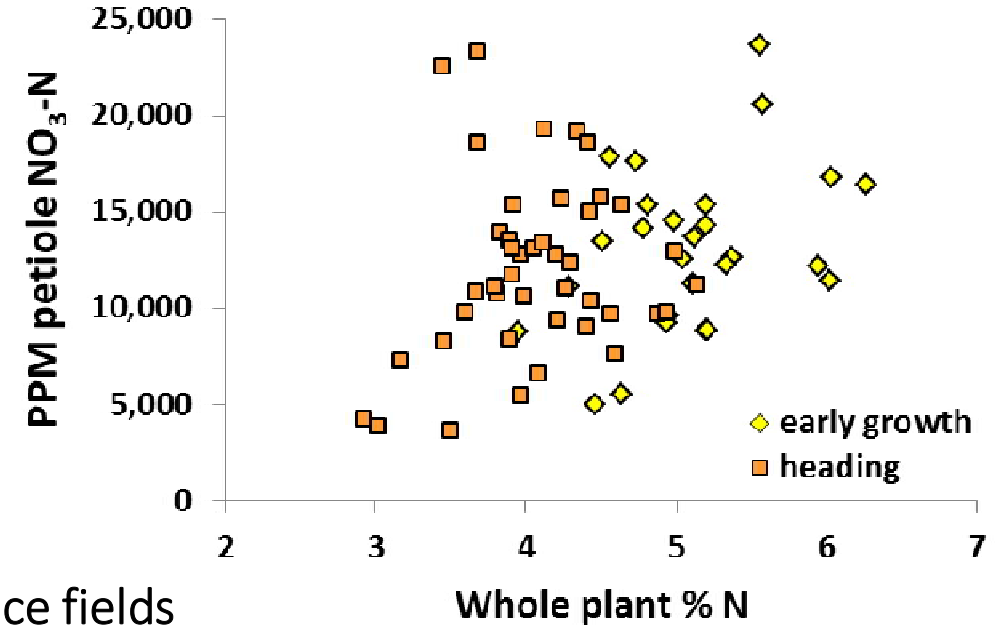


Tissue diagnostics:

- Leaf N correlated to whole plant N; critical values approximately 4% N early season, 3.5% N preharvest

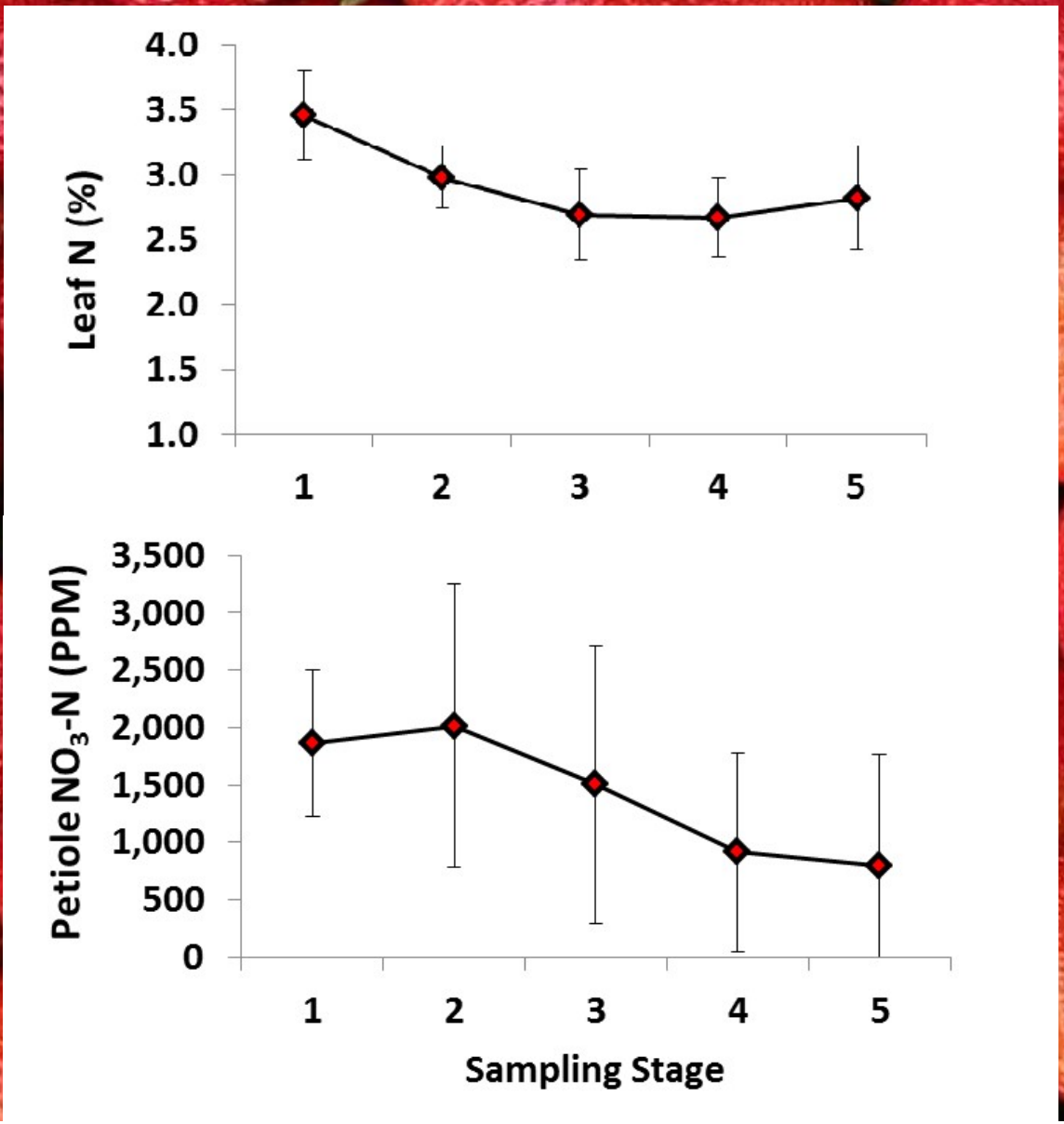


- Petiole NO_3-N highly variable, not correlated to either leaf N or whole plant N



Data from 24 N-sufficient coastal lettuce fields

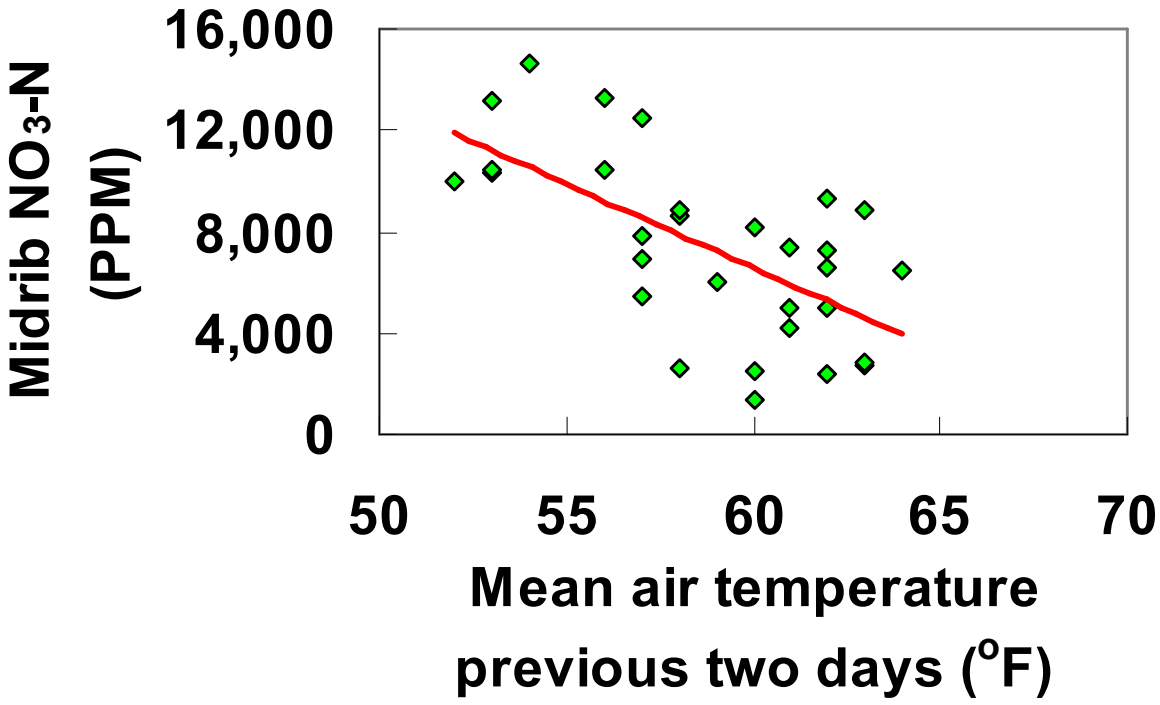
Comparison of leaf %N and petiole NO_3-N for high-yield strawberry fields



Why is petiole NO_3-N so variable?

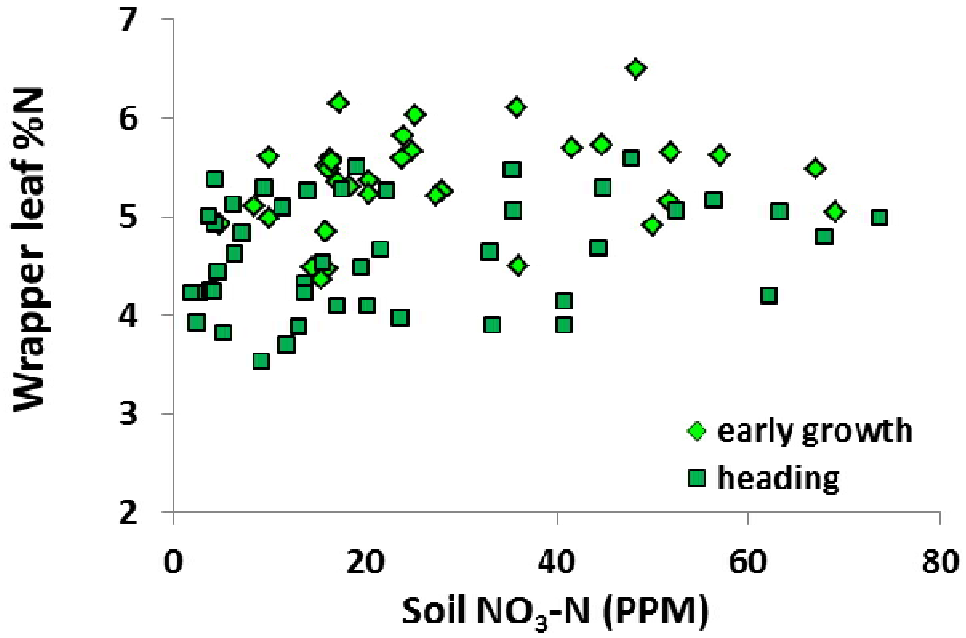
- Environmental factors affect the rate at which the plant incorporates NO_3-N into organic compounds

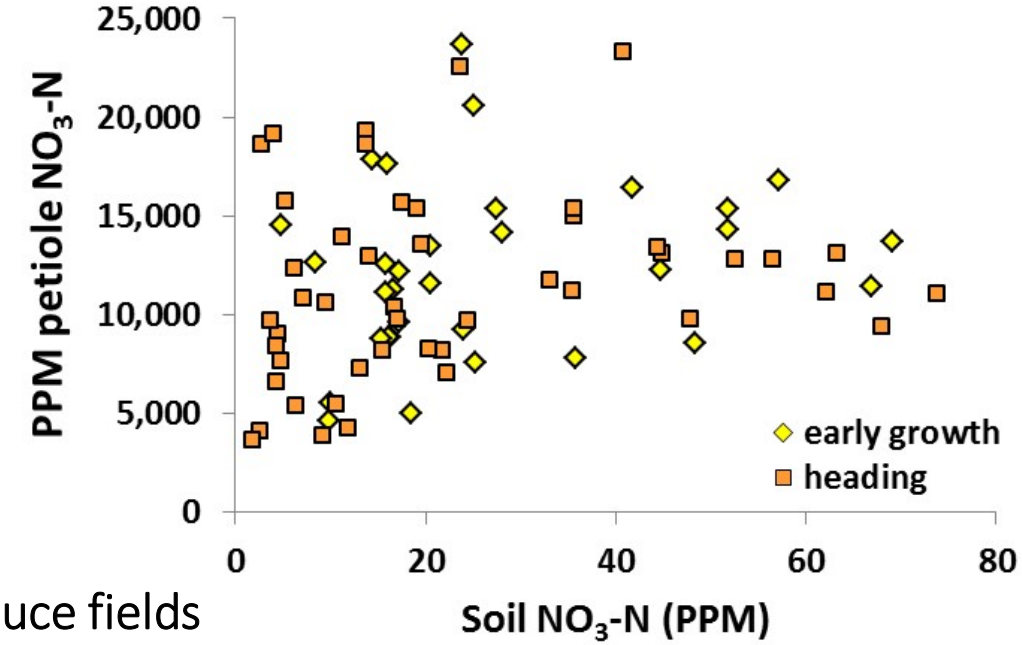
Lettuce midrib NO_3-N:



Tissue analysis and N fertilizer scheduling:

- Neither plant tissue correlates well with soil NO_3-N





Data from 24 N-sufficient coastal lettuce fields

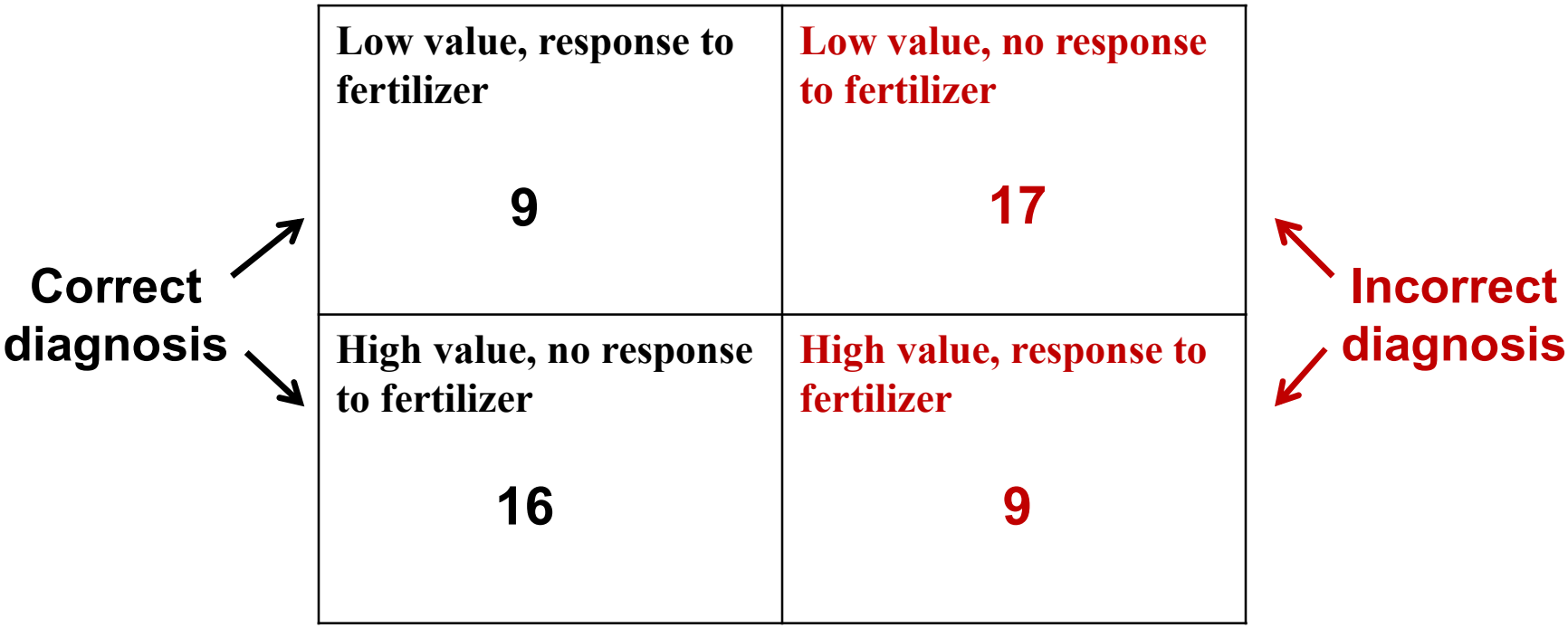
Can petiole analysis guide N fertilizer decisions ?

N fertilizer trials in the lower desert :

19 lettuce experiments

- midrib NO_3-N analysis prior to each sidedressing
- at each sidedressing replicated fertilized and unfertilized plots established
- 8,000 PPM NO_3-N sufficiency threshold assumed

Evaluating petiole NO_3-N as a predictor of sidedress N need:



C. A. Sanchez, Diagnostic Tools for Efficient N Management of Vegetables Produced in the Low Desert, available at CDFA FREP: https://www.cdfa.ca.gov/is/frep/Default.aspx

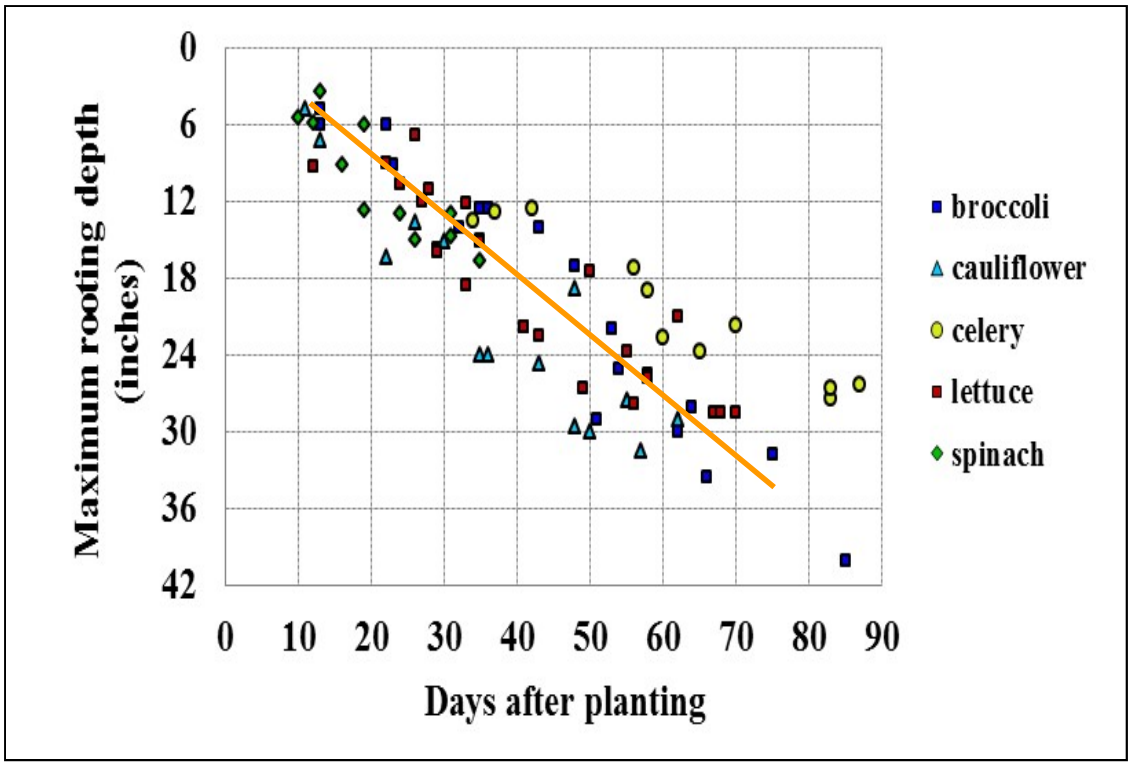
Bottom line on plant tissue testing :

- whole leaf sampling gives a good snapshot of current crop N status, but it is a poor indicator of current soil NO_3-N supply, and therefore a poor indicator of future need for N fertilization
- Petiole NO_3-N testing is a flawed technique. Maintaining high petiole NO_3-N helps ensure crop nitrogen sufficiency; however, *this often leads to unnecessary fertilization*

The CDFA-FREP Lower desert study by Sanchez concluded that:
'The pre-sidedress soil nitrate test was the most reliable test for making sidedress N fertilizer decisions'

What depth of sample is appropriate?

- 12” depth is good for most crops
- 24” depth for Brassicas late in the crop cycle?



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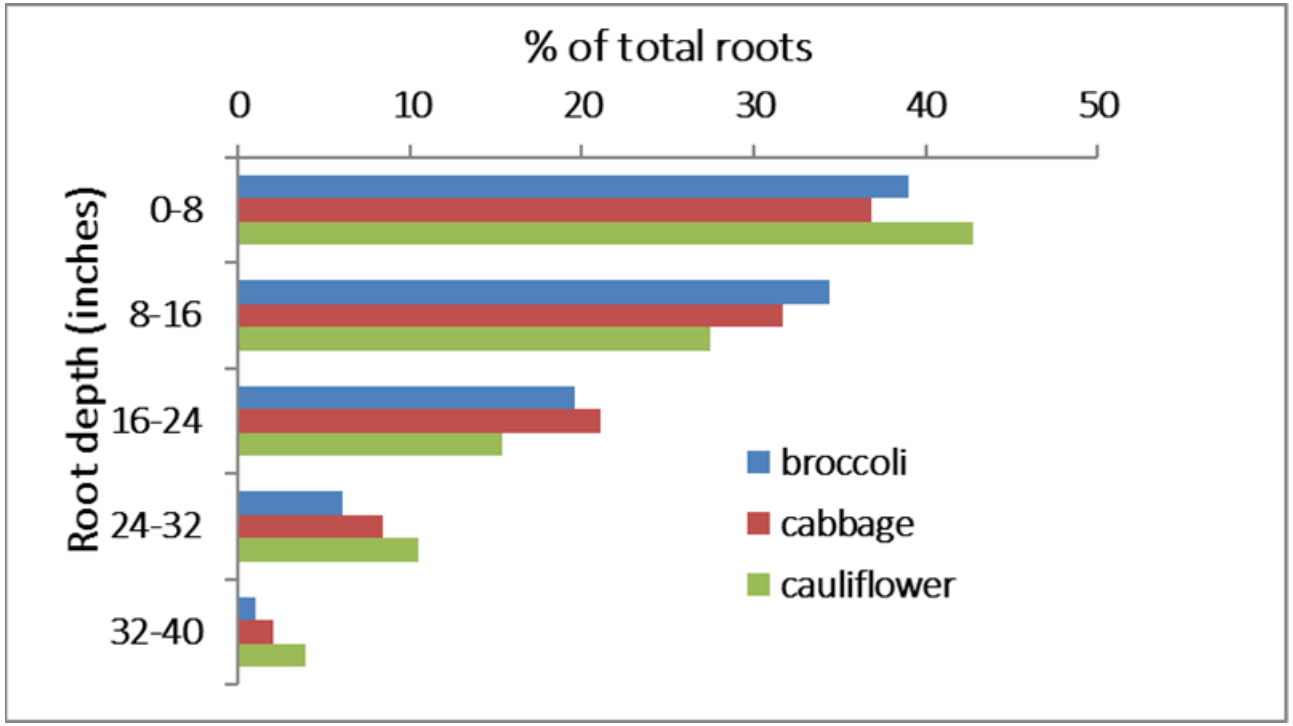
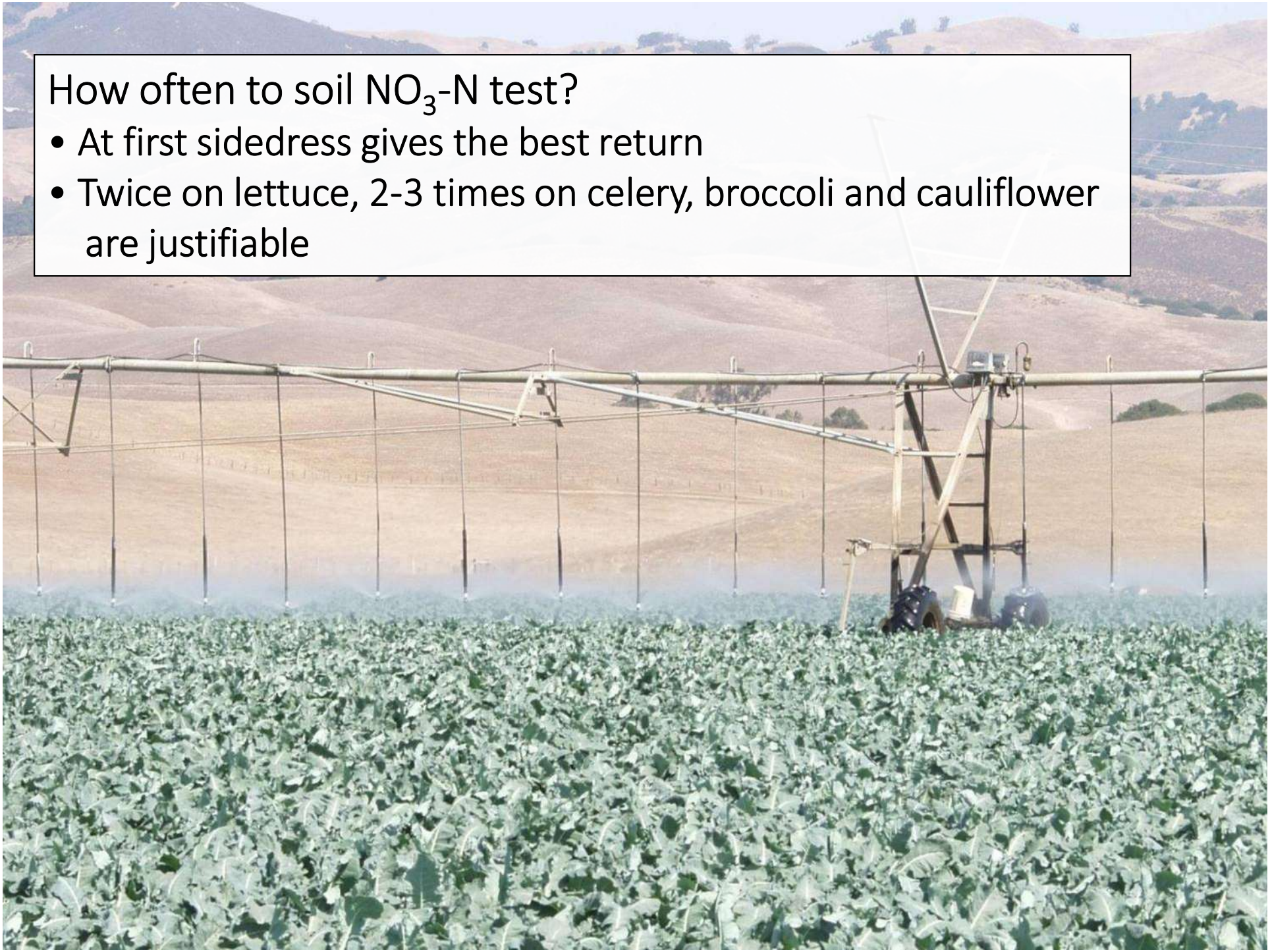
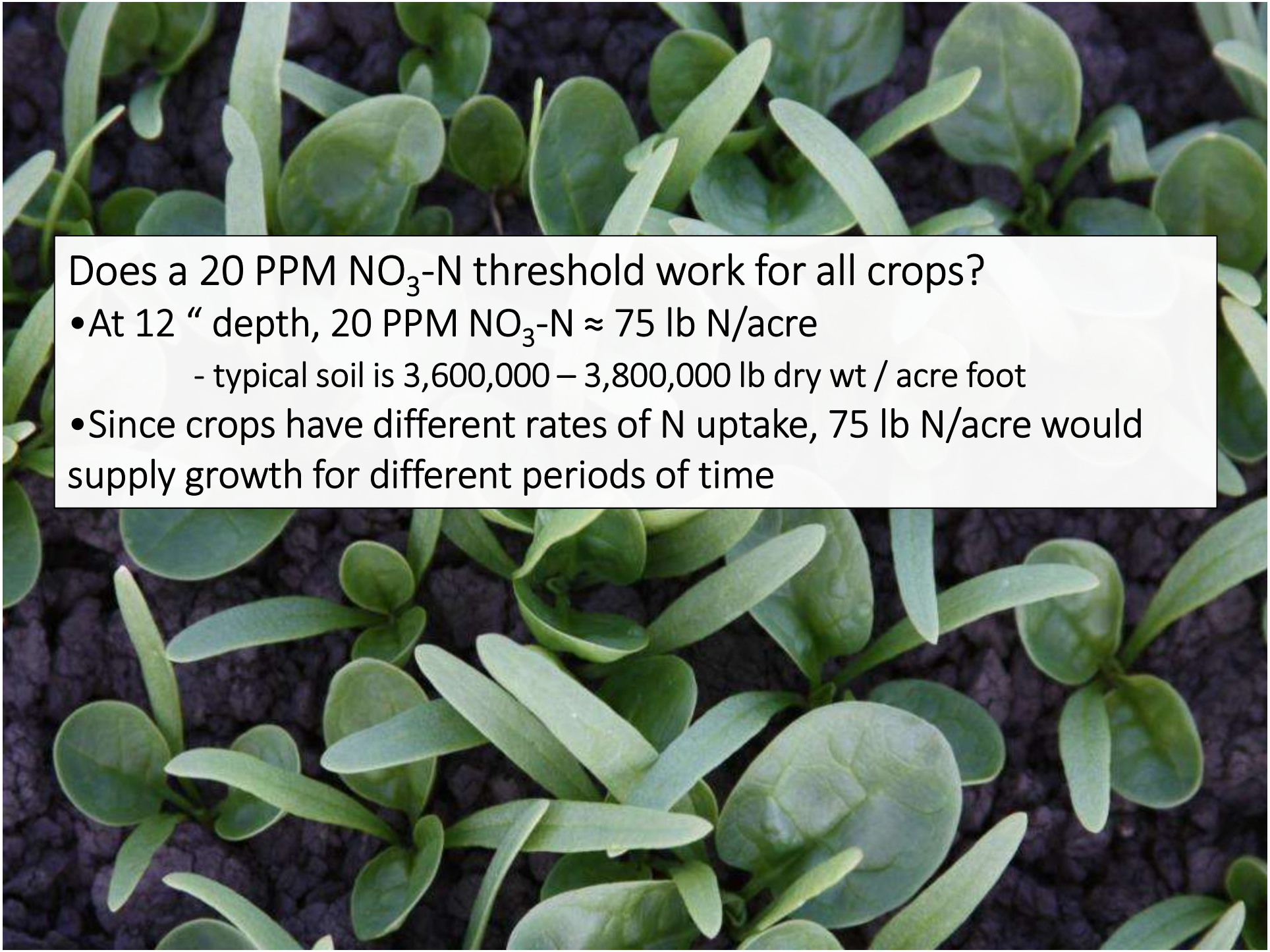




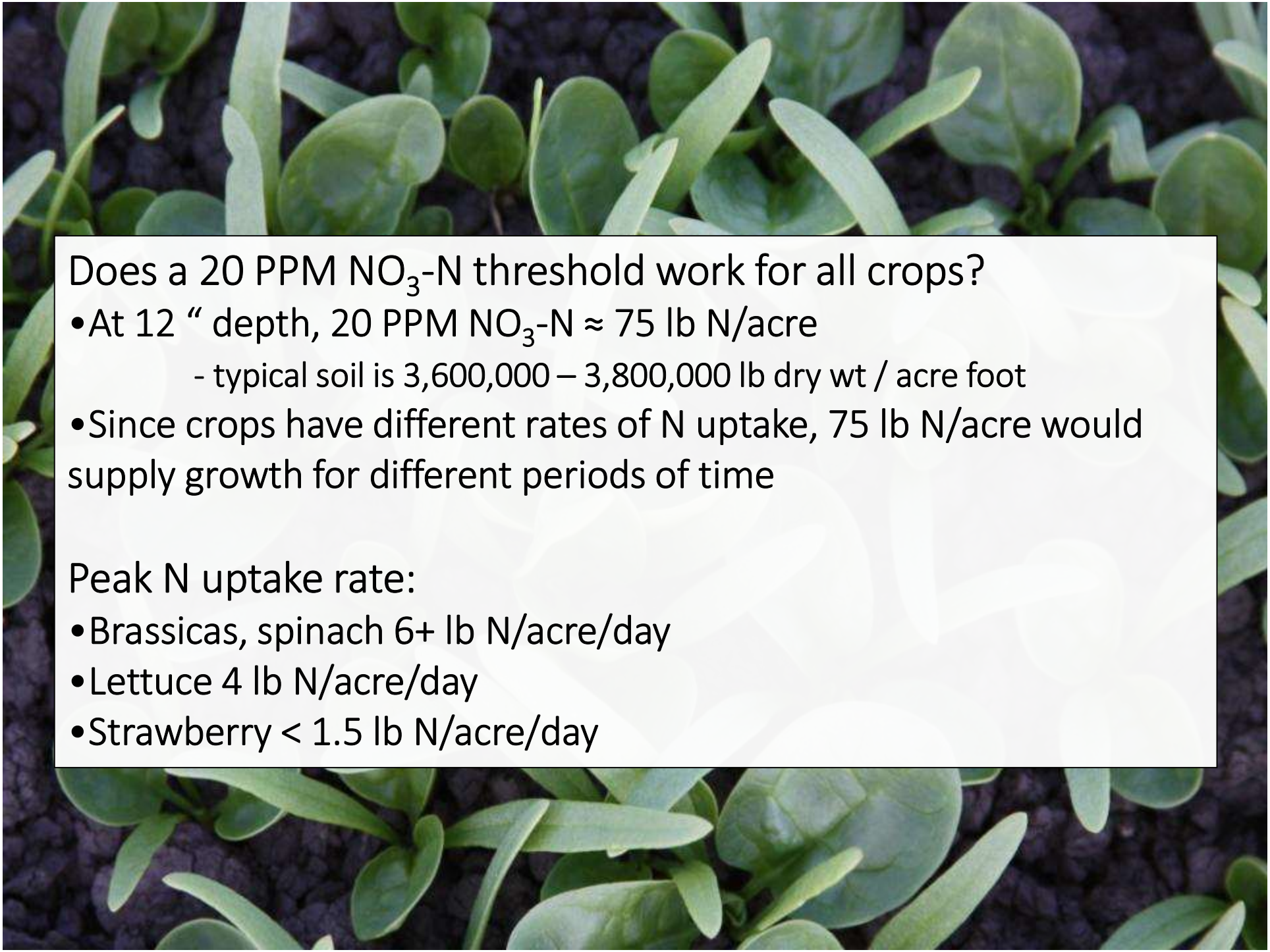
How often to soil NO_3-N test?

- At first sidedress gives the best return
- Twice on lettuce, 2-3 times on celery, broccoli and cauliflower are justifiable



Does a 20 PPM NO_3-N threshold work for all crops?

- At 12 " depth, 20 PPM NO_3-N ≈ 75 lb N/acre
  - typical soil is 3,600,000 – 3,800,000 lb dry wt / acre foot
- Since crops have different rates of N uptake, 75 lb N/acre would supply growth for different periods of time



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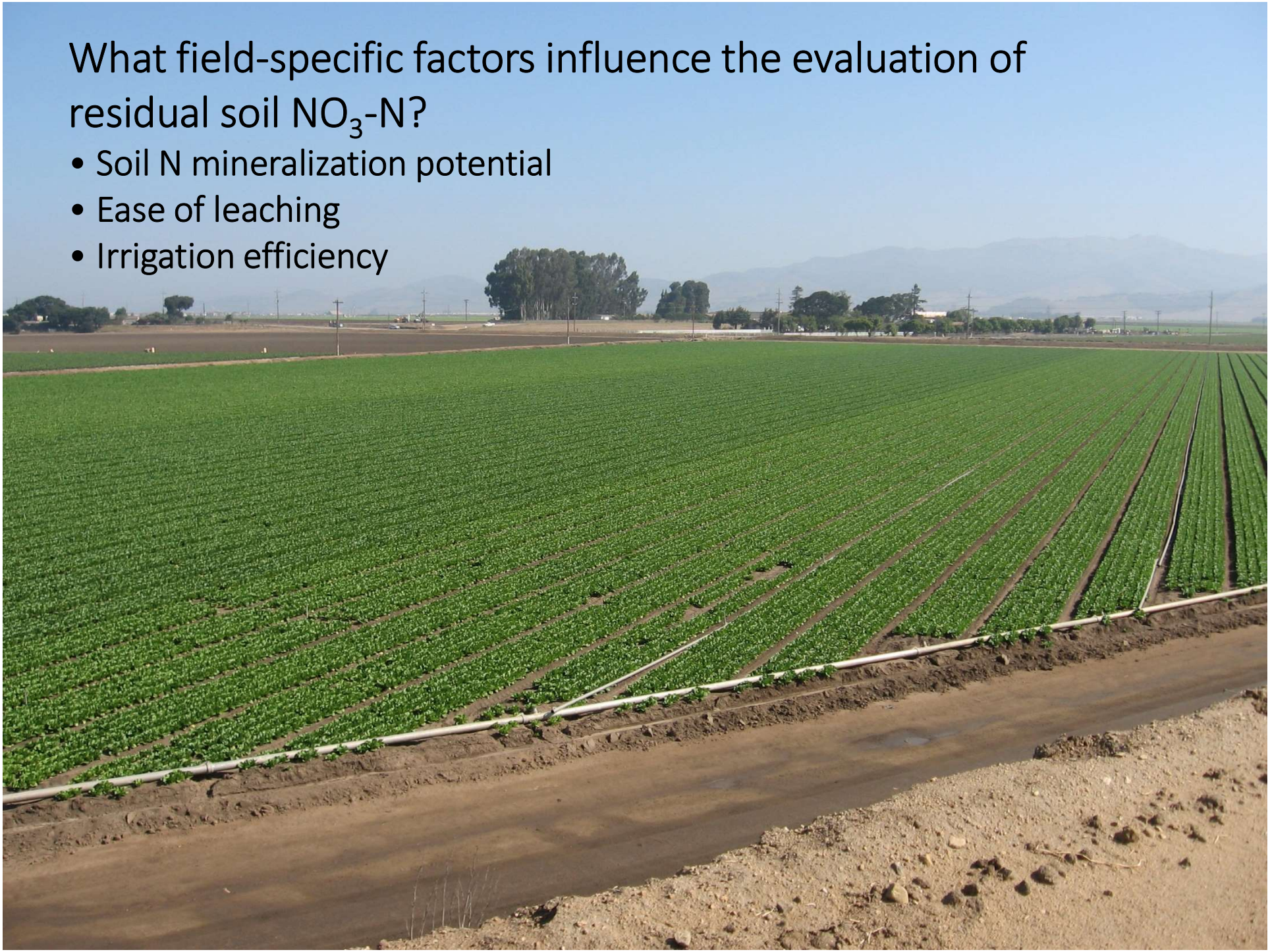
Peak N uptake rate:

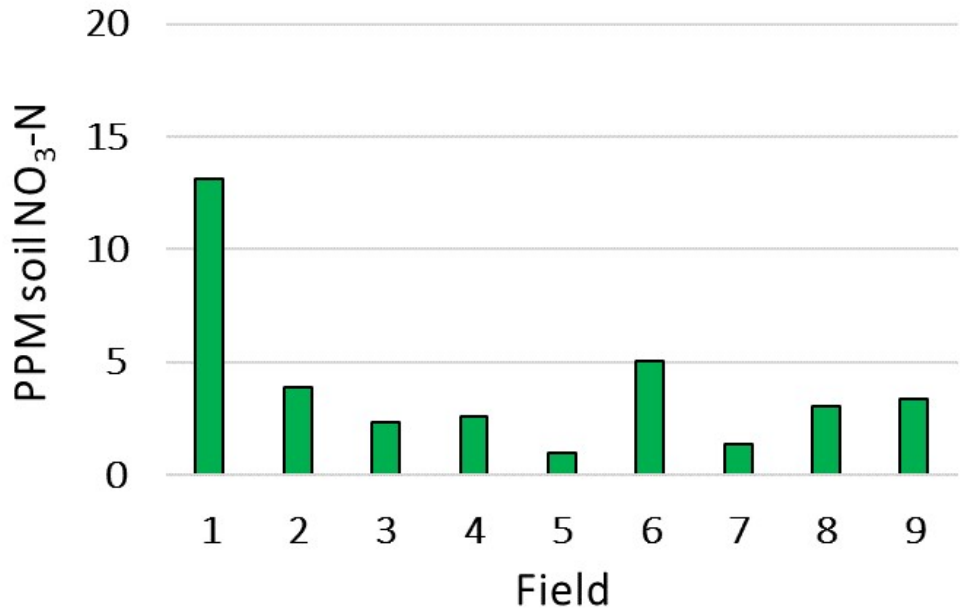
- Brassicas, spinach 6+ lb N/acre/day
- Lettuce 4 lb N/acre/day
- Strawberry < 1.5 lb N/acre/day


What field-specific factors influence the evaluation of residual soil NO_3-N?
• Soil N mineralization potential
• Ease of leaching
• Irrigation efficiency

Must 20 PPM NO_3-N be maintained through the entire crop cycle to ensure N sufficiency?

- Lettuce, celery, Brassicas can draw down to 5-10 PPM without slowing growth
- Strawberries can draw down < 5 PPM without slowing growth

Soil NO_3-N at harvest in broccoli fields, *top 2 feet*:



If soil NO_3-N is < 20 PPM do I need a full sidedress rate?

- Sidedressing to make up *the difference* is adequate

Assuming a 12” sample depth:

(20 PPM NO_3-N – PPM of soil test) x 3.7 = lb N/acre to apply

Are there crops for which in-season soil NO_3-N testing is problematic?

- Strawberries
- Baby greens

In summary:

- Soil monitoring is the basis for field-specific N fertilizer management
- Leaf N monitoring is a reliable measure of current crop N status