Potassium in Vegetable Production: Soil Fertility and Plant Nutrition Aspects

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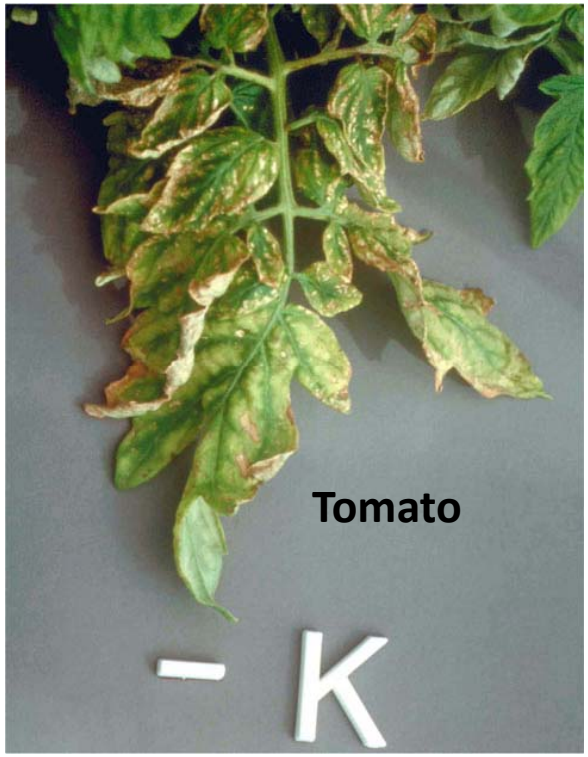
Winegrapes (Bloom petiole: 0.68% K)

K deficient weed



Lettuce

Cotton

Tomato – color disorder of fruit

Corn

Topics today

- K soil test interpretation
- Rates of K fertilization
- Soil K fixation
- K leaching, movement in soil

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Generic soil test interpretation

(ammonium acetate extraction)

- **< 100 PPM = response likely for many crops**
- **100–200 PPM = response possible for high K demand crops** (Examples: alfalfa, tomato)
- **200–300 PPM = yield or quality response possible for high K demand crops under certain conditions** (Example: tomato in high CEC soil, fruit color response more likely than yield response)
- **> 300 PPM = no response likely; K fertilization encourages luxury consumption**

Source: T. Hartz

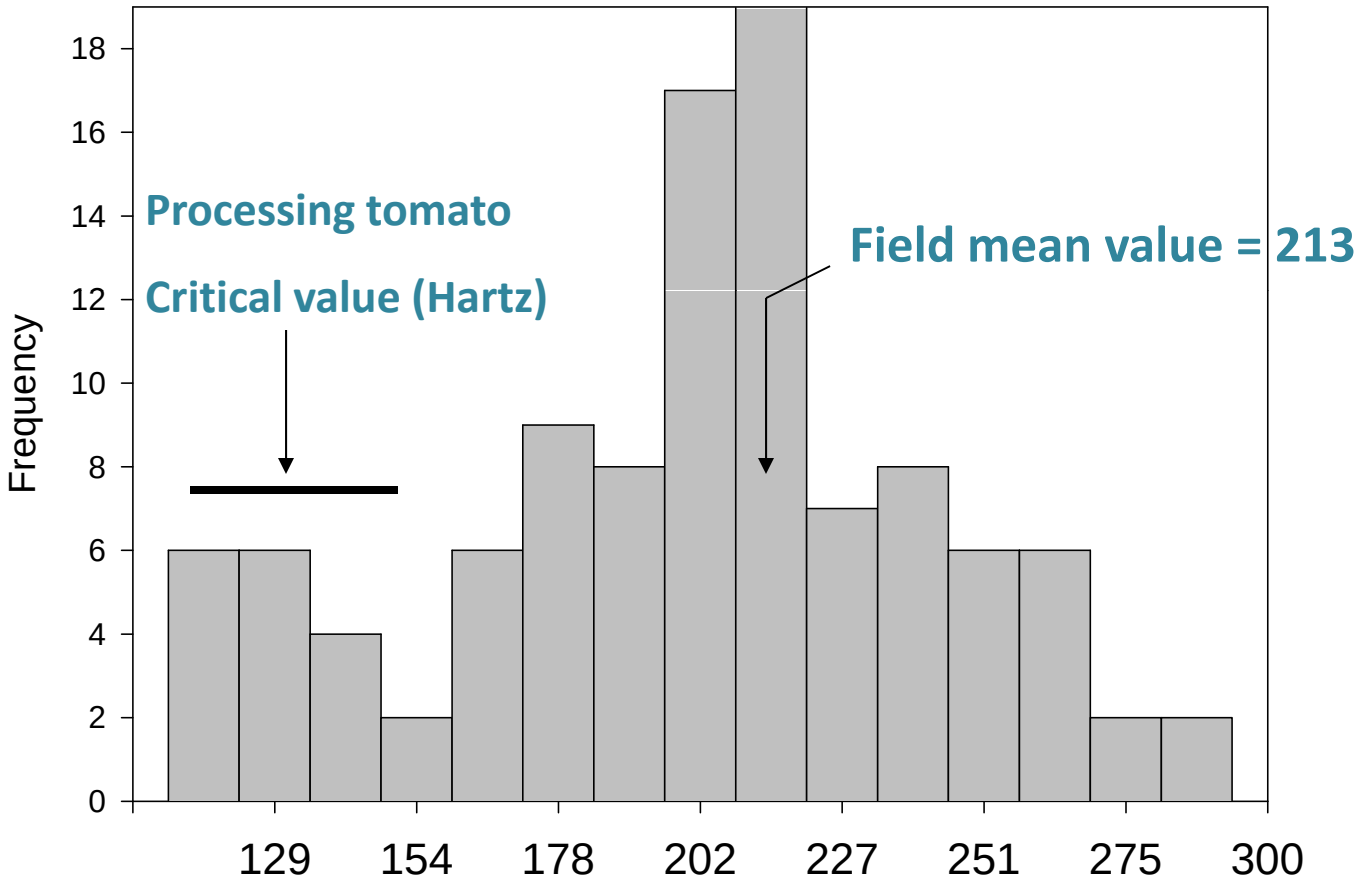
Soil Type	Soil K Test ppm
Chualar Loam	182
Metz loamy sand	112
Metz loamy sand	182
Gary sandy loam	147
Cropley clay	419
Mocho silty clay	317
Salinas clay loam	500
Sorrento clay loam	424
Chualar sandy loam	370
Clear lake clay	496
Salinas loam	217
Antioch sandy loam	171
Sorrento clay loam	346
Sorrento clay loam	261
Mean	**296**

Source: 2010 UCCE survey of Central Coast Soils

Soil Type	Soil K Test ppm	Soil K Test % of CEC
Chualar Loam	182	3.2
Metz loamy sand	112	3.7
Metz loamy sand	182	2.7
Gary sandy loam	147	2.0
Cropley clay	419	3.1
Mocho silty clay	317	2.3
Salinas clay loam	500	3.8
Sorrento clay loam	424	3.7
Chualar sandy loam	370	7.9
Clear lake clay	496	3.6
Salinas loam	217	2.6
Antioch sandy loam	171	1.6
Sorrento clay loam	346	3.5
Sorrento clay loam	261	2.0
Mean	**296**	**3.3**

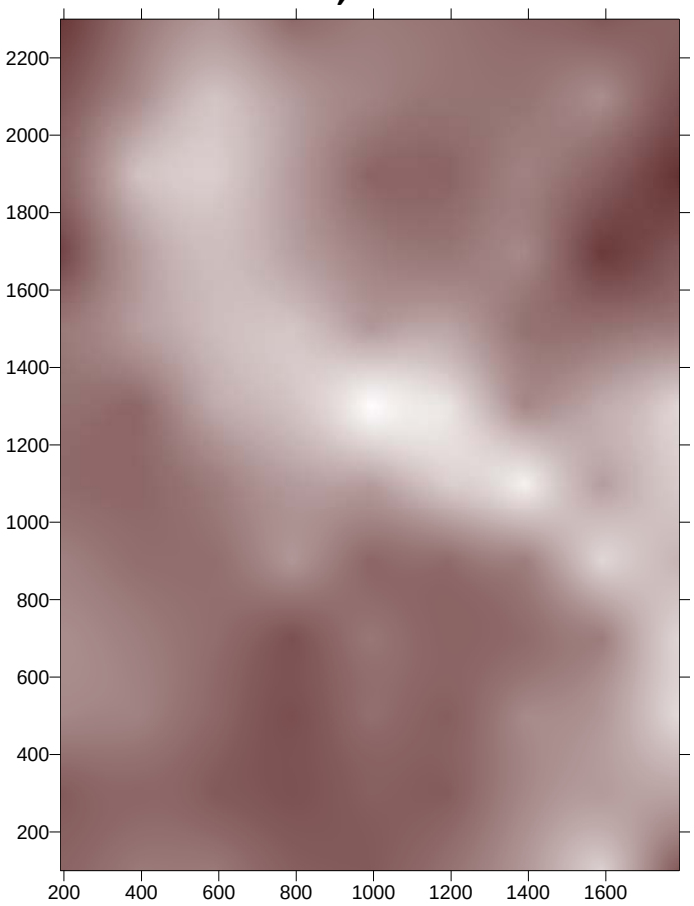
Source: 2010 UCCE survey of Central Coast Soils

Soil test K (ppm) distribution in 108-acre field

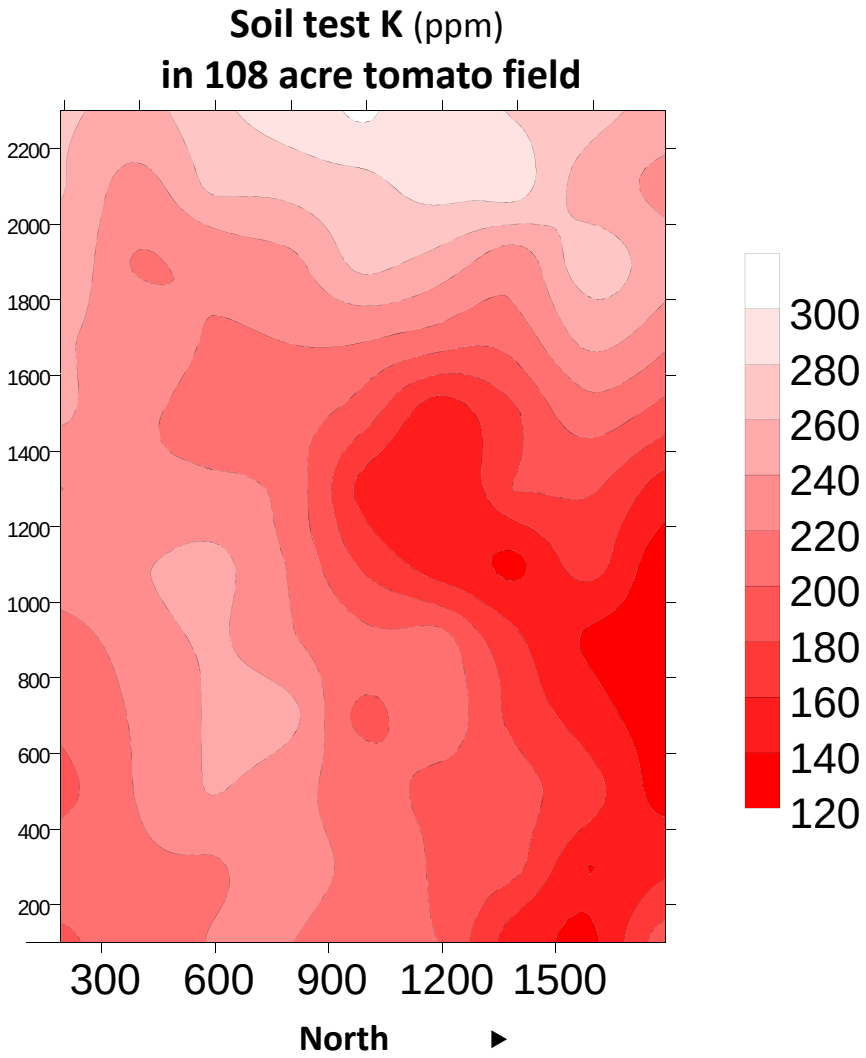


Yolo Co. 1997

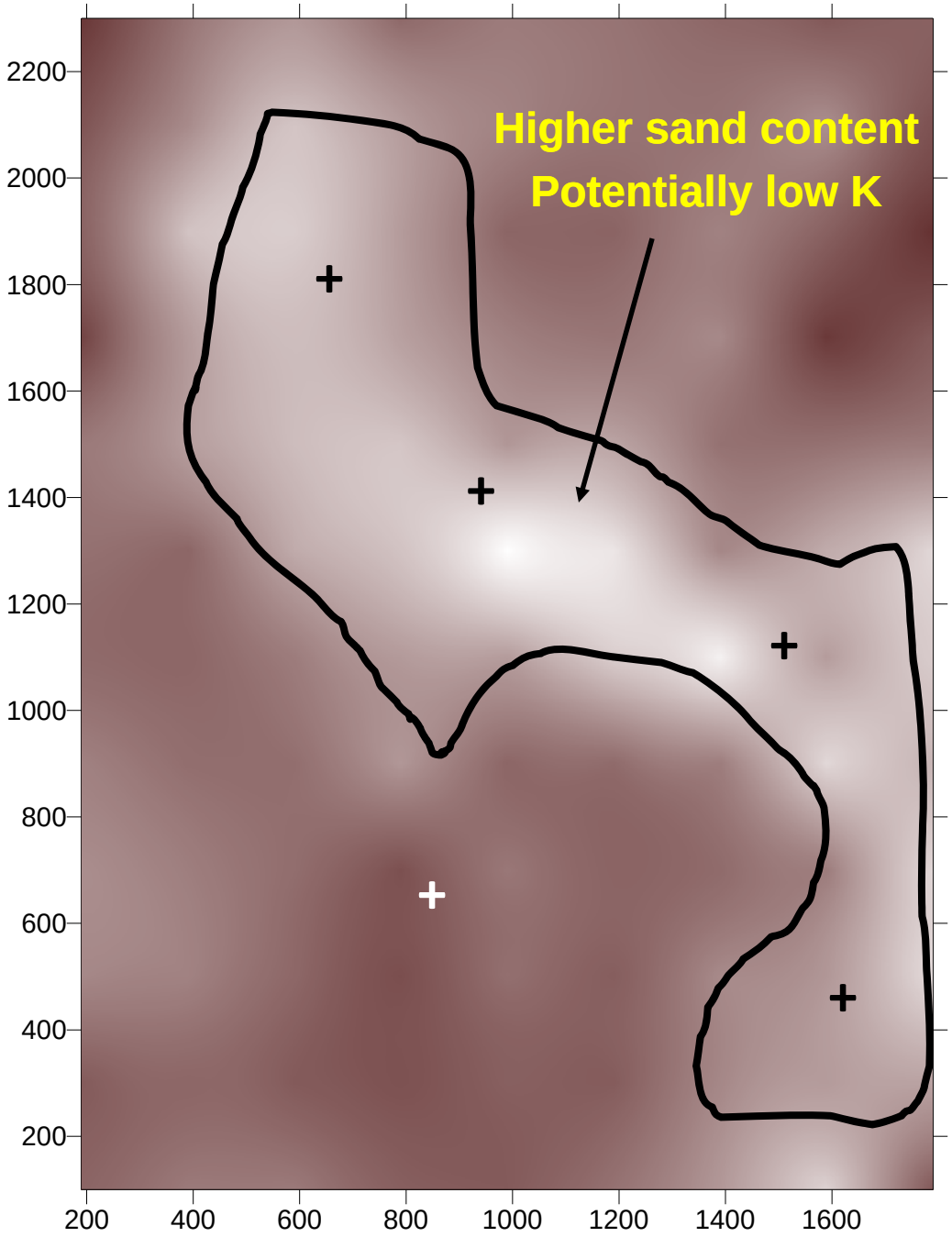
Spatial variability is REAL!



derived from 200 x 200 ft grid samples



Unpublished data, Pettygrove, Plant et al. 1997



Directed sampling based on sand content.

Sand could be mapped from aerial photo of bare soil.

K fertilizer rates often a compromise between cost, crop security, and soil fertility maintenance

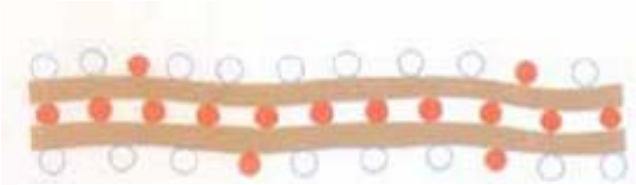
	lb K_2O/acre in harvest removal
9 ton/acre alfalfa	450
50 ton/acre tomatoes	300
10 ton/acre cantaloupe	180
30 ton/acre lettuce	130
10 ton/acre grapes	80

Sources: T. Hartz, S. Pettygrove

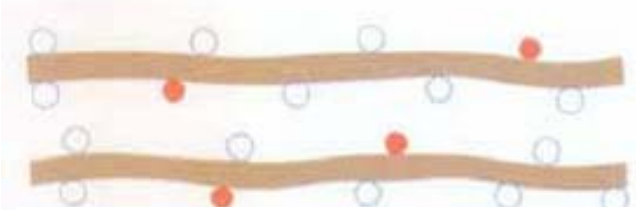
Topics today

- ✓K soil test interpretation
- ✓Rates of K fertilization
- **Soil K fixation**
- K leaching, movement in soil

Effects of clay minerals on the fate of K

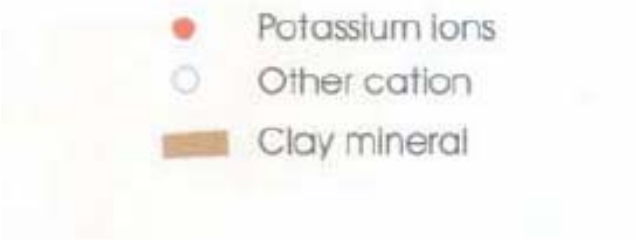


Vermiculite-intermediately weathered soils

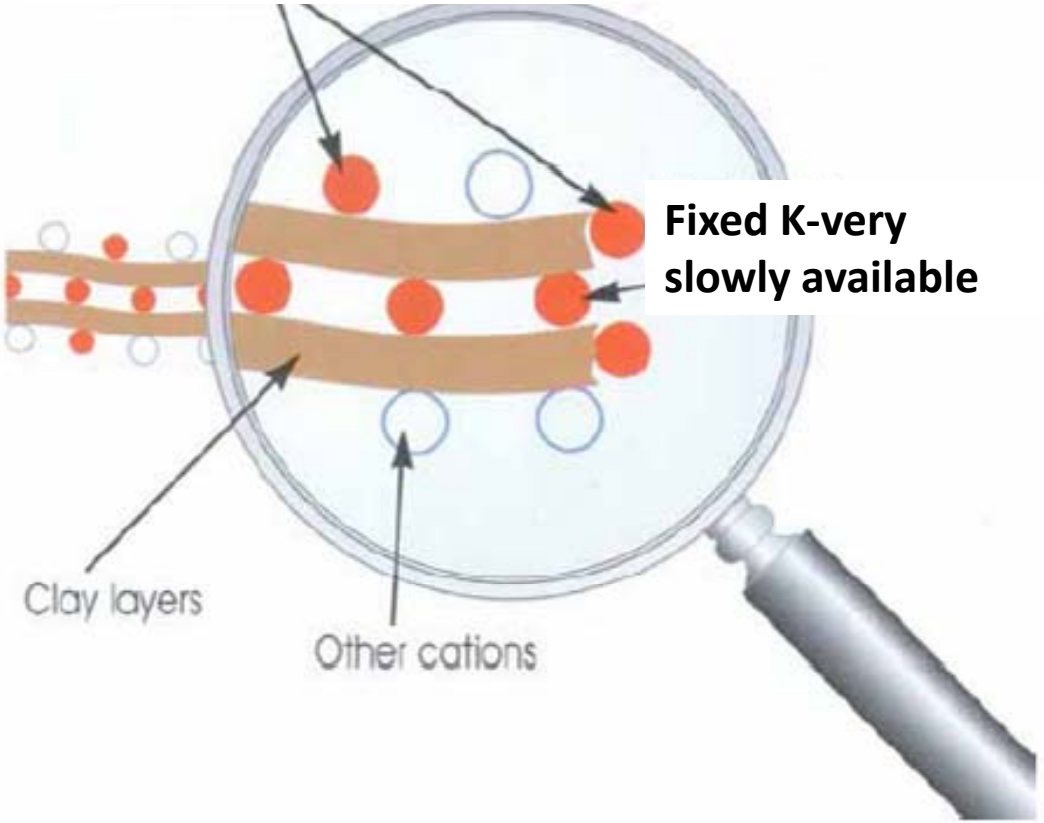


Smectite-shrink swell clays

Kaolinite-old, highly weathered soils

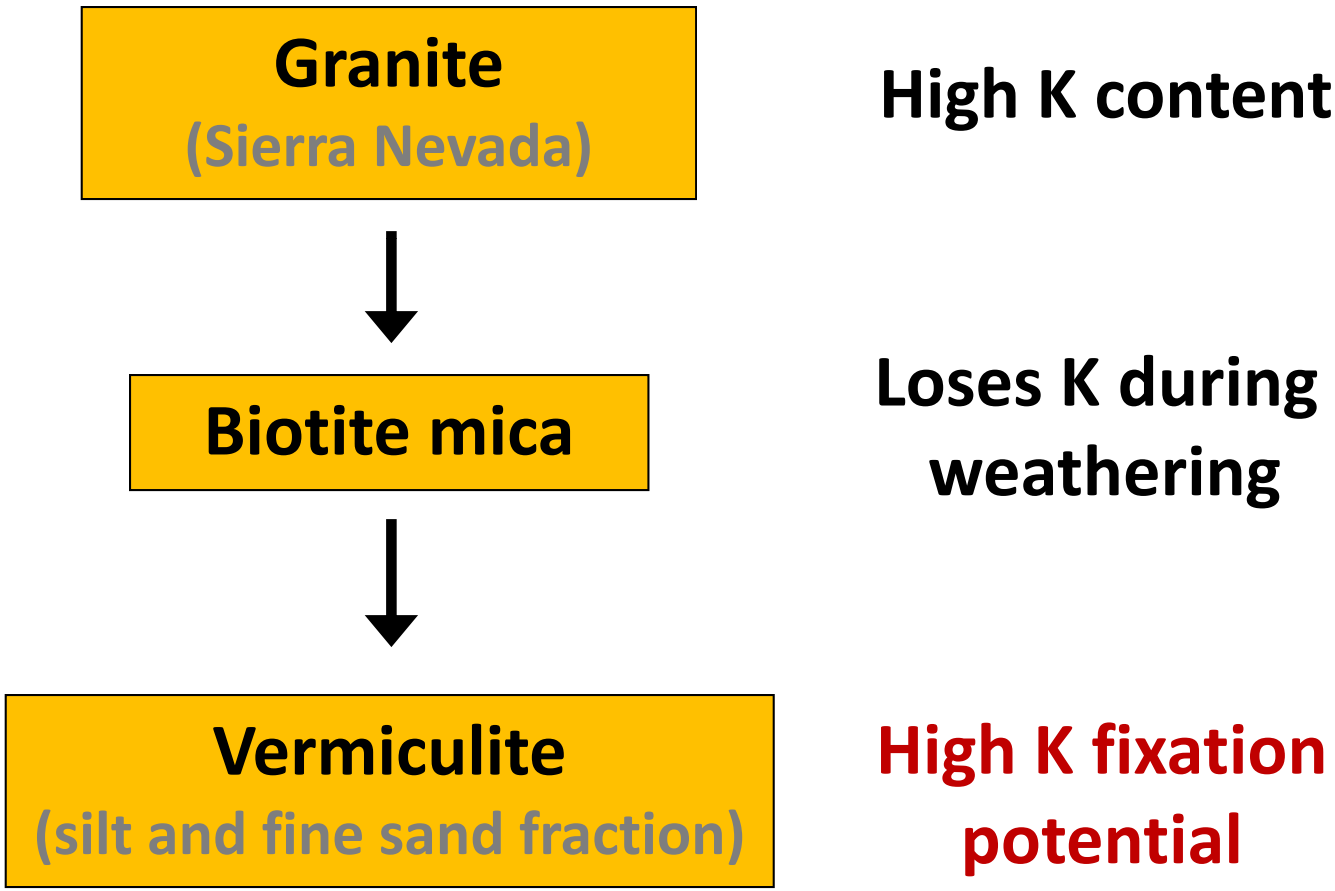


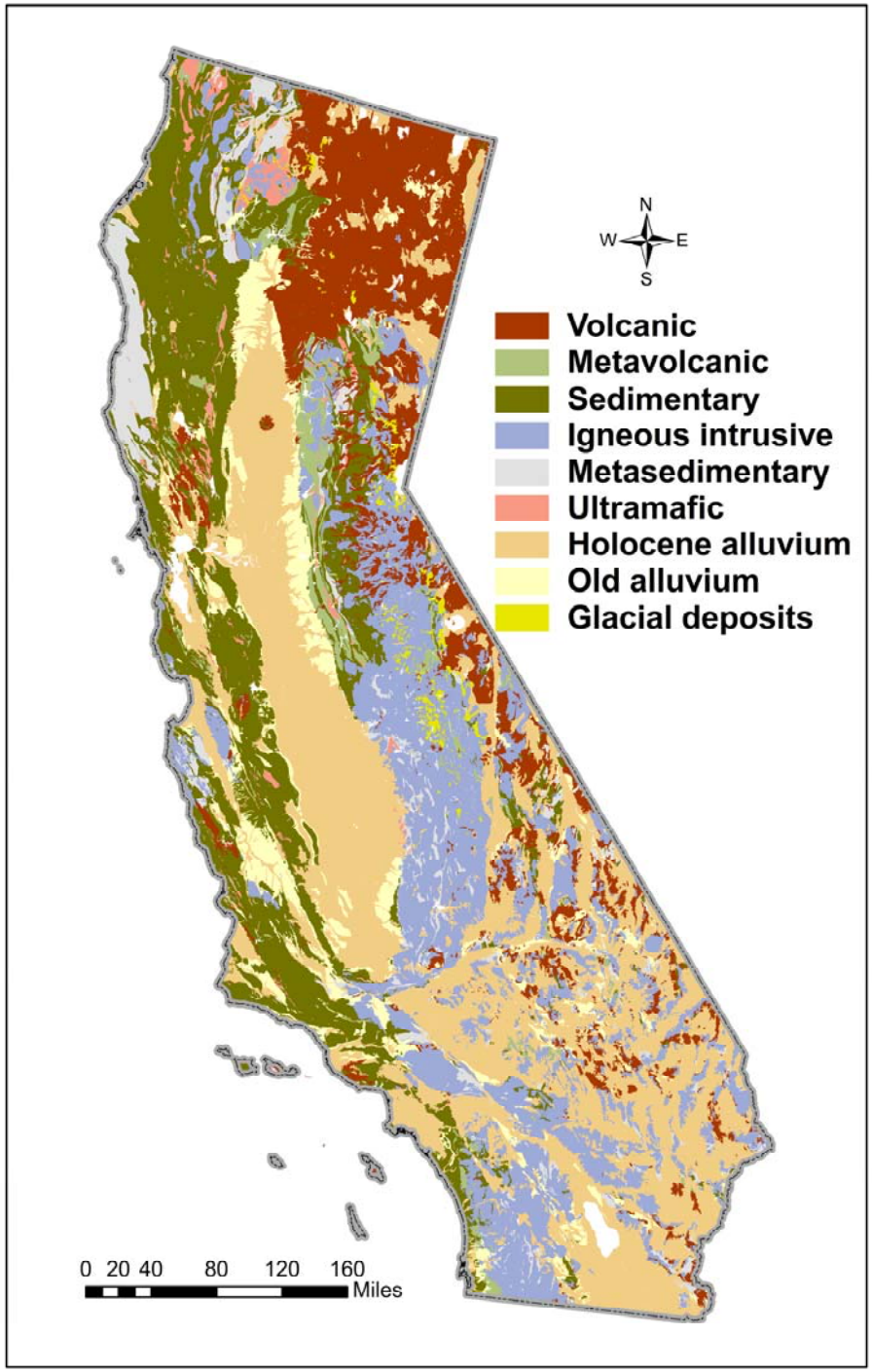
Exchangeable K on clay surface & edges



Source: Potash for heavy soils, 1999 (PDA publication)

Weathering sequence creates K fixation in coarse fraction





Soils with K fixation capacity are common on the east side of the San Joaquin Valley in soils formed on granitic alluvium.

	San Joaquin loam (K-fixing soil)		Tokay sandy loam (Non K-fixing soil)	
Depth, inches	Ammon acetate K, ppm	K fixation potential, ppm	Ammon acetate K, ppm	K fixation potential, ppm
0-8	133	0	213	0
8-16	62	126	117	0
16-24	59	161	86	5

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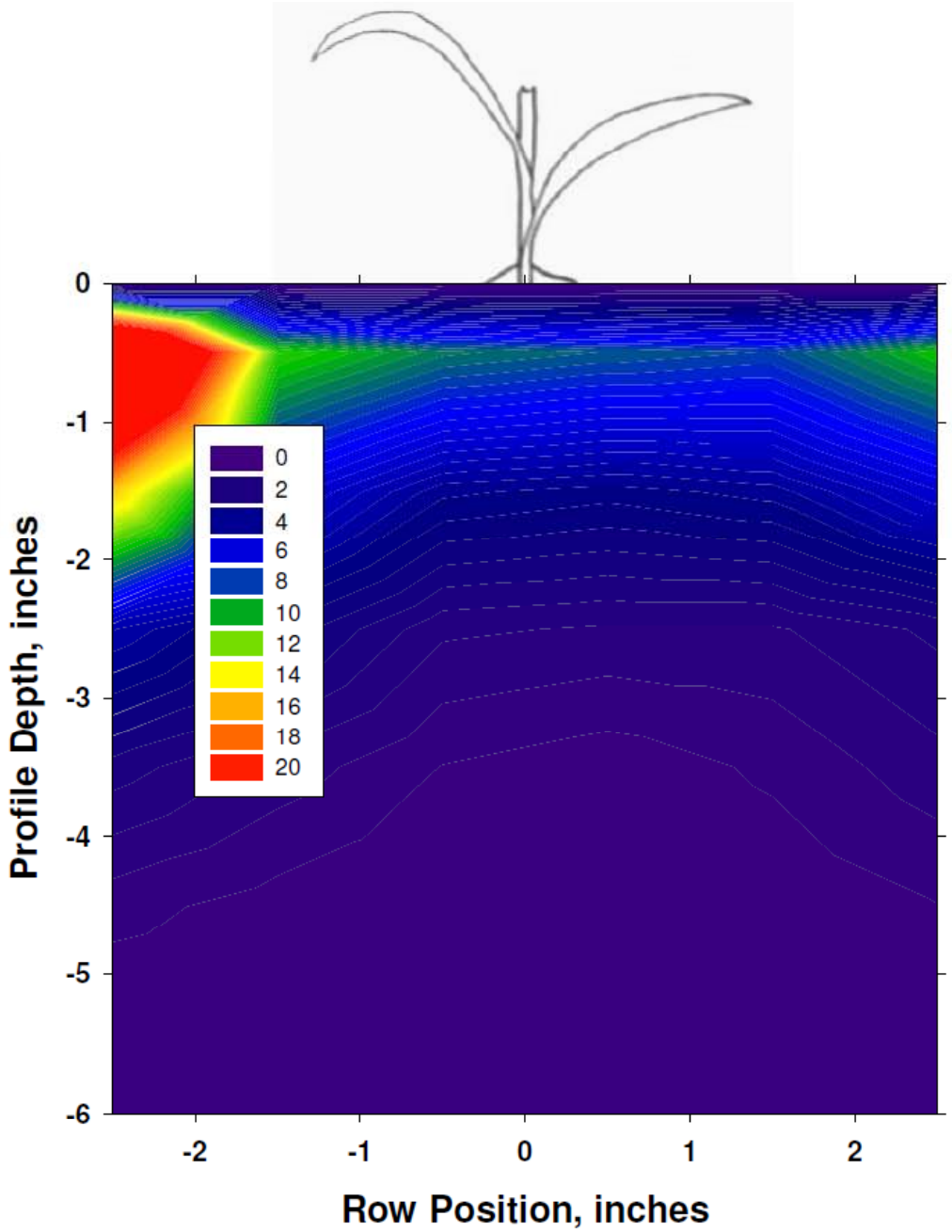
- **K leaching, movement in soil**



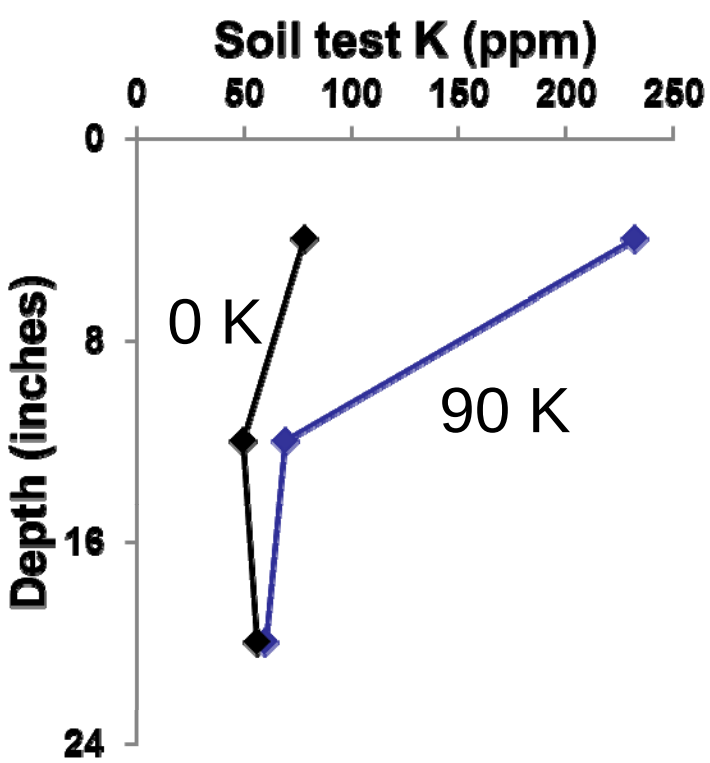
- Silty clay loam soil in Iowa
- 30 lb K_2O/acre
- Liquid 0-0-8
- Surface dribble 2” to side of corn row
- After 28 days, measured avail K by resin method

Result:

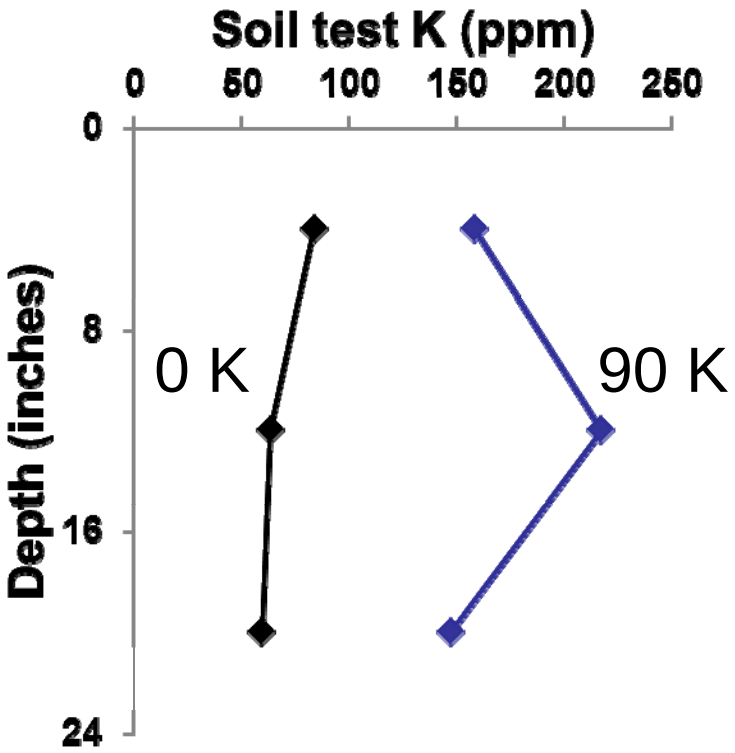
Most K was found 0.5-1.5 inches deep below band.

Kovar et al. 2009. Proc Internat Plant Nutrition Colloq XVI

Lodi district winegrape vineyard K fertilizer studies



San Joaquin silt loam
K fixing



Tokay fine sandy loam
Non-K fixing

3 years of 90 lb K_2O/acre increased available K under emitter to 8-inch depth on K-fixing silt loam, to 24-inch depth on non-K-fixing sandy loam.

Summary…

1. K soil test is key tool
2. For most situations, K expressed in ppm (rather than as % CEC) is appropriate basis for interpretation
3. No risk in withholding K fert when soil test is >200 ppm
4. Check spatial variability of soil test K
5. K fertigation in drip systems is effective
6. Leaching of K can occur in sandiest soils
7. Soil K fixation unlikely in Central Coast – but further investigation needed


Pinot Noir 4/13/10
Montpellier-Cometa soil
Medium K-fixing potenti