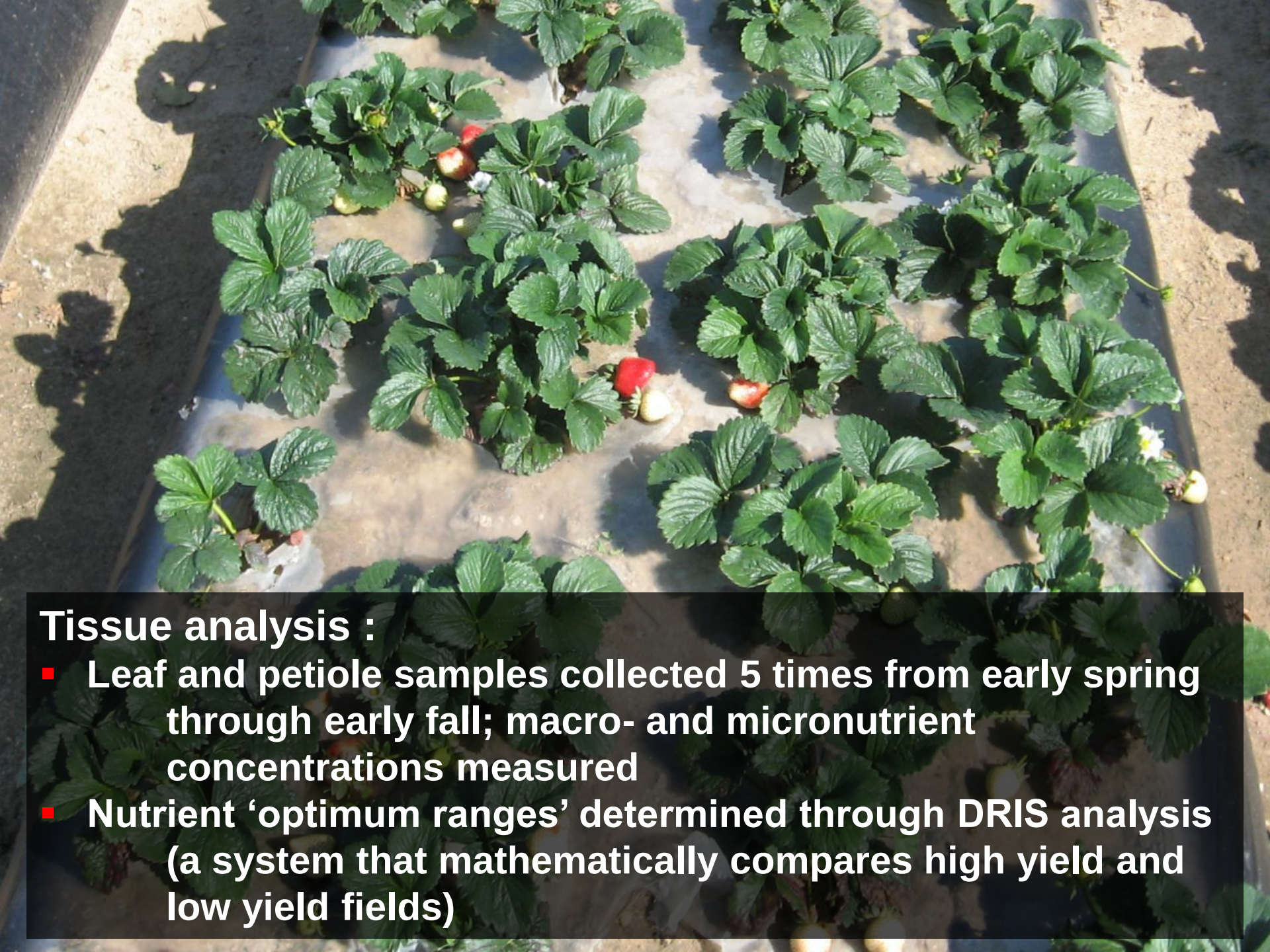
Strawberry nutrient management

Thanks to:
California Strawberry Commission
Community Foundation for Monterey County
Cooperating growers

2009-11 strawberry nutrient management projects :

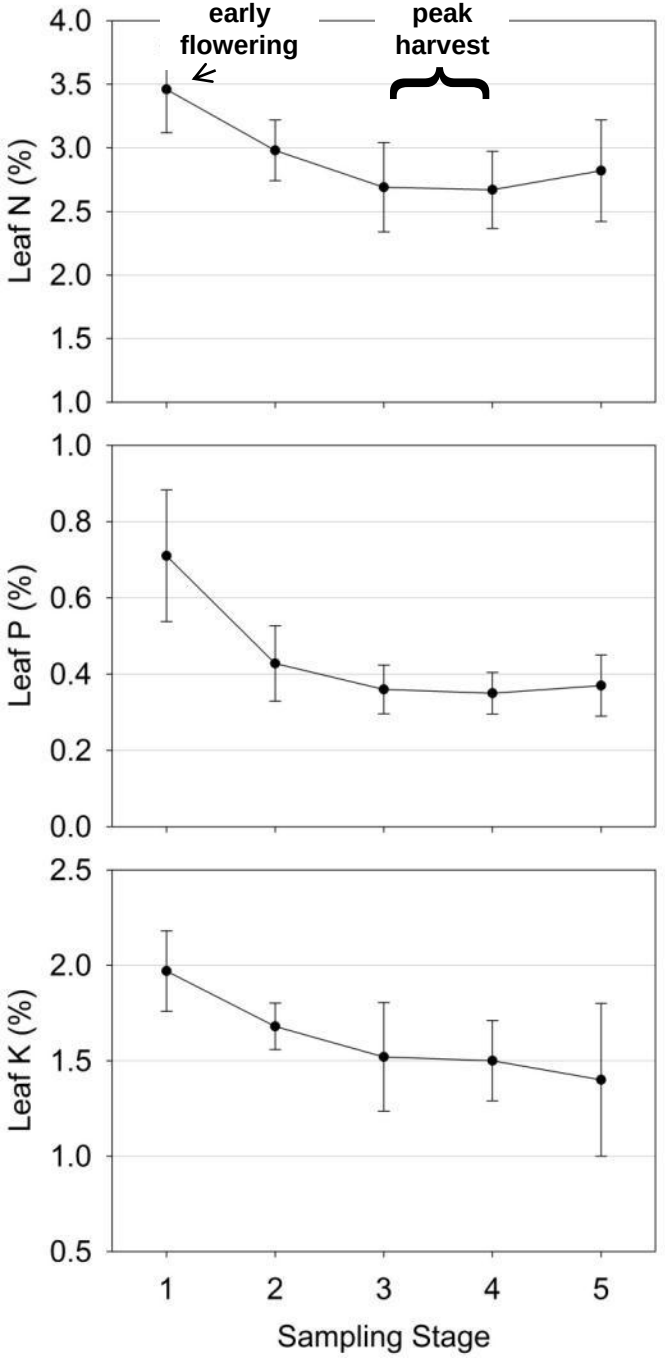
- Survey of > 50 ‘Albion’ fields in the Watsonville-Salinas and Santa Maria areas to reset leaf and petiole nutrient diagnostic levels
- Monitoring of irrigation and fertility practices in 26 fields in the Watsonville-Salinas area
- Measurement of nutrient uptake in 10 fields of day-neutral berries



Tissue analysis :

- **Leaf and petiole samples collected 5 times from early spring through early fall; macro- and micronutrient concentrations measured**
- **Nutrient ‘optimum ranges’ determined through DRIS analysis (a system that mathematically compares high yield and low yield fields)**

DRIS leaf ‘optimum ranges’ :

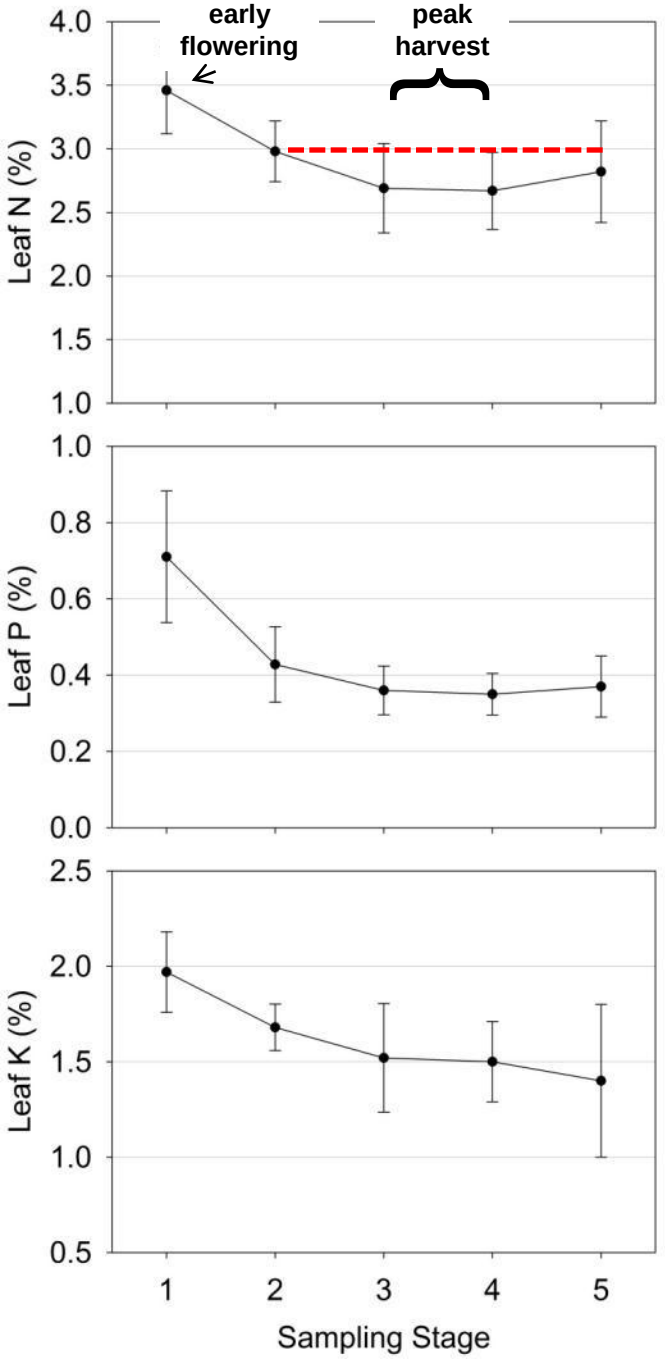


High yield, nutritionally balanced fields

DRIS leaf ‘optimum ranges’ :

- **Mid-season leaf N lower than existing UC recommendations**

---------- = Existing UC ‘critical level’

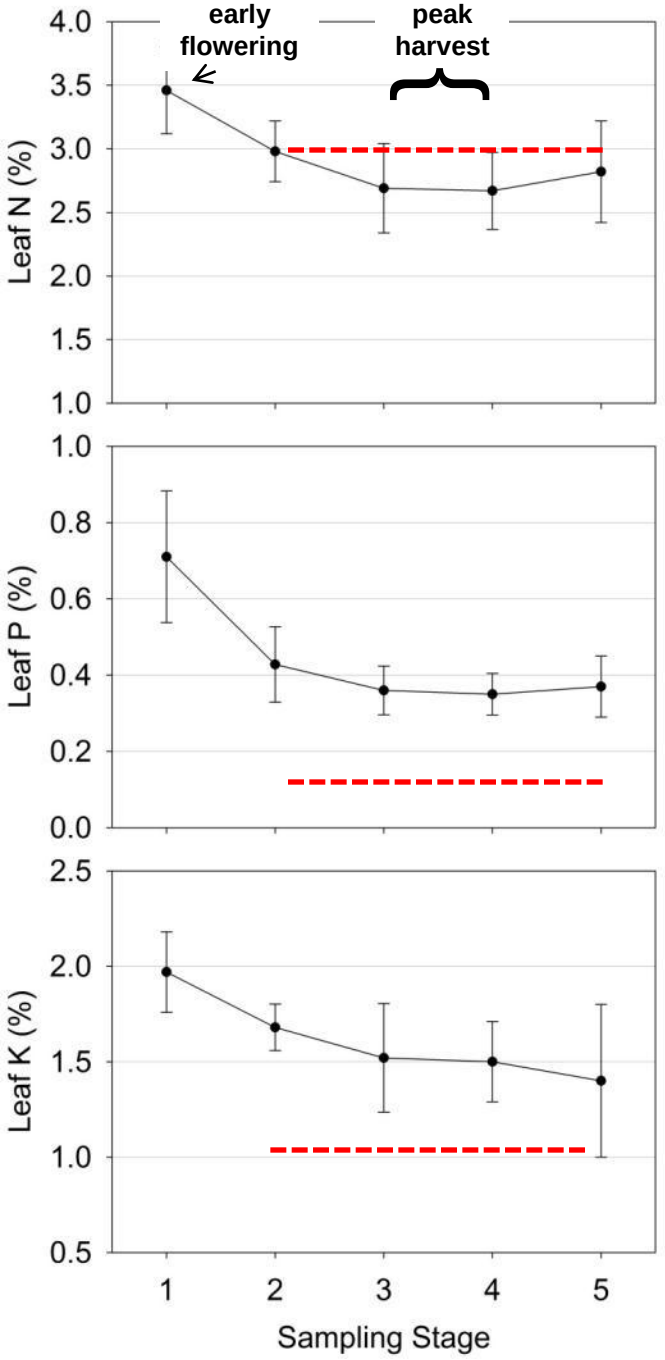


High yield, nutritionally balanced fields

DRIS leaf ‘optimum ranges’ :

- Mid-season leaf N lower than existing UC recommendations
- P and K much higher, indicates that current fertilizer rates are probably much higher than necessary

---------- = Existing UC ‘critical level’

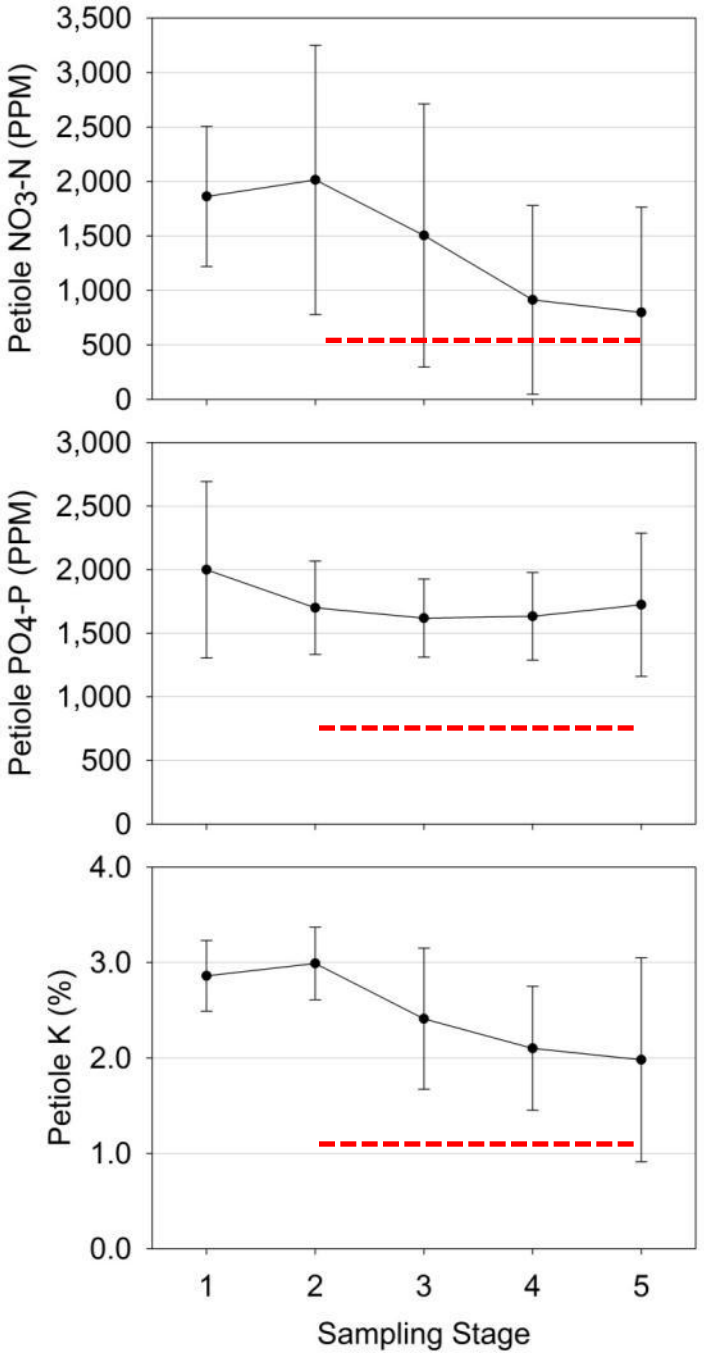


High yield, nutritionally balanced fields

DRIS petiole ‘optimum ranges’ :

- More highly variable than leaf values, especially NO_3-N
- P and K currently maintained at high levels

---------- = Existing UC ‘critical level’



High yield, nutritionally balanced fields

DRIS micronutrient ‘optimum ranges’ :

- Agree with prior UC recommendations, except for zinc

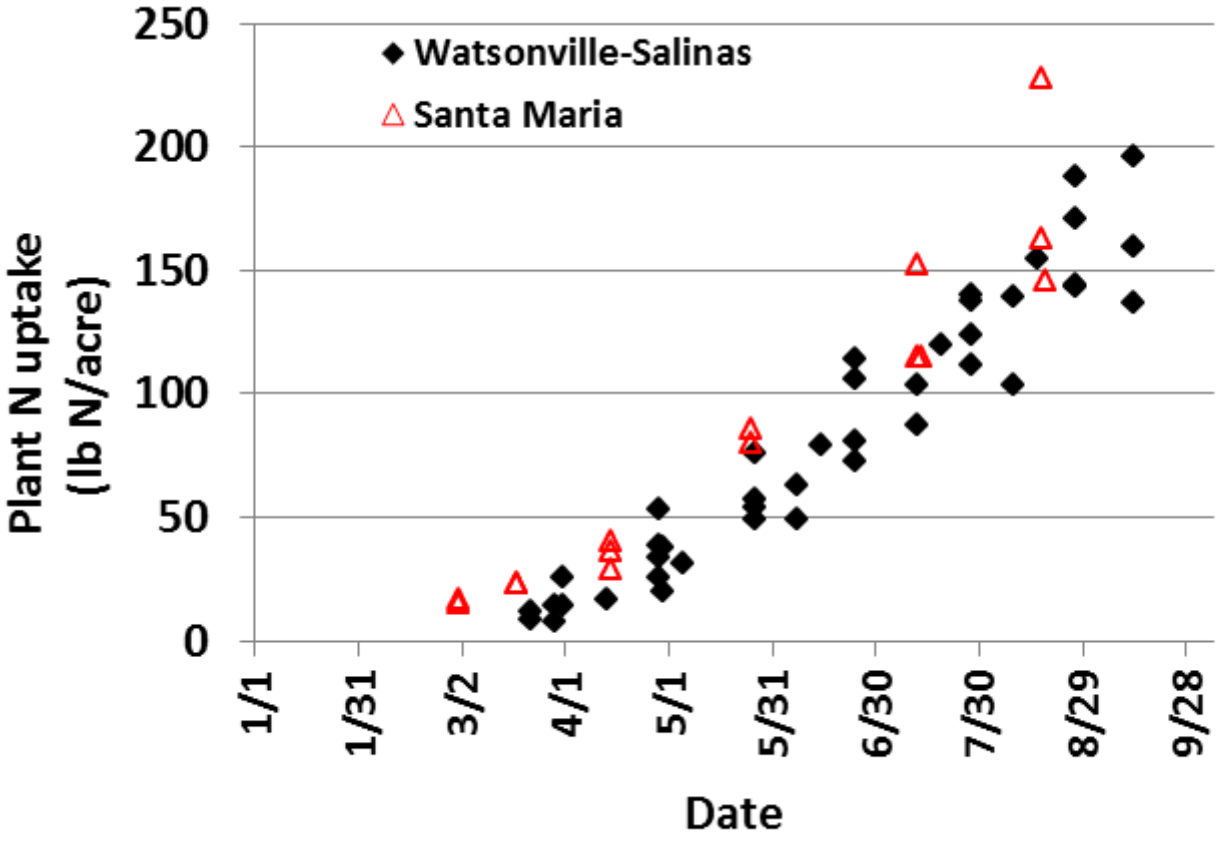
	DRIS optimum range	Prior UC recommendation
% Ca	1.0 - 2.2	0.4 - 2.7
% Mg	0.28 - 0.42	0.3 - 0.7
% S	0.15 - 0.21	> 0.10
PPM B	40 - 70	35 - 200
PPM Zn	11 - 20	20 - 50
PPM Mn	65 - 320	30 - 700
PPM Fe	85 - 200	50 - 3,000
PPM Cu	2.6 - 4.9	3 - 30

Determination of nutrient uptake by strawberry :

- **Monthly whole plant samples collected from day-neutral cultivars**
  - 7 fields in Watsonville-Salinas, 3 in Santa Maria

- **nutrient uptake in fruit estimated from commercial yield and fruit nutrient concentration**

Nitrogen uptake by a strawberry crop :



- strawberries have limited N uptake until fruiting starts; by first harvest, cumulative crop N uptake typically about 30 lb / acre
- from that point forward, N uptake averages about 1 lb / acre / day
- over the season, total crop N uptake approximately 180-240 lb / acre (including runners, roots and cull fruit)

Approximate N / P / K uptake for a 30 ton/acre crop :

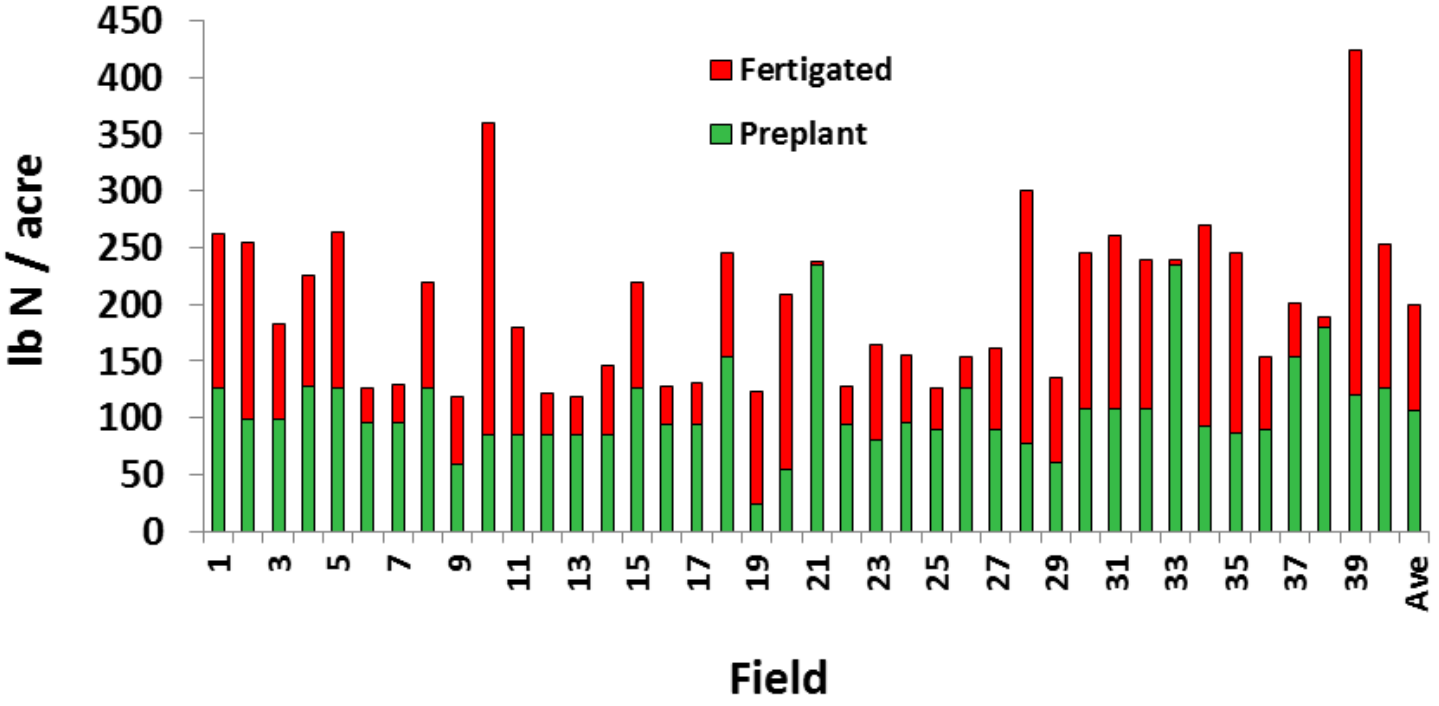
	Crop uptake (pounds/acre)		
	N	P	K
Plant	110	20	90
Fruit	90	20	140
Total	200	40	230

Each ton of fruit contains approximately:

- 2.5 lb N
- 4.0 lb K
- 0.6 lb P

Fertilization practices :

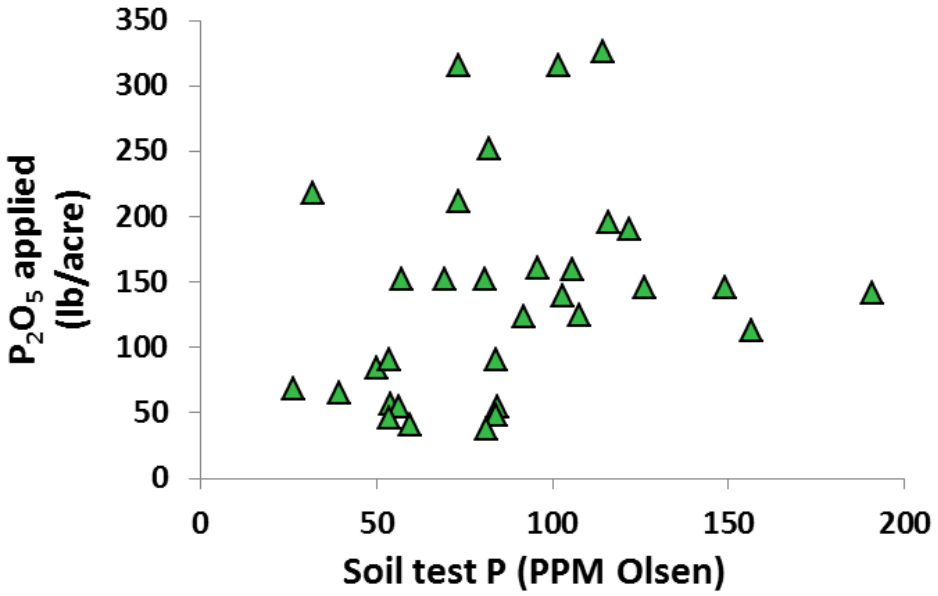
40 commercial fields in Watsonville-Salinas and Santa Maria

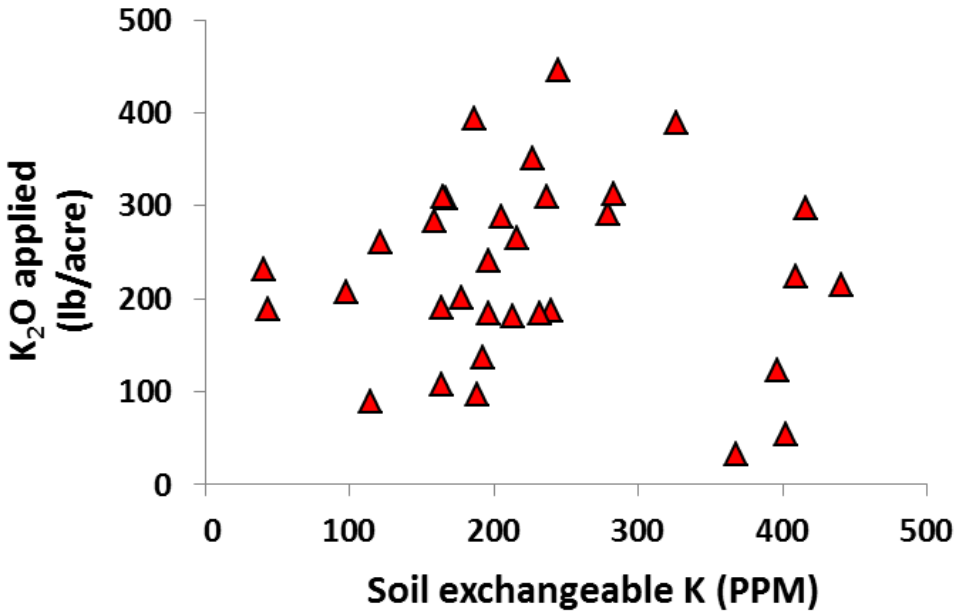


	Ave	Min	Max
Preplant	106	24	234
Fertigated	93	3	304
Total	200	118	424

How about P and K ?

- **Soil tests are not guiding fertilization decisions**

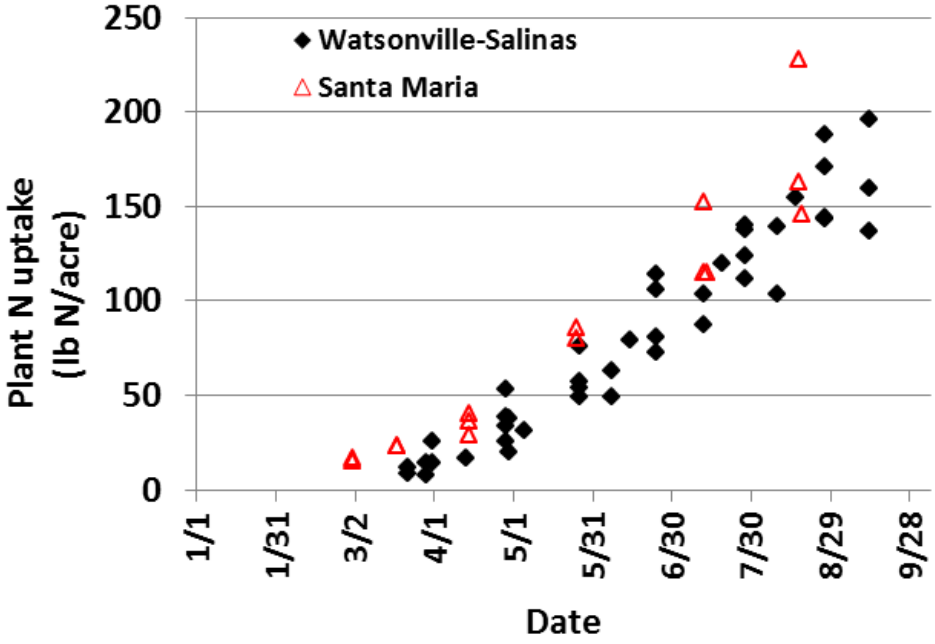




Preplant fertilization :

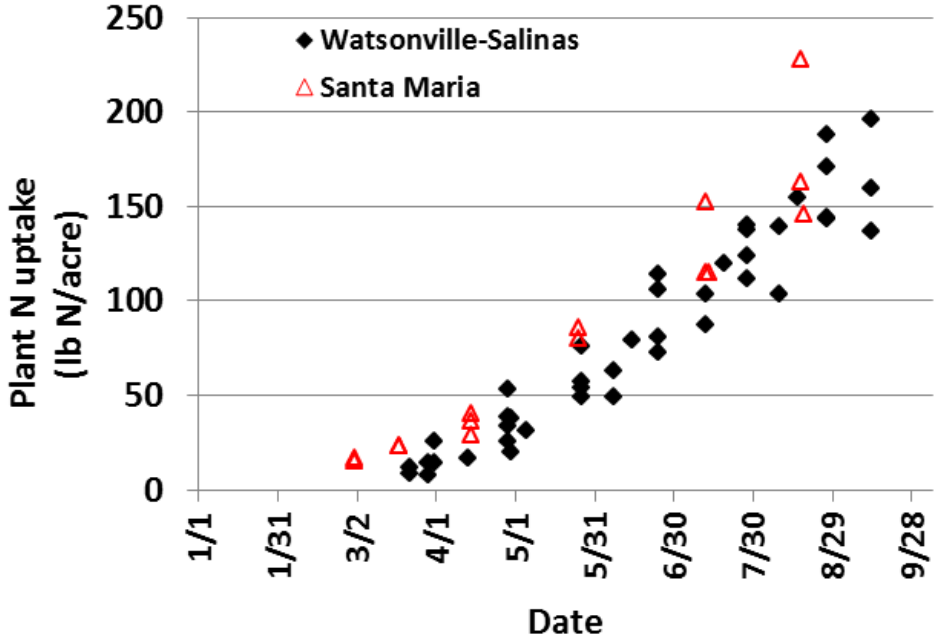
- **how to handle controlled release fertilizer (CRF) ?**
  - **what release characteristic best fits the plant uptake ?**
  - **how much preplant vs. in-season fertigation ?**

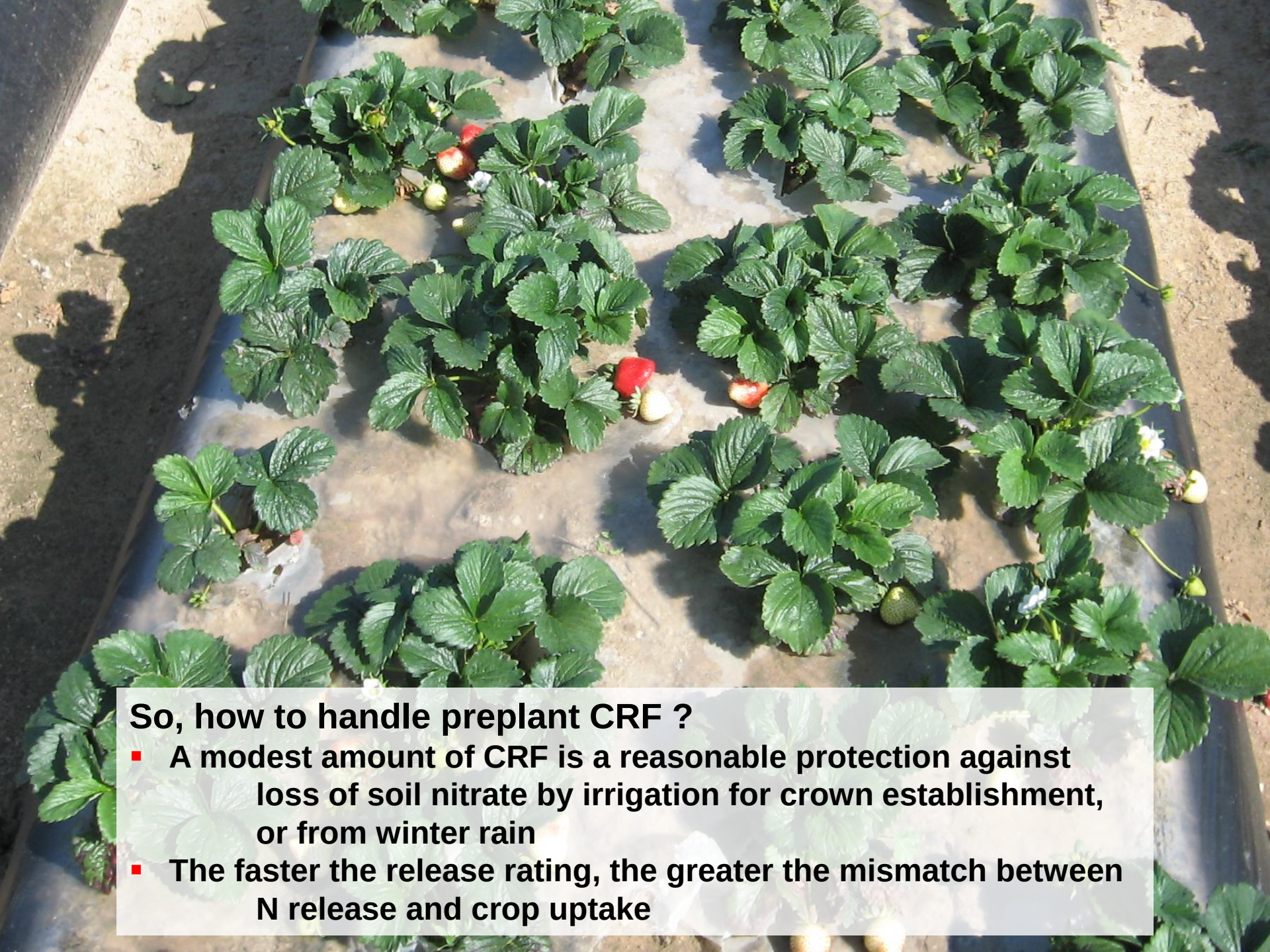
- **Manufacturers' CRN release ratings are pretty good estimates of field behavior**
- **Soil temperature affects release rate (Sept - Oct release higher than Jan - Feb)**
- **There is an unavoidable mismatch in CRF N release and strawberry N uptake**



Example:

- **An 6-8 month release product applied at 150 lb N / acre in mid-September will likely have released *at least* half the N by mid January**
- **Crop uptake by mid January likely to be no more than 30-40 lb N/acre**



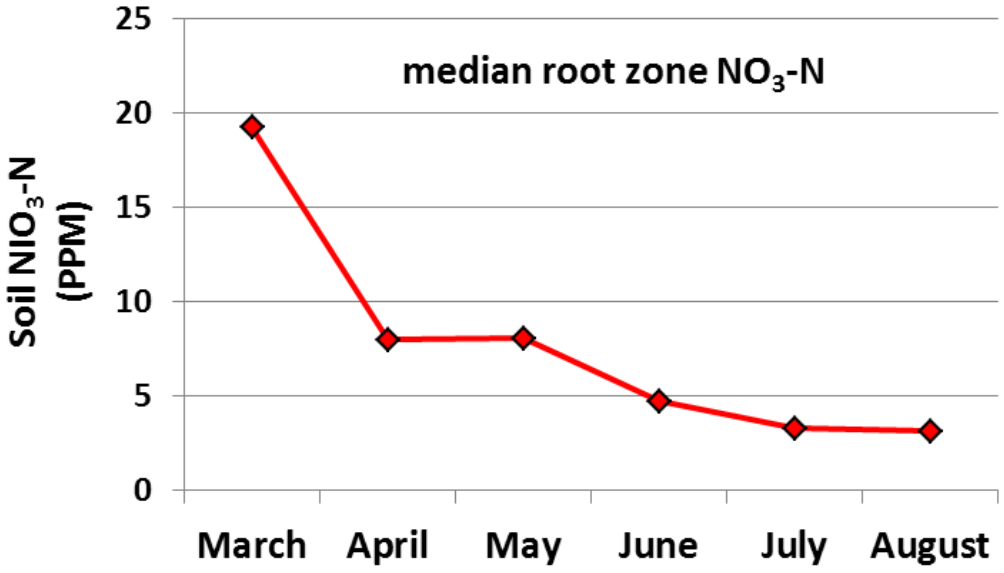


So, how to handle preplant CRF ?

- A modest amount of CRF is a reasonable protection against loss of soil nitrate by irrigation for crown establishment, or from winter rain
- The faster the release rating, the greater the mismatch between N release and crop uptake

How to handle fertigation ?

- Once fruit harvest begins, crop N uptake is quite consistent, so fertigation should be as well
- Because berry N uptake is slow, a large soil nitrate reserve is not needed
  - the majority of monitored berry fields were maintained at < 10 PPM soil NO_3-N during the harvest season



In summary :

- updated strawberry tissue nutrient diagnostic levels are now available
- strawberry nutrient uptake pattern is clear and dependable
- Potential for NO_3-N leaching loss is greatest during the winter