UC Cooperative Extension
University of California
Agriculture & Natural Resources

Nitrogen deficiency symptoms
(Haifa Group)

Vegetable Nutrient Deficiency Symptoms

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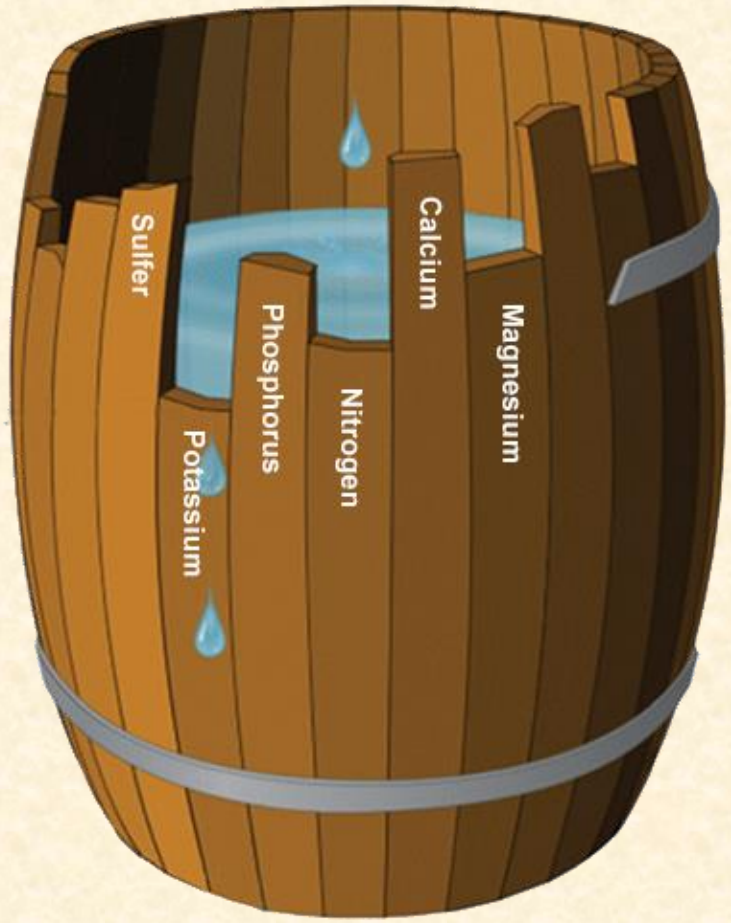
Sonoma, Marin, Napa Counties

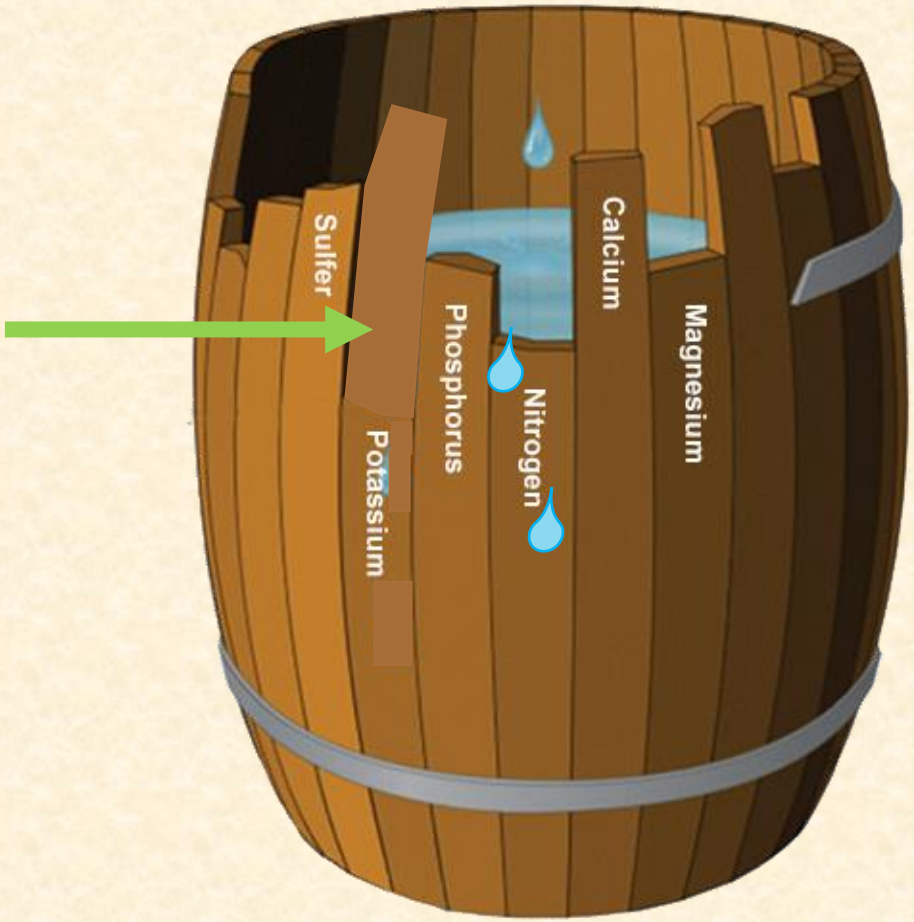
Nutrient Management

- Law of the Minimum
  - If one of the essential elements is low, plant functioning & yield will be low until that deficiency is lifted
  - Barrel metaphor: lowest stave represents the most limiting nutrient

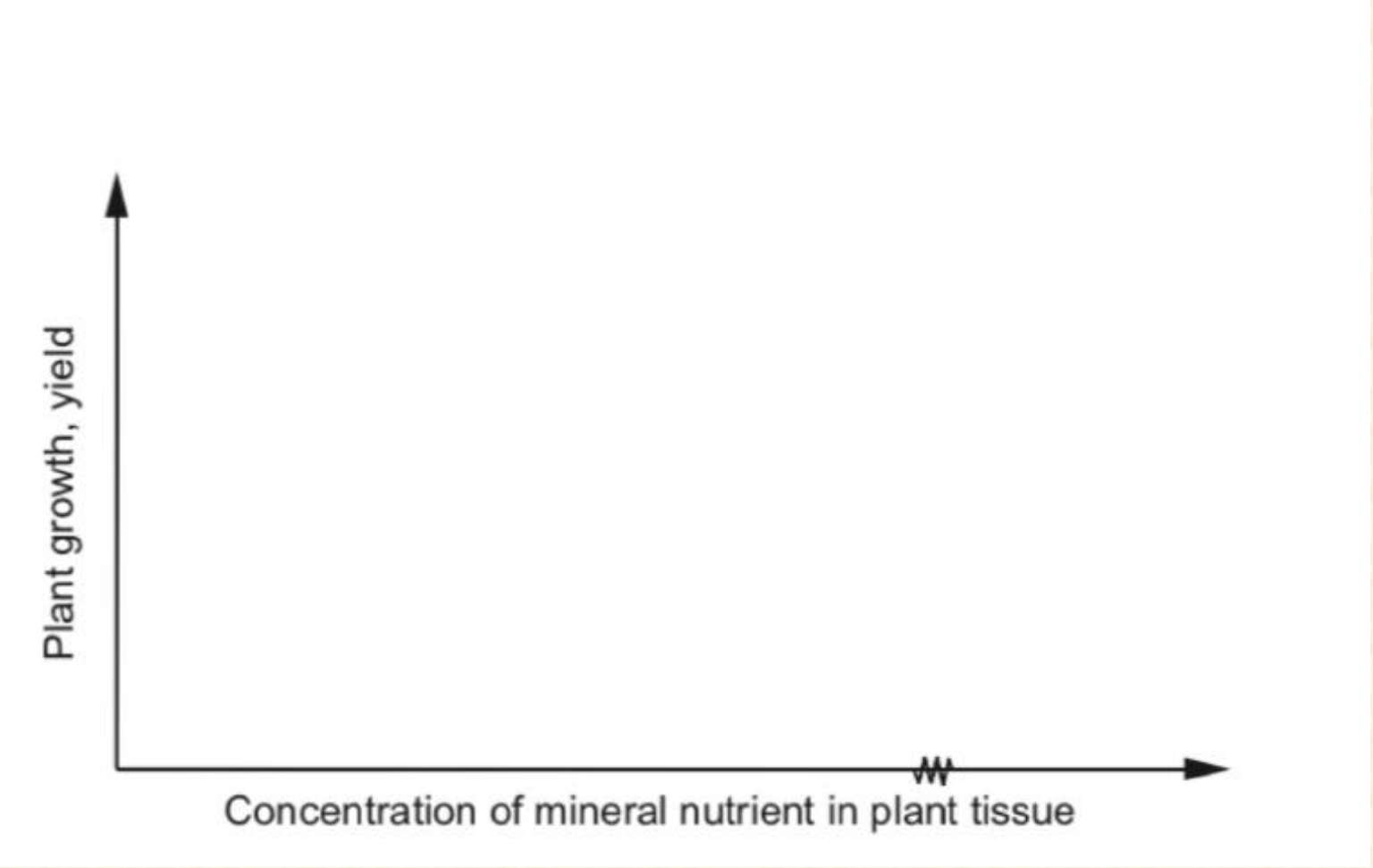


Nutrient Management

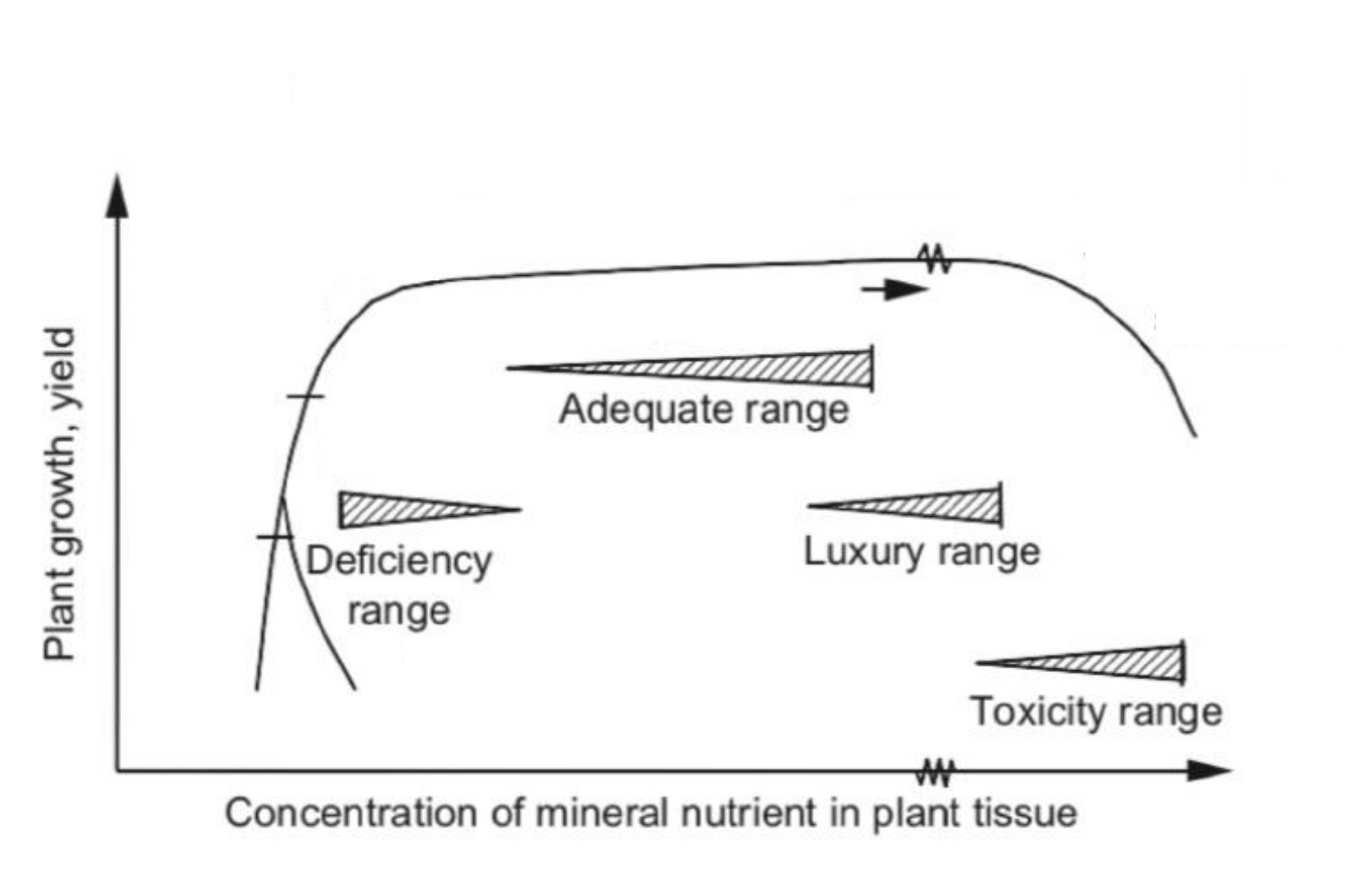
- Law of the Minimum
  - Supplying the most limiting nutrient lifts the yield potential to the next most limiting factor – address the lowest stave



Rate

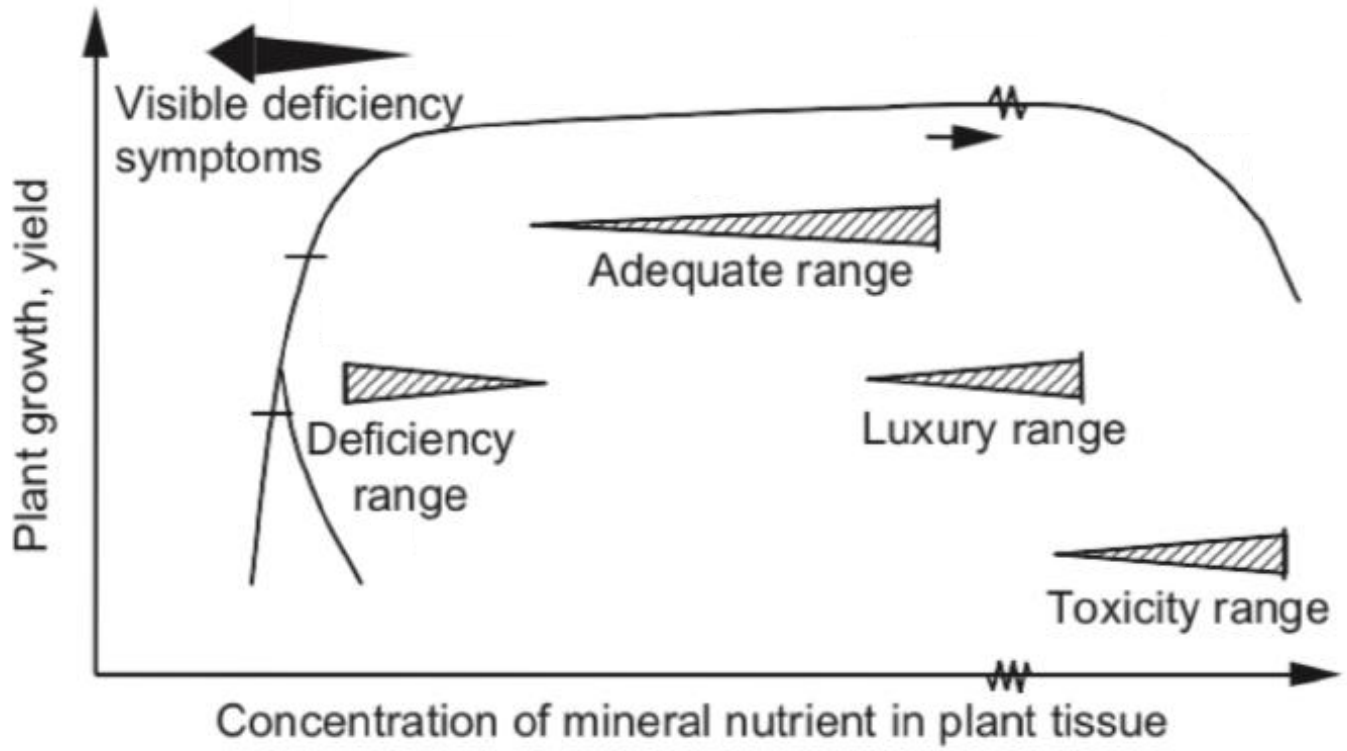

Plant growth, yield
Concentration of mineral nutrient in plant tissue

Rate


Plant growth, yield
Adequate range
Deficiency range
Luxury range
Toxicity range
Concentration of mineral nutrient in plant tissue

Rate

Deficiencies impair plant functioning & yield



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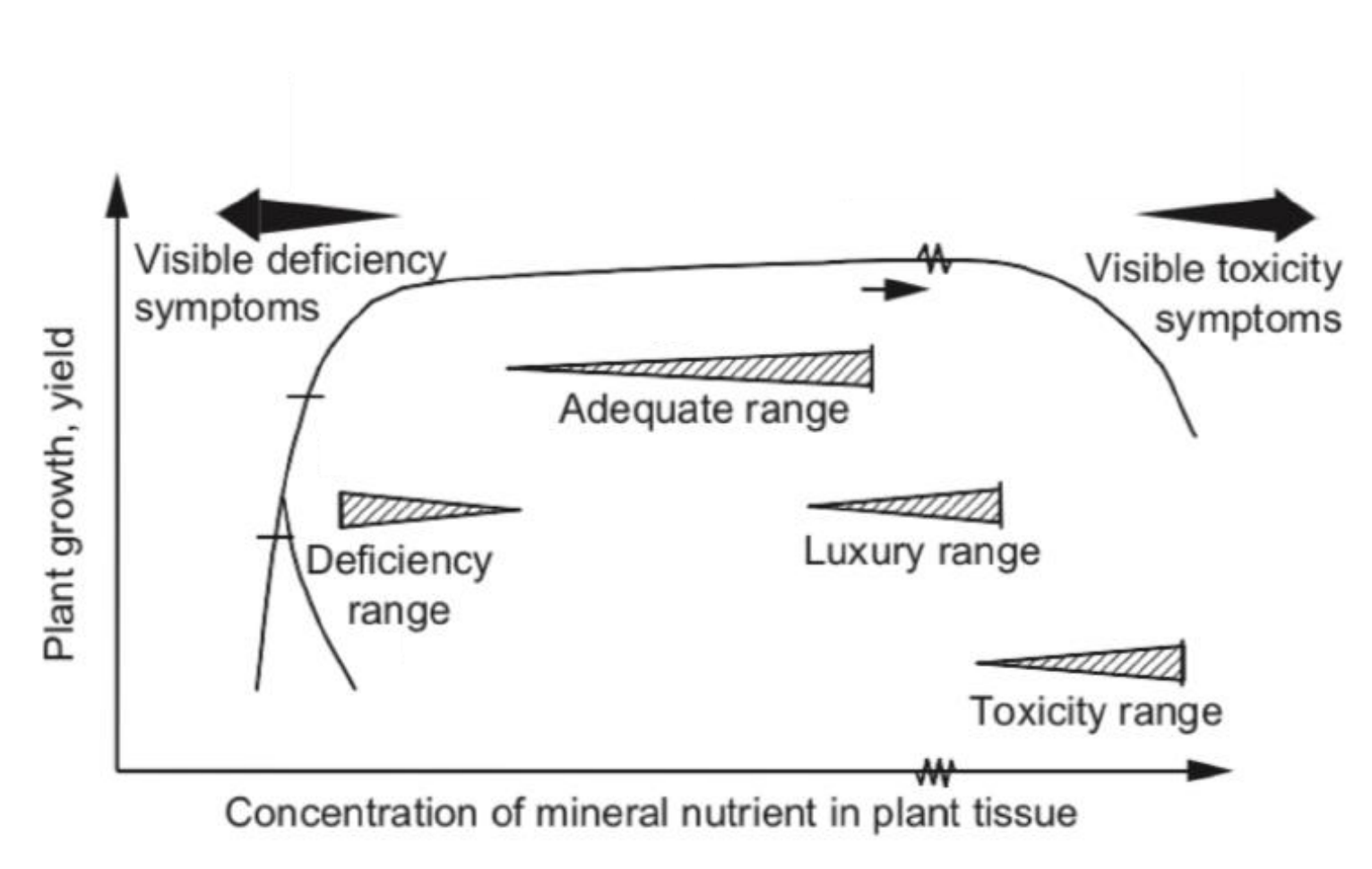
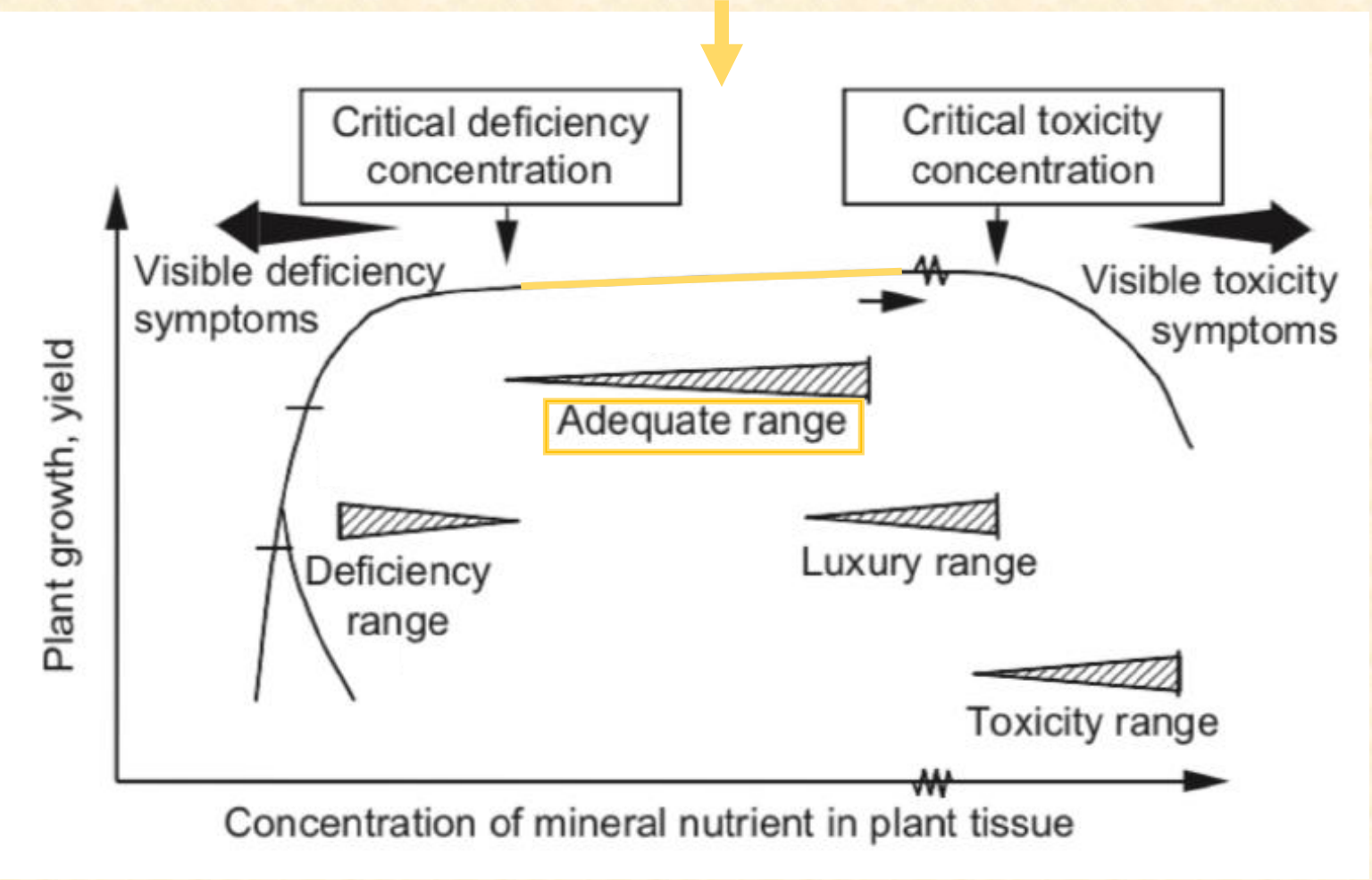


Over fertilizing can lead to

- excess vigor
- lower yield & quality
- environmental damage
- wasted money

Rate

Visual assessments and diagnostic tools help keep tree nutrient status in the safe range

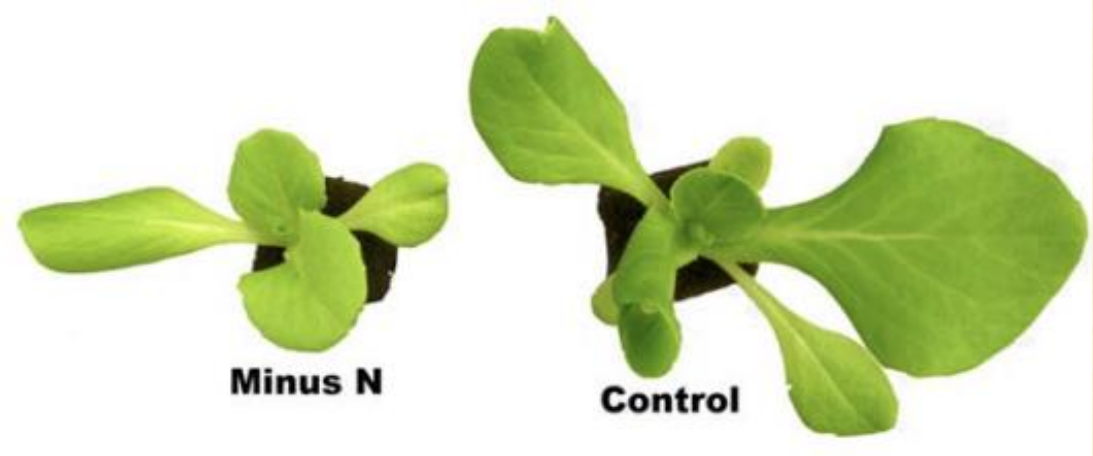


Nutrient Management

- Nutrient Budget Approach
  - First, maintain optimum nutrient status (not too much, not too little) for plant function & yield
  - Then replace amount of nutrients exported at harvest

- Leaf tissue testing: nutrient status of plant

Plant Nutrient Deficiency Symptoms



(University of Toledo & Ohio State Extension)

- **Nitrogen deficiency** can cause uniform leaf chlorosis—light green/yellow leaves—and stunting

Fields with sufficient (left) and insufficient (right) nitrogen (Cornell).

Plant Nutrient Deficiency Symptoms

Phosphorus deficiency symptoms in broccoli (Yara)

- **Phosphorus deficiency** can cause purplish discoloration on leaves. Not a common issue in our area.

Phosphorus deficiency symptoms in corn (Alabama & Auburn Extension)

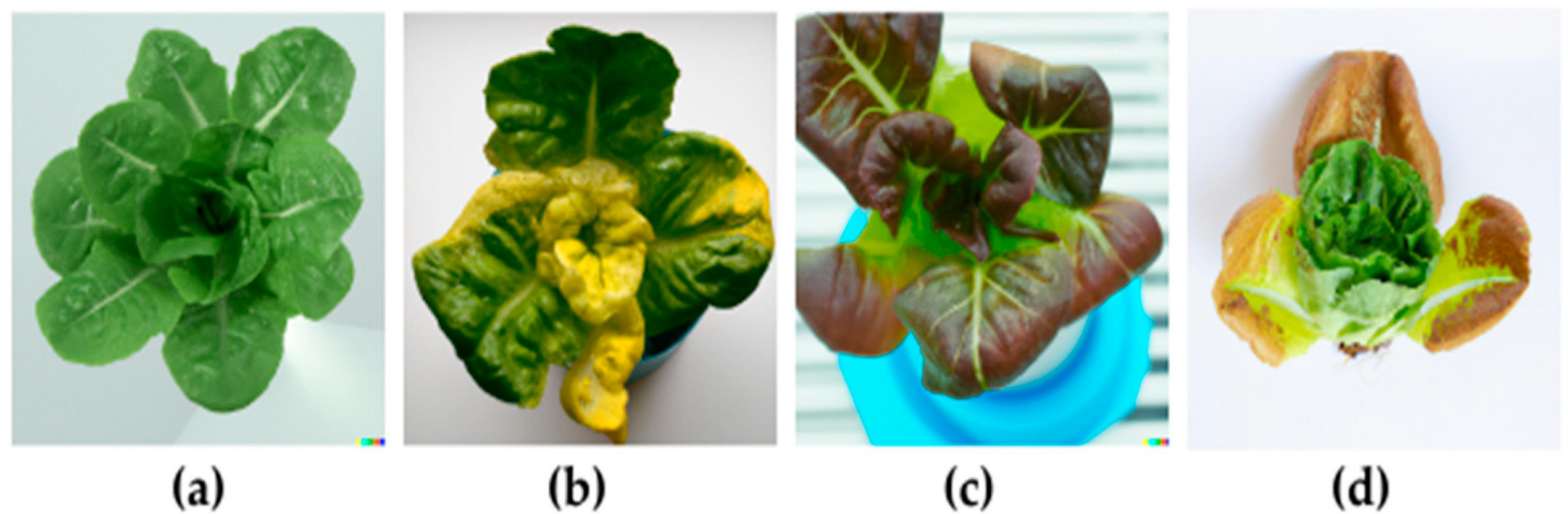
Plant Nutrient Deficiency Symptoms

Potassium deficiency symptoms in lettuce (PowerAg)

Potassium deficiency symptoms in tomato (Eric Sideman, Maine Organic)

- **Potassium deficiency** can cause leaf crinkling, cupping, or rolling and discoloration on the leaf tips or margins.

Plant Nutrient Deficiency Symptoms



Lettuce with sufficient nutrients

Nitrogen deficiency symptoms

Phosphorus deficiency symptoms

Potassium deficiency symptoms

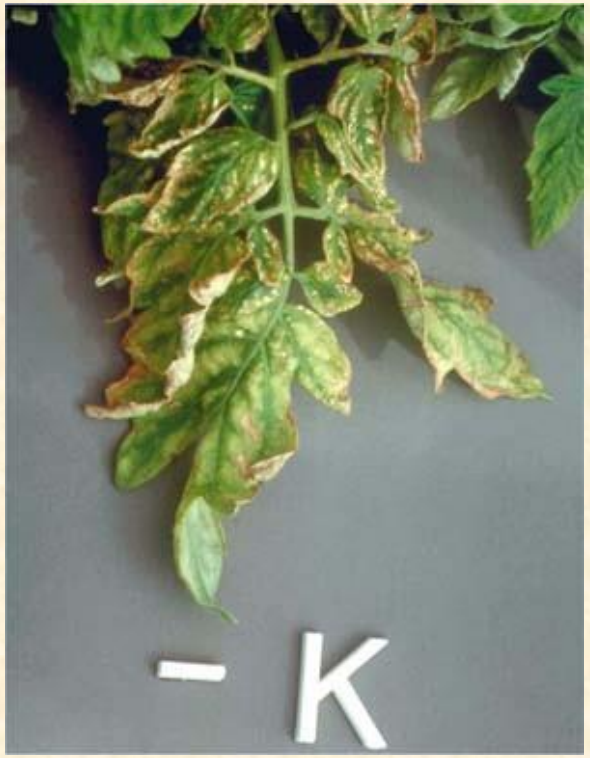
(Sikati & Nouaze 2023, MDPI)

Plant Nutrient Deficiency Symptoms

Tomato with
sufficient nutrients

Nitrogen
deficiency symptoms

Phosphorus
deficiency symptoms

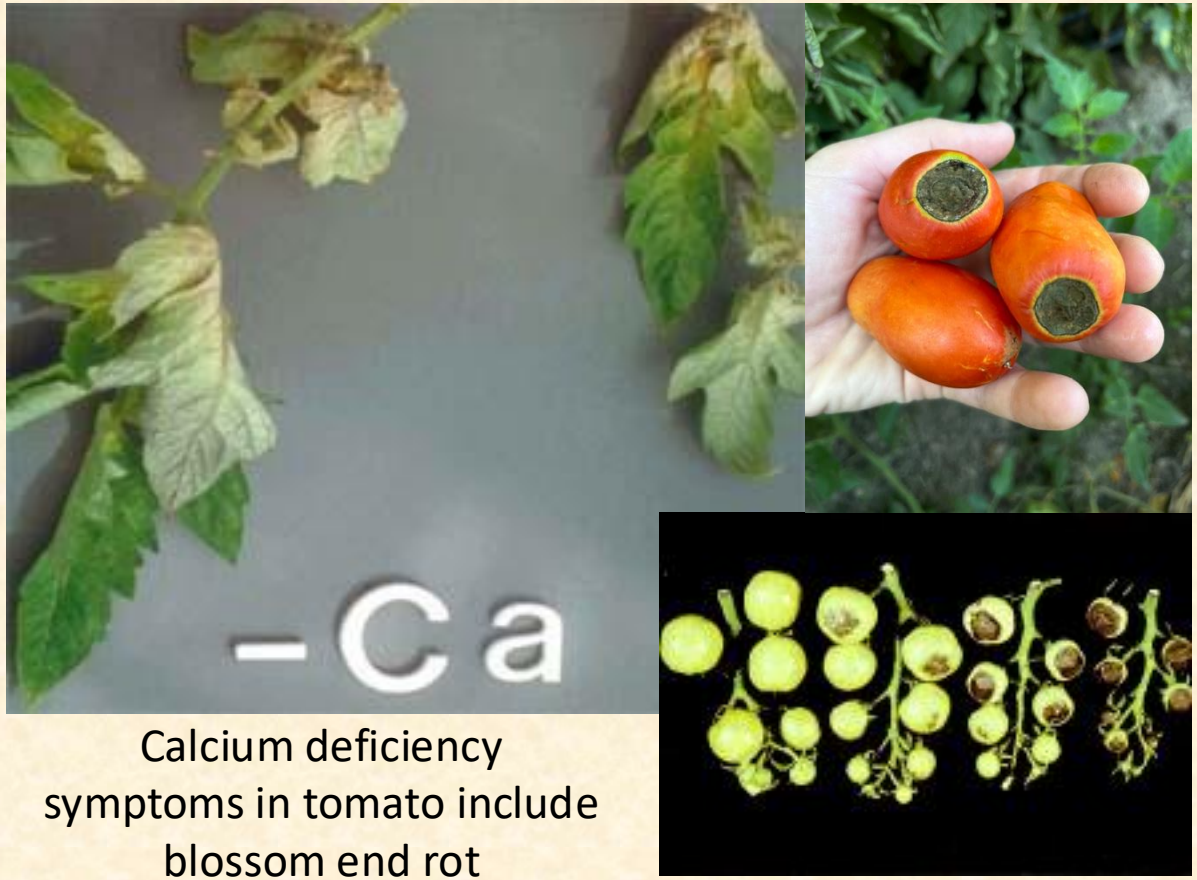


Potassium
deficiency symptoms

(Haifa Group)

Plant Nutrient Deficiency Symptoms

- There are many more



Calcium deficiency symptoms in tomato include blossom end rot

(Haifa Group)

Plant Nutrient Deficiency Symptoms

- There are many more

Calcium deficiency symptoms in tomato include blossom end rot

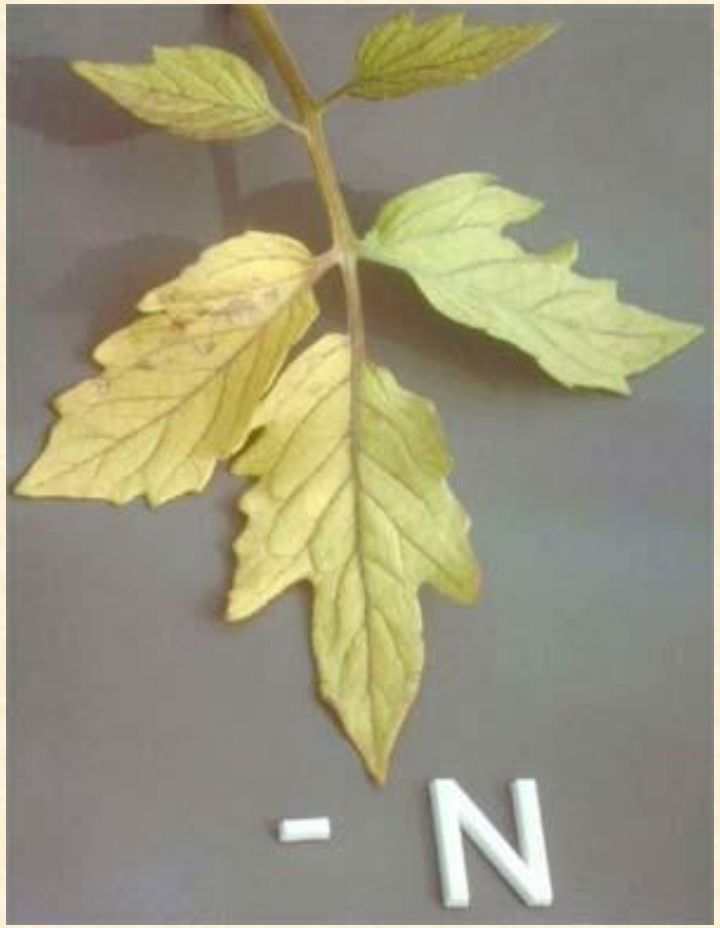
Iron deficiency symptoms

Magnesium deficiency symptoms

(Haifa Group)

Soil Fertility Notes for Our Region

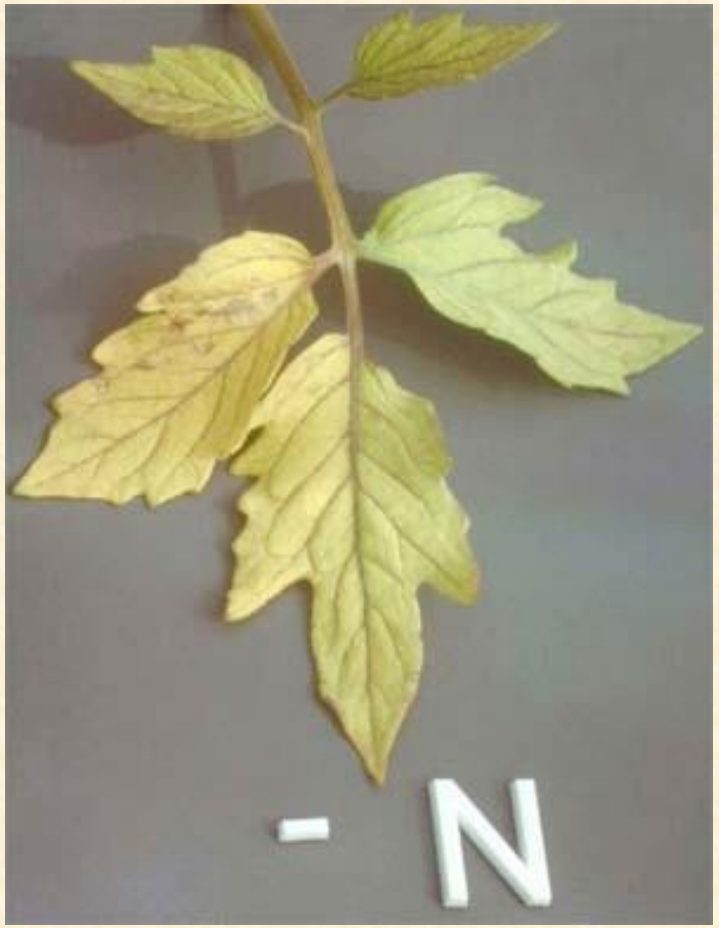
- In organic veg crop systems: there is often high phosphorus (P) & potassium (K), but low nitrogen (N)
    - N is the main nutrient being removed in harvest, and leached in some cases
    - P & K inputs often exceed crop removal, so their levels rise over time



Nitrogen deficiency symptoms (Haifa Group)

Soil Fertility Notes for Our Region

- In organic veg crop systems: there is often high phosphorus (P) & potassium (K), but low nitrogen (N)
    - Most organic fertilizers are NPK blends with similar amounts of NPK, but veg crops need and remove more N than P&K
    - No downside to having high P & K levels, as long as P<100ppm & K<1000ppm
    - If you see N deficiency symptoms, consider side-dressing with N fertilizer (there are organic options)



Nitrogen deficiency symptoms (Haifa Group)

Organic Matter Amendments & Microbes

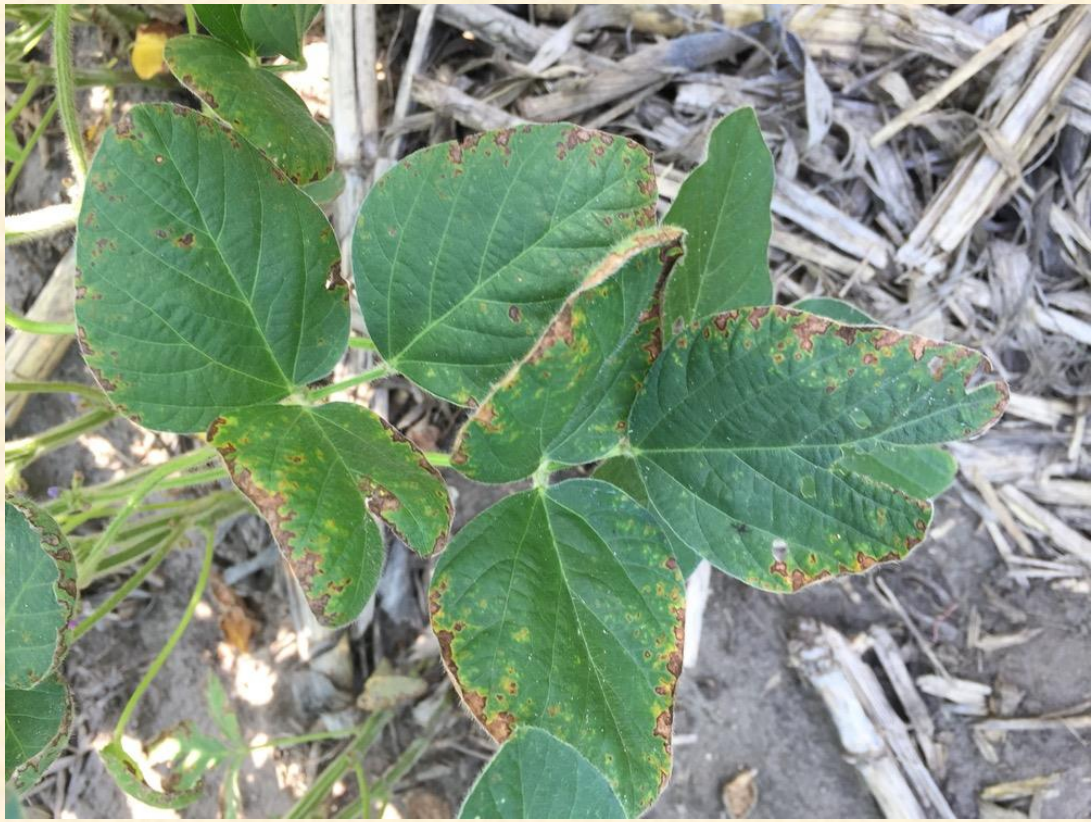
- Lower carbon to nitrogen ratio (C:N) means microbes have more nitrogen

- High-quality, well-decomposed compost will have lower C:N than mulch

(source unknown—thank you whoever made this meme)

Soil Fertility Notes for Our Region

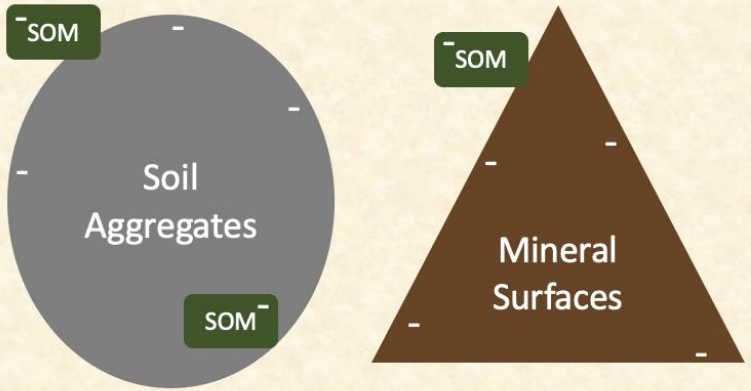
- Boron (B): test irrigation water & soil
  - B toxicity (excess) symptoms vary by species but generally include: yellowing, dead tissue, and scorch on leaf tips and margins of older leaves
  - Water & soil should have <1ppm boron



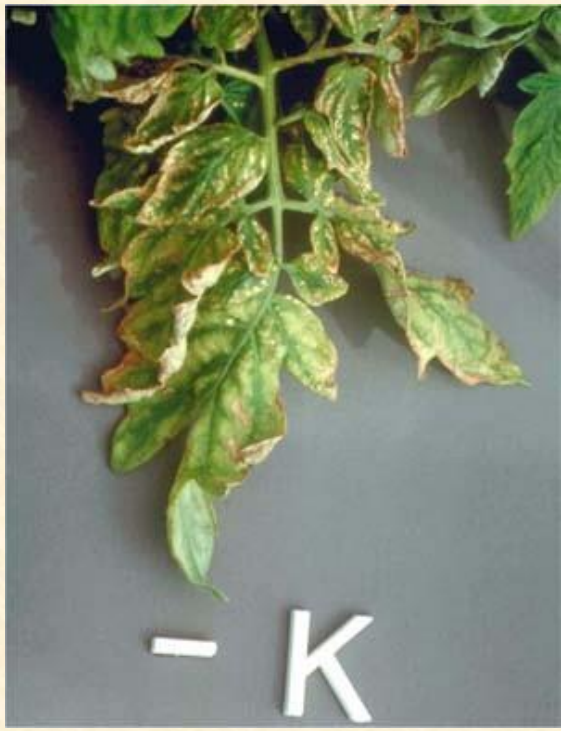
Boron toxicity symptoms in soybeans
(Nathan Mueller, University of Nebraska-Lincoln)

Soil Fertility Notes for Our Region

- Low soil potassium levels in sandy soils → K deficiency
  - Can be caused by low CEC & high crop K demand
  - Add K to improve plant health & yield
  - Increase SOM for more “parking spots”



Soil Texture	**Typical CEC Range** (meq/100 g soil)
Sand & loamy sand	2 – 6
Sandy loam	3 – 8
Loam	7 – 15
Silt loam	10 – 18
Clay	15 – 30



Potassium deficiency symptoms (Haifa Group)

California Crop Fertilization Guidelines

UCDAVIS

A collaboration between CDFA, FREP and UC Davis

Field crops and vegetables

Alfalfa

Barley

Dry Beans

Broccoli

Carrot

Cauliflower

Celery

Corn

Cotton

Lettuce

Melons

Onion

Cebolla (en Español)

Potato

Rice

Safflower

Strawberries

Sunflower

Processing Tomatoes

California Fertilization Guidelines

Lettuce

Nitrogen (N)

Soil Test | Leaf Analysis

Preplant N | Starter N | Sidedress N

Phosphorus (P_2O_5)

Soil Test | Leaf Analysis

Preplant P | Starter P

Potassium (K_2O)

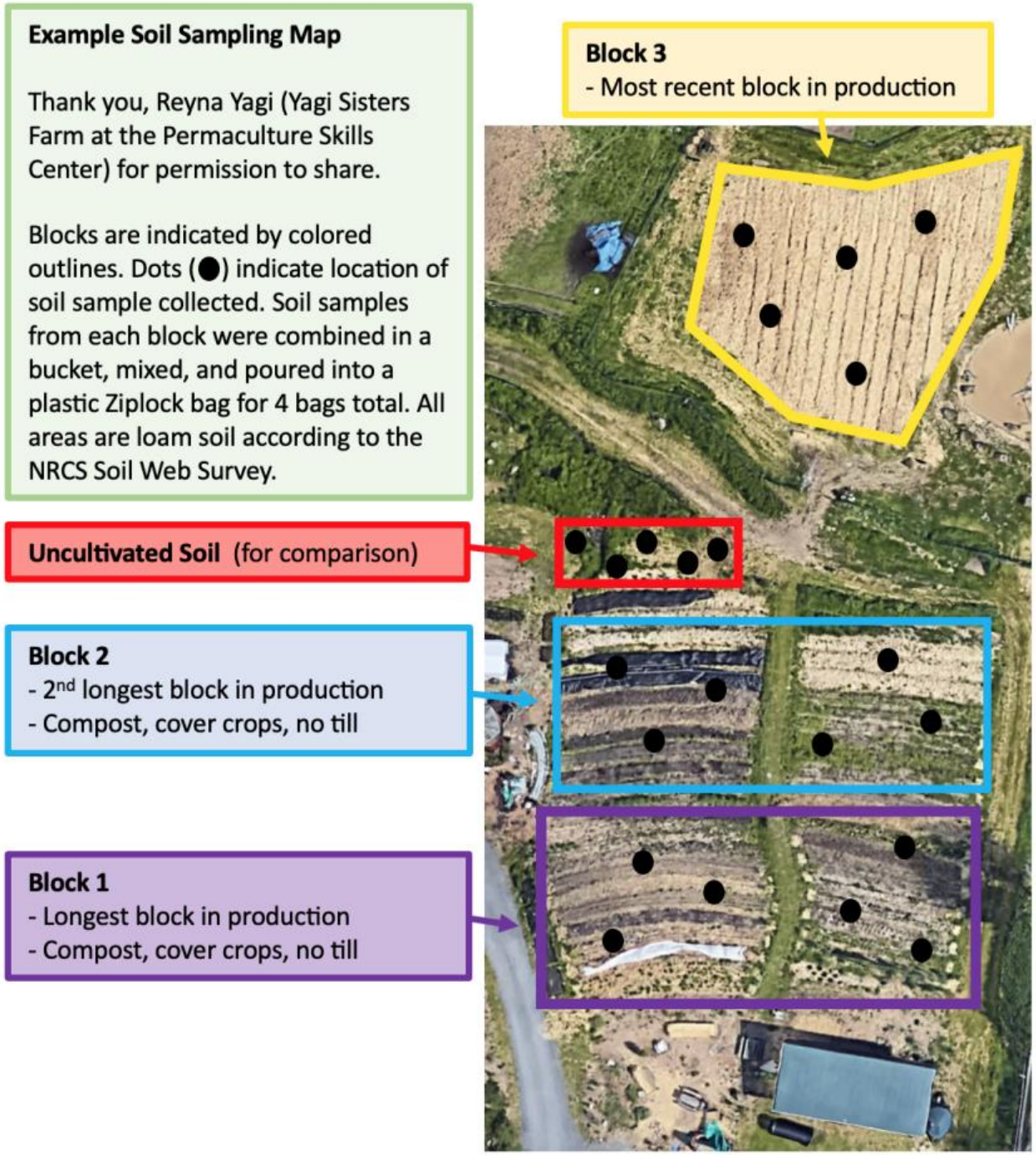
Soil Test | Leaf Analysis

Preplant K / K Fertigation

Acknowledgments | Additional Information | Take a Quiz! | Links

Soil Sampling Map

- Dots indicate location of soil samples
- Soil samples from each block were combined in a bucket, mixed, and poured into a plastic Ziplock bag
- 4 areas of interest → 4 bags total



Example

No.	Description	AA Ext **NO_3-N** mg/kg	Olsen Ext **PO_4-P** mg/kg	AA Ext **K** mg/kg	DTPA Ext **Zn** mg/kg	DTPA Ext **Mn** mg/kg	DTPA Ext **Fe** mg/kg	DTPA Ext **Cu** mg/kg	**OM** %
1	Upper Bed	67	108	363	21	21	98	2.1	8.30
2	2nd Block	88	118	418	28	31	98	2.9	12.40
3	3rd Block	12	115	280	11	19	100	1.5	4.90
4	Uncultivated	12	84	297	9.1	32	99	1.5	3.90

Vegetable soils		NO_3-N	PO_4-P	K	Zn	Mn	Fe	Cu	OM
Low		< 20	< 50	<250	< 2.5	< 2.5	<5	< 2	<1.0
Medium/ Optimal		20 - 30	50 - 60	250-350	2.5 - 4.5	2.5 - 10	5-10	2 - 4	1-3
High		30 +	60 +	350+	4.5 +	10 +	10+	4+	3+

ND = None Detected

* pH values should be above 7.2 to prevent club root. Lower levels are acceptable for other than cole crops

** EC values above 2 can reduce lettuce yields. EC values up to 4.0 may be tolerated ***if*** primarily calcium, however, yield will still likely be reduced.

Example

Yagi Soil Fertility Results 2023

Dellavalle Labs, Fresno CA

No.	Description	Sat. Paste **SP** %	Sat. Paste **pH** units	Sat. Paste **EC** dS/m	Sat. Paste **Ca** meq/l	Sat. Paste **Mg** meq/l	Sat. Paste **Na** meq/l	**ESP** %	Sat. Paste **B** mg/l
1	Upper Bed	48	6.9	2.03	10.9	5.0	3.9	0.8	0.3
2	2nd Block	50	6.8	1.76	9.7	4.7	2.8	0.3	0.2
3	3rd Block	42	6.9	1.28	9.0	3.0	1.6	ND	0.1
4	Uncultivated	38	6.4	0.72	4.2	2.1	0.7	ND	0.1

Vegetable soils		Texture	pH*	salts**	Ca	Mg	Na	ESP	B
Low		Sand <20	< 7.3	<1.0	< 5	< 3		< 1	0.1
Medium/ Optimal		20-50	7.3 - 7.8	1.0- 2.0	5 - 10	1/2 Ca		1 - 4	0.2- 0.5
High		Clay >50	7.8 +	2.0+	10 +	> Ca	>Ca	4 +	1.0+