Nitrogen management and water quality regulation

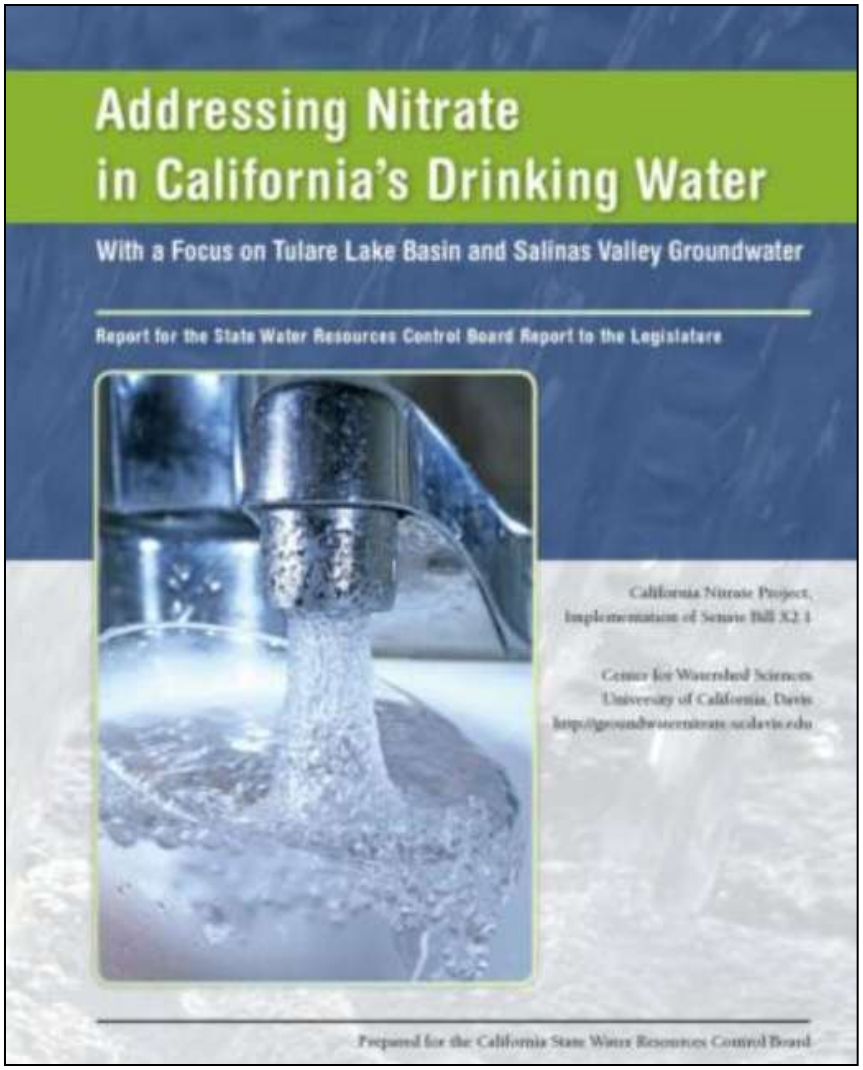
Surface runoff and tile drainage can degrade surface water quality

- **Pesticide residues**
- **Sediment**
- **Nutrients**

Conversion to drip solves the surface runoff problem …

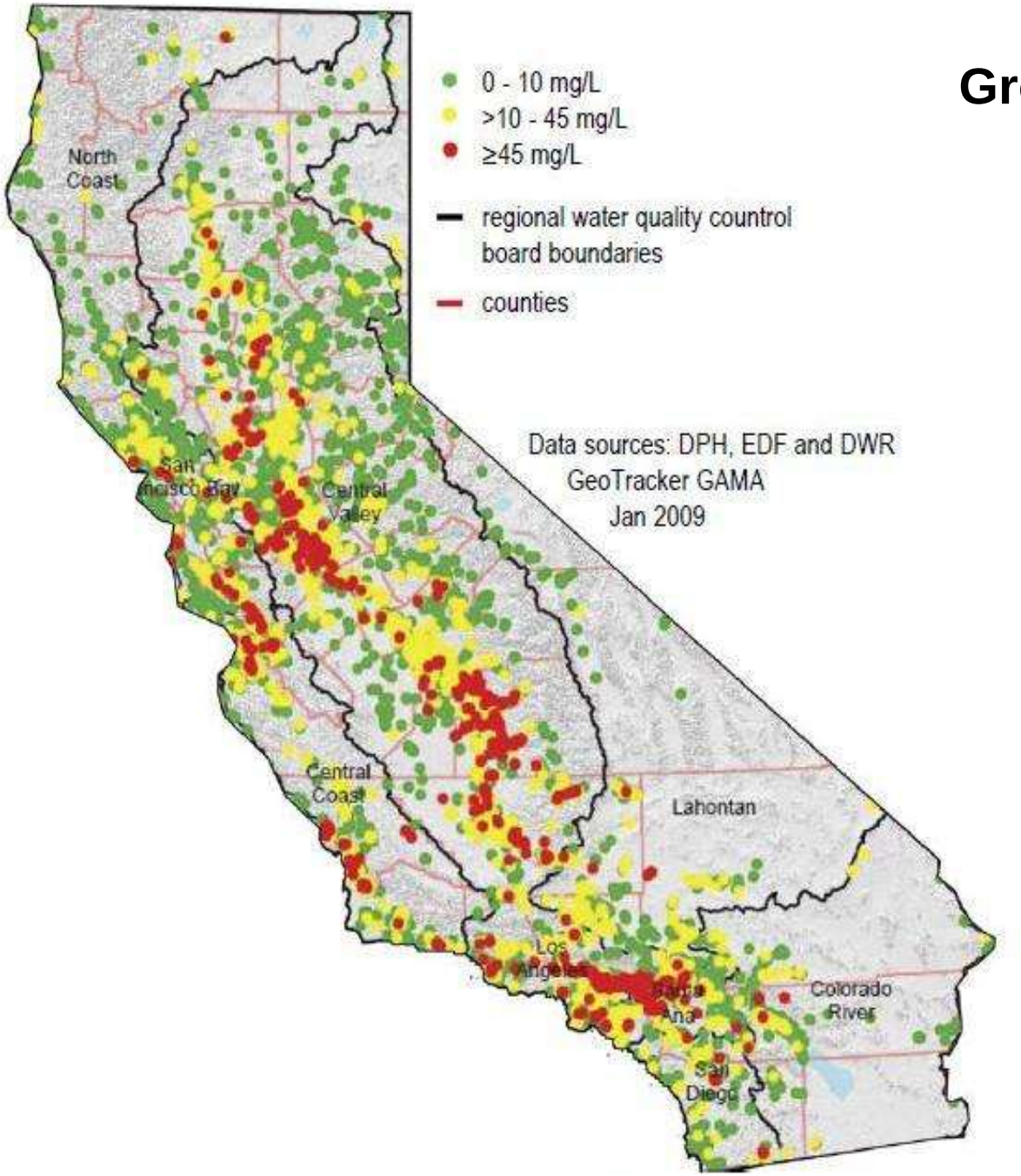
… but not the groundwater problem

Nitrate leaching to groundwater has become a hot issue :



Federal drinking water standard is 10 PPM NO_3-N (= 45 PPM $NO3^-$)

Groundwater NO_3-N :



Regional Water Quality Control Boards

Regulatory action on nitrogen management :

- **Region 5 Board imposed an N balance restriction on dairies, and is now focusing on other cropping systems**

Central Valley dairy :

- **Annual N application target of 1.4 times forage crop N uptake**

Coastal vegetable crops :

- **Proposed annual N application targets of 1.0 for vegetable crops**

First target:

(N application = crop N uptake)

Ultimate target:

(N application = harvest N removal)

What comes next ?

- **Region 5 wants data on potential groundwater loading from the major Central Valley crops**
- **Processing tomato not in the immediate line of fire, but future scrutiny is likely**

Nitrogen balance for processing tomato :

	lb N/acre
Seasonal fertilizer application	190
Crop N uptake	240
N removed with harvest	150
Application - crop uptake	- 50
Application - harvest removal	+ 40

Based on a 50 ton crop

Why focus on harvest removal ?

- N applied to the field but not removed in harvested product is viewed as at risk for eventual loss to the environment

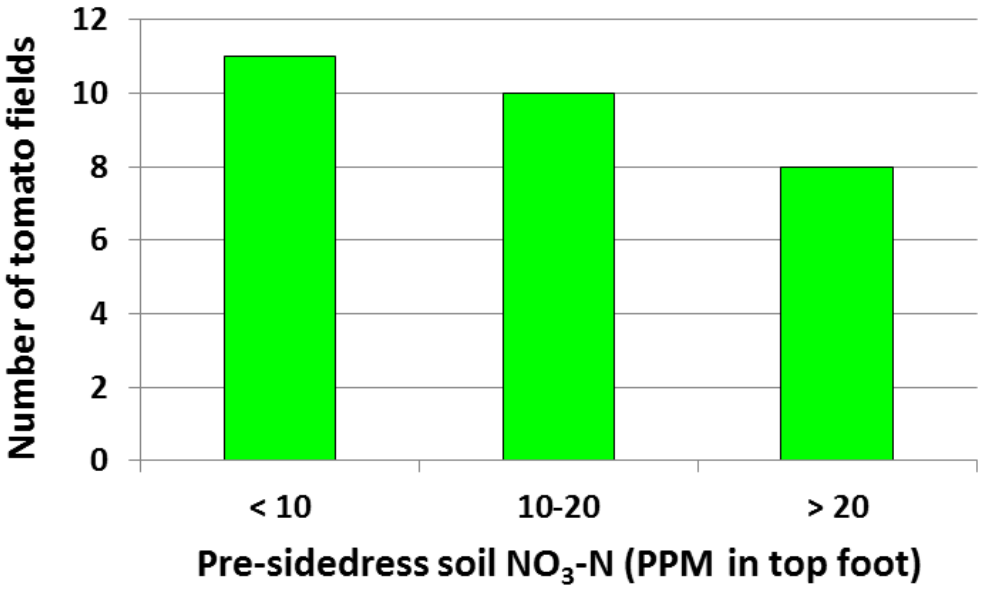
Steps to more efficient N management :

- Evaluate residual soil NO_3-N
- Credit N contribution from organic amendments
- Control in-season leaching

Evaluate residual soil NO_3-N :

- Tomato fields differ widely

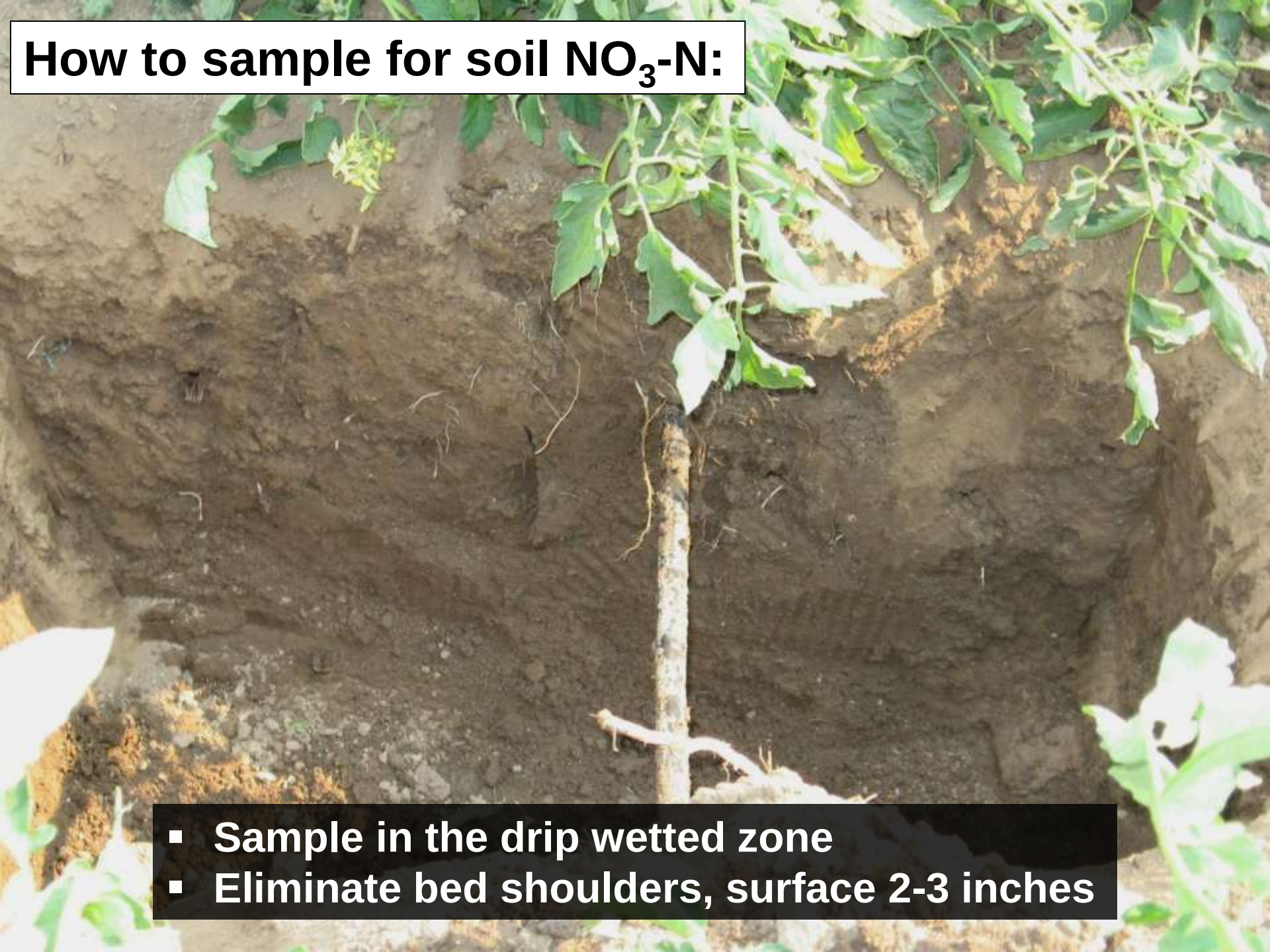
29 fields were monitored:



How to use residual soil NO_3-N to modify N application program :

- **Each PPM NO_3-N represents about 4 lb N/acre in the top foot**
- **Therefore, N credit could be *as much as* 4 lb N/acre for each PPM NO_3-N above 5 PPM**

How to sample for soil NO_3-N:



- Sample in the drip wetted zone
- Eliminate bed shoulders, surface 2-3 inches

Credit N contribution from organic amendments :

Percent of original N content likely to mineralize over the tomato growing season :

	< 2% N	> 2% N
fall applied compost *	0	0-5%
spring applied compost	0-5%	5-10%

*** N mineralization from fall to spring already represented by post-transplanting soil NO_3-N test**

Control in-season leaching :

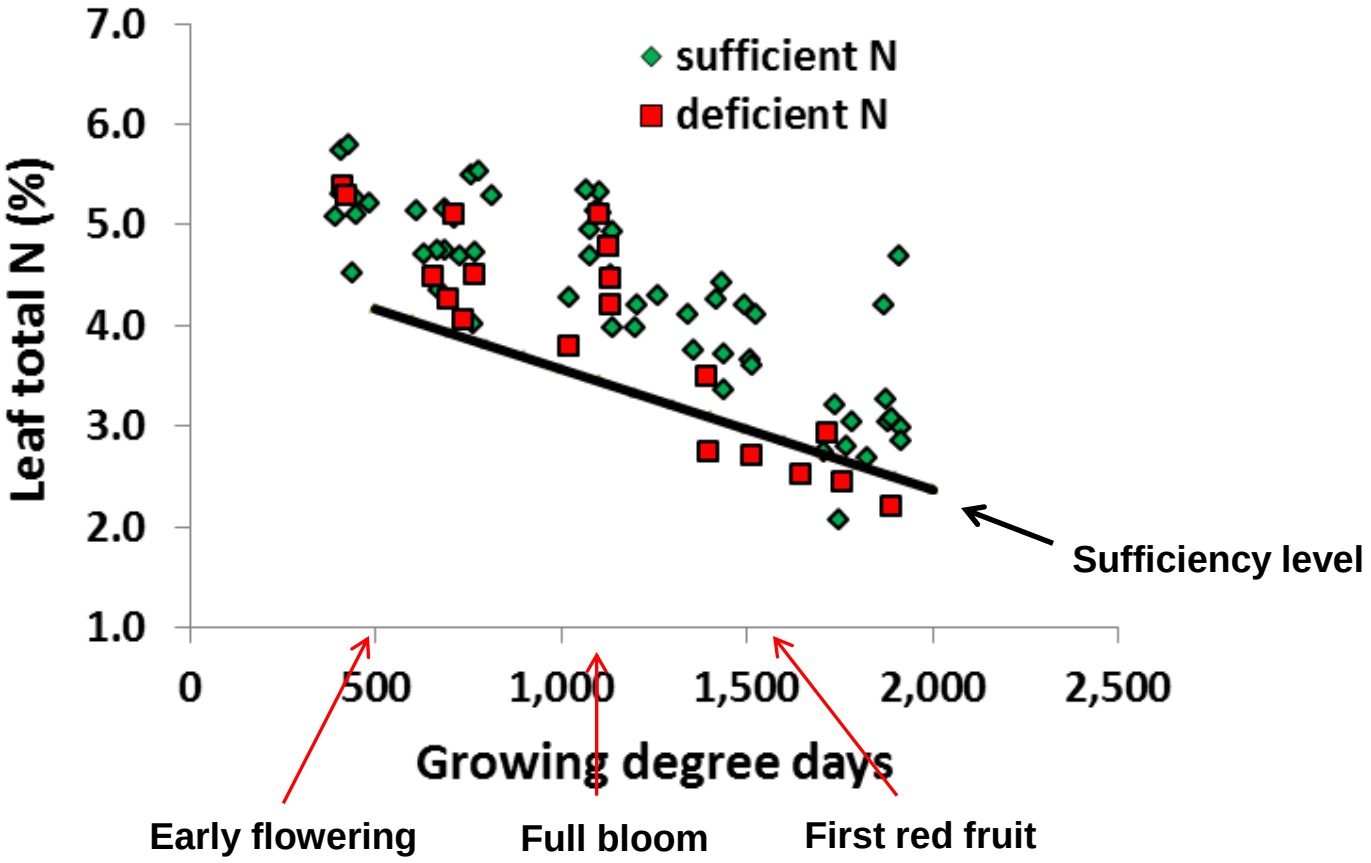
- To estimate NO_3-N concentration in leachate, multiply soil NO_3-N by 3 or 4
  Example: If root zone soil NO_3-N is 15 PPM, leachate is likely to be 40-60 PPM
- Leachate NO_3-N x 0.23 = lb N per acre-inch of leaching

In processing tomato production, NO_3-N loss is likely to be in the range of
5-15 lb N/acre inch of leaching

Can tissue analysis improve N efficiency?

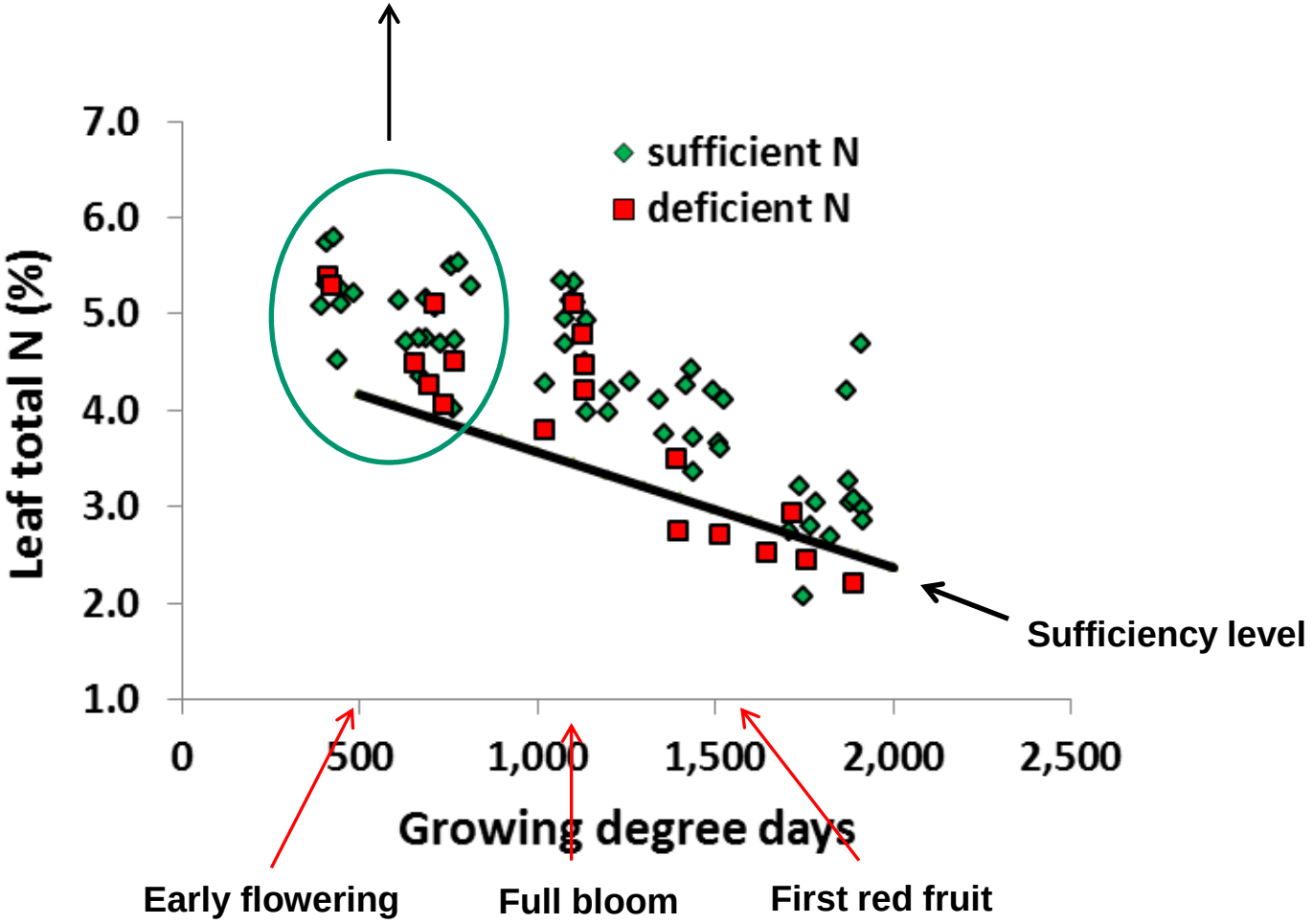
- As currently used, tissue analysis more often leads to increasing a grower's normal N fertilization program than decreasing it
- Sufficiency level for leaf total N is well established, but petiole NO_3-N sufficiency level needs review

Leaf N data from 20 fields :



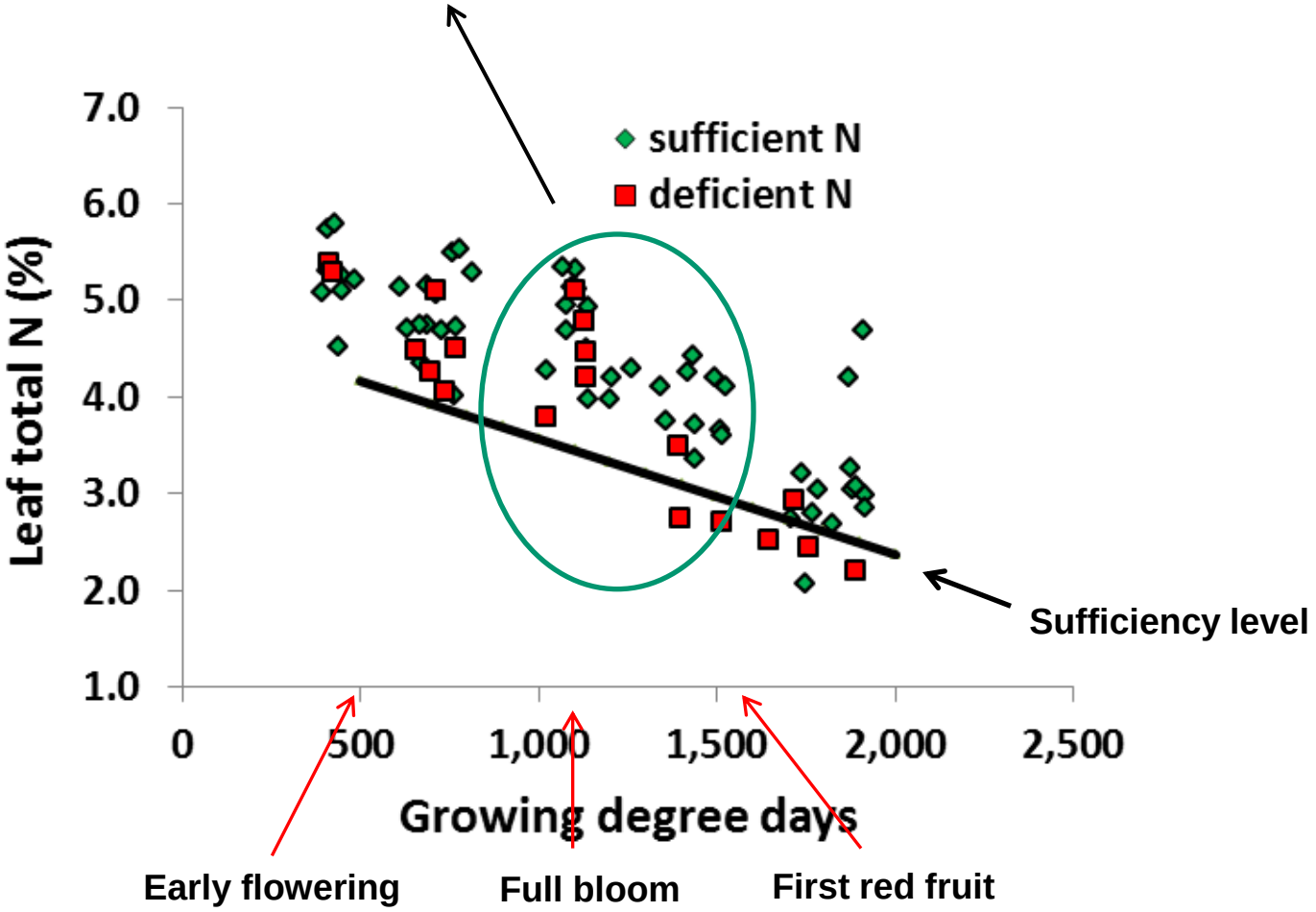
Leaf N data from 20 fields :

<u>3-7 weeks post-transplant</u>:
Very low leaf N may indicate limited soil N availability, but plant N uptake is not yet rapid enough to put a strain on soil N supply, so high values do not necessarily indicate high soil N



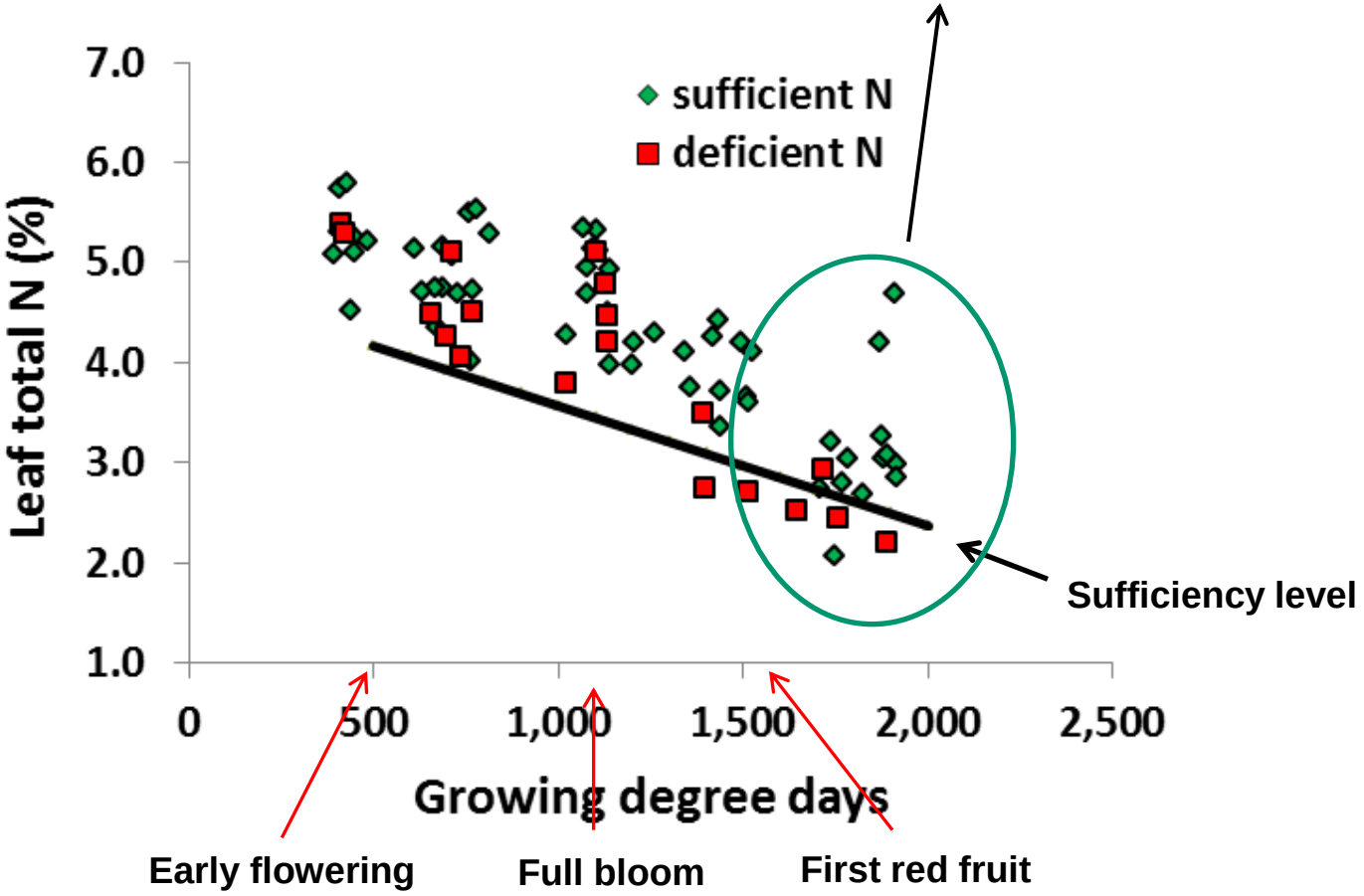
Leaf N data from 20 fields :

<u>7-11 weeks post-transplant</u>:
This is the period of peak N uptake, and leaf N can fall rapidly; by the first red fruit stage leaf N comfortably above the sufficiency level indicates that N fertigation can stop

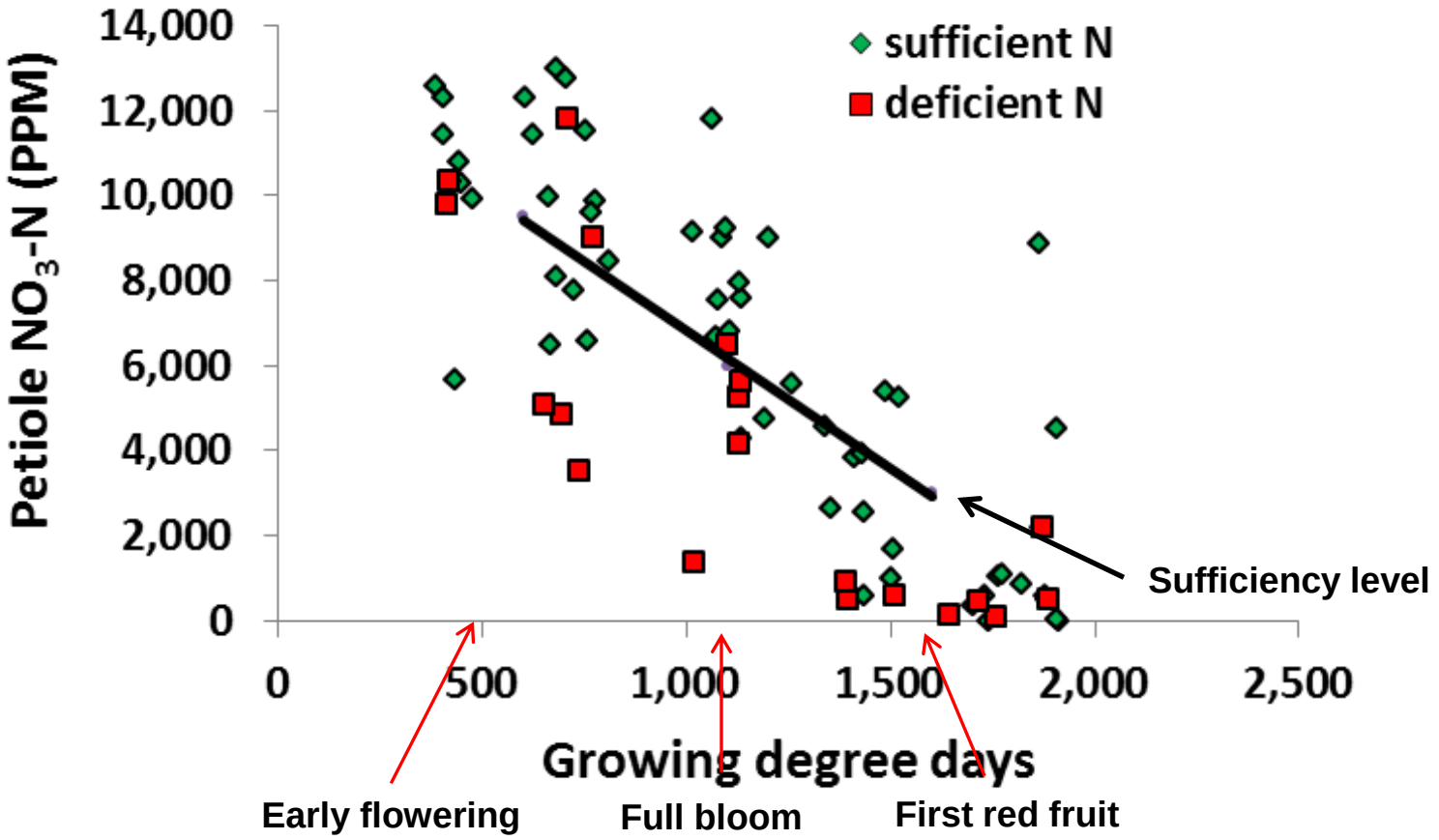


Leaf N data from 20 fields :

<u>> 11 weeks post-transplant</u>:
After first red fruit only fields with very low leaf N are candidates for continued fertigation; high leaf N at preharvest indicates excessive N application

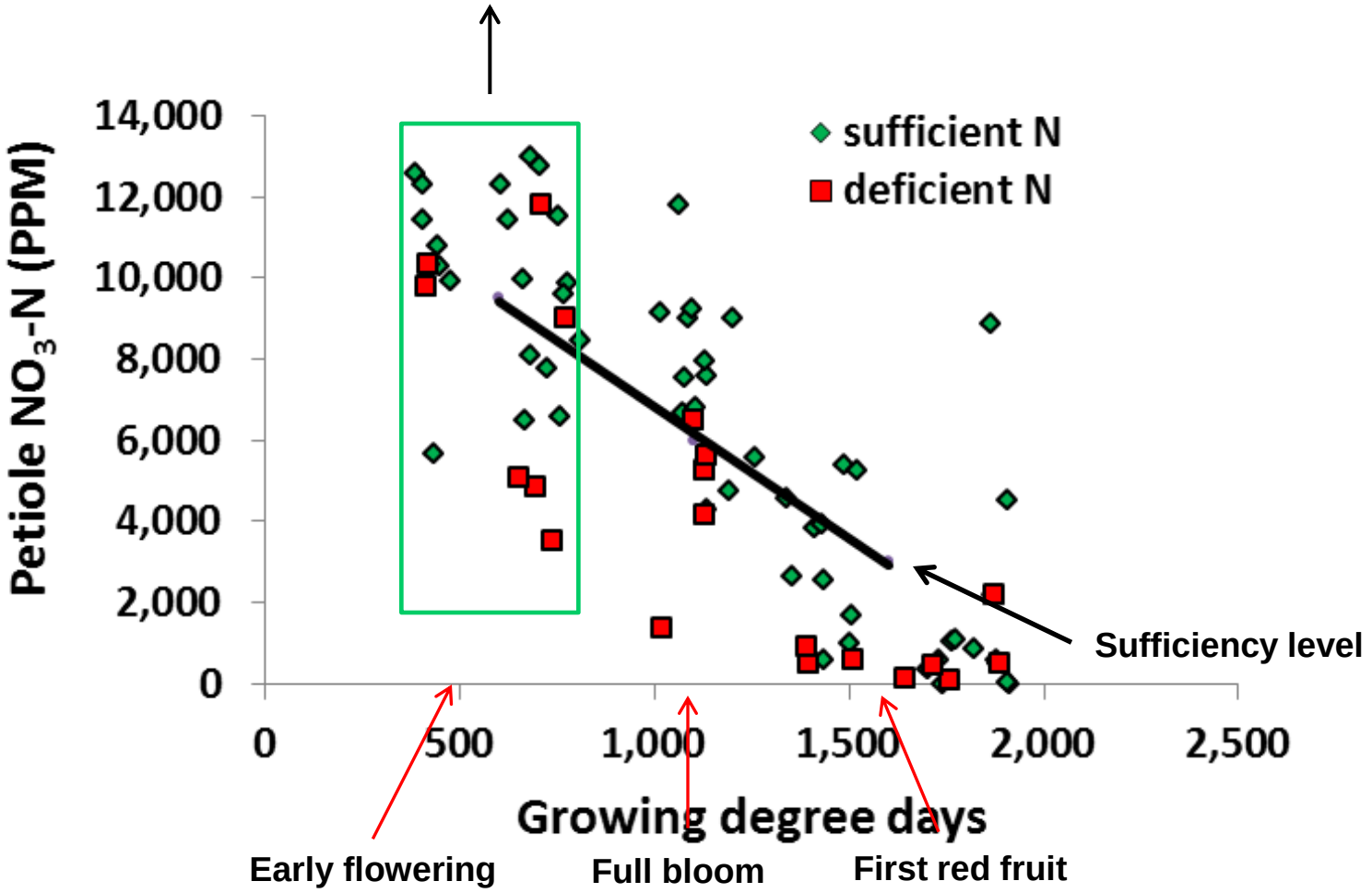


Petiole NO_3-N data from 20 fields :



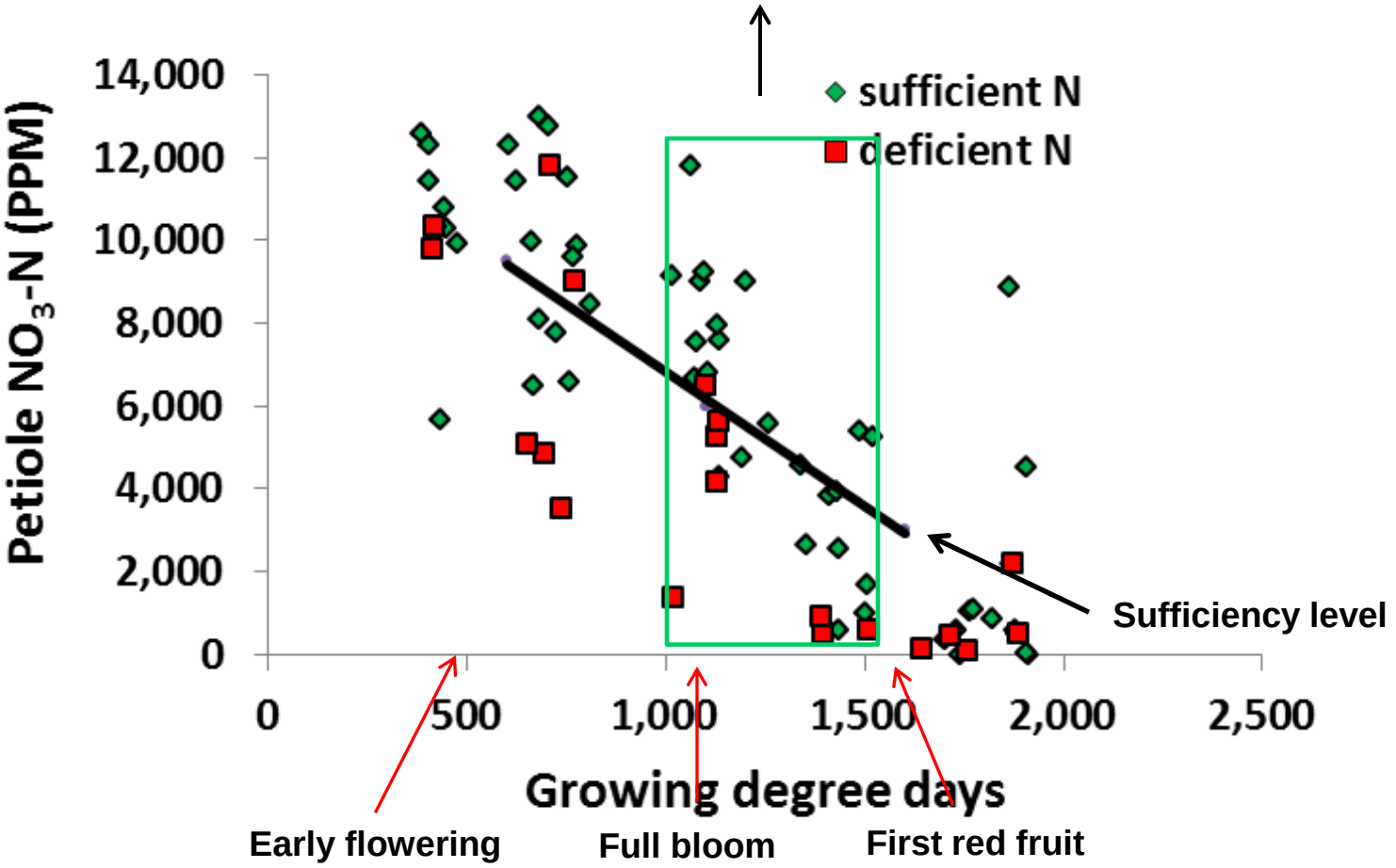
Petiole NO_3-N data from 20 fields :

<u>3-7 weeks post-transplant</u>:
Very low petiole NO_3-N early in the season indicates limited soil N availability, but in the sufficient range higher values do not necessarily indicate more soil N



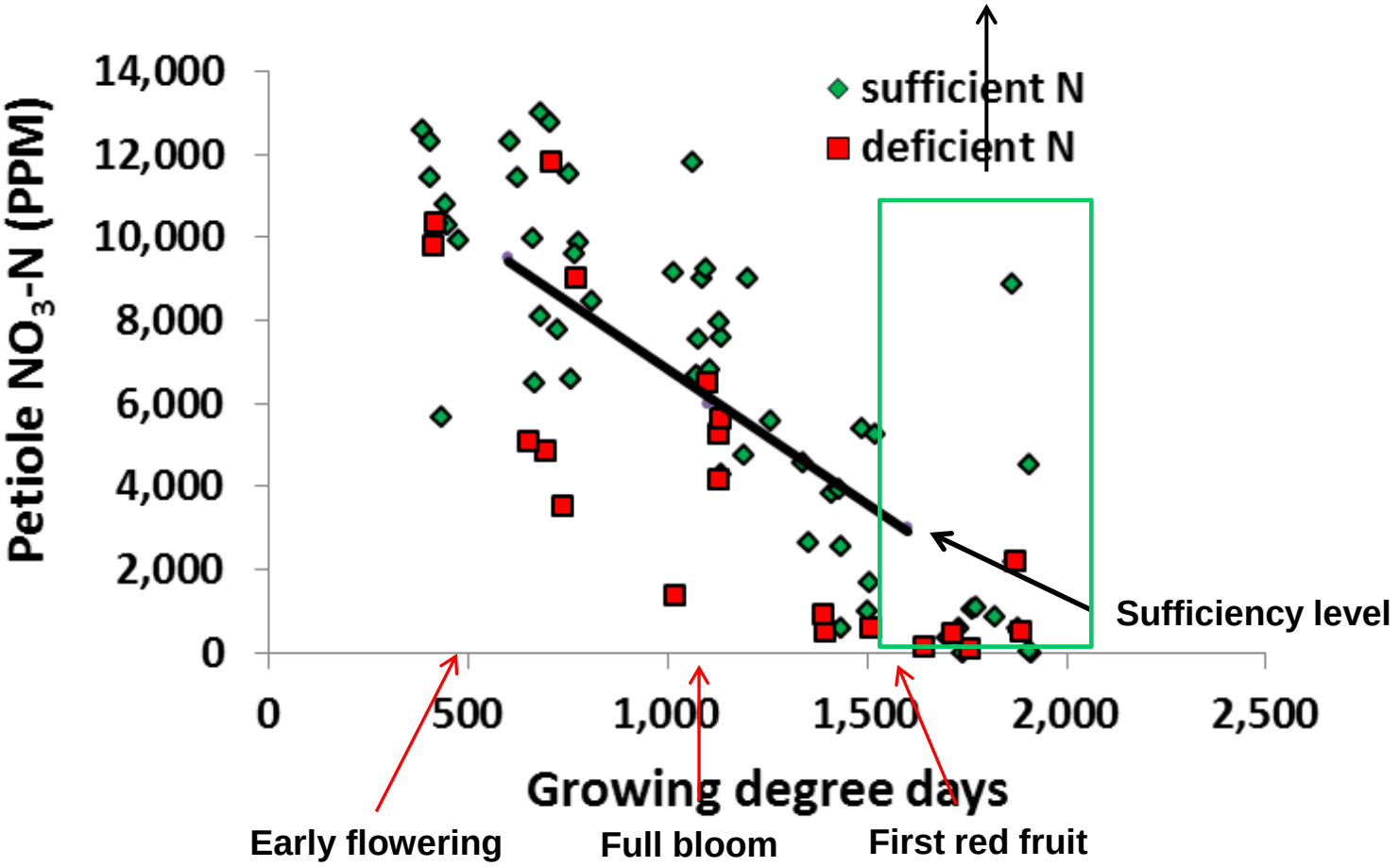
Petiole NO_3-N data from 20 fields :

<u>7-11 weeks post-transplant</u>:
Petiole values fall rapidly in this period, and it is difficult to set a sufficiency level; maintaining 4,000 PPM NO_3-N through first red fruit is not required



Petiole NO_3-N data from 20 fields :

<u>> 11 weeks post-transplant</u>:
After first red fruit the only thing that petiole analysis can tell you is whether you have applied excessive N



In summary :

- N management may draw regulatory scrutiny in the years ahead
- Fertilizer N requirement can vary widely depending on residual soil NO_3-N, and on irrigation management
- Tissue testing can document N sufficiency, but is less useful in identifying when N fertilization can be reduced