

Zinc Deficiency in Cotton

Brenda S. Tubana
Associate Professor of Soil Fertility
School of Plant Environmental and Soil Sciences

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Estimated Removal Rate

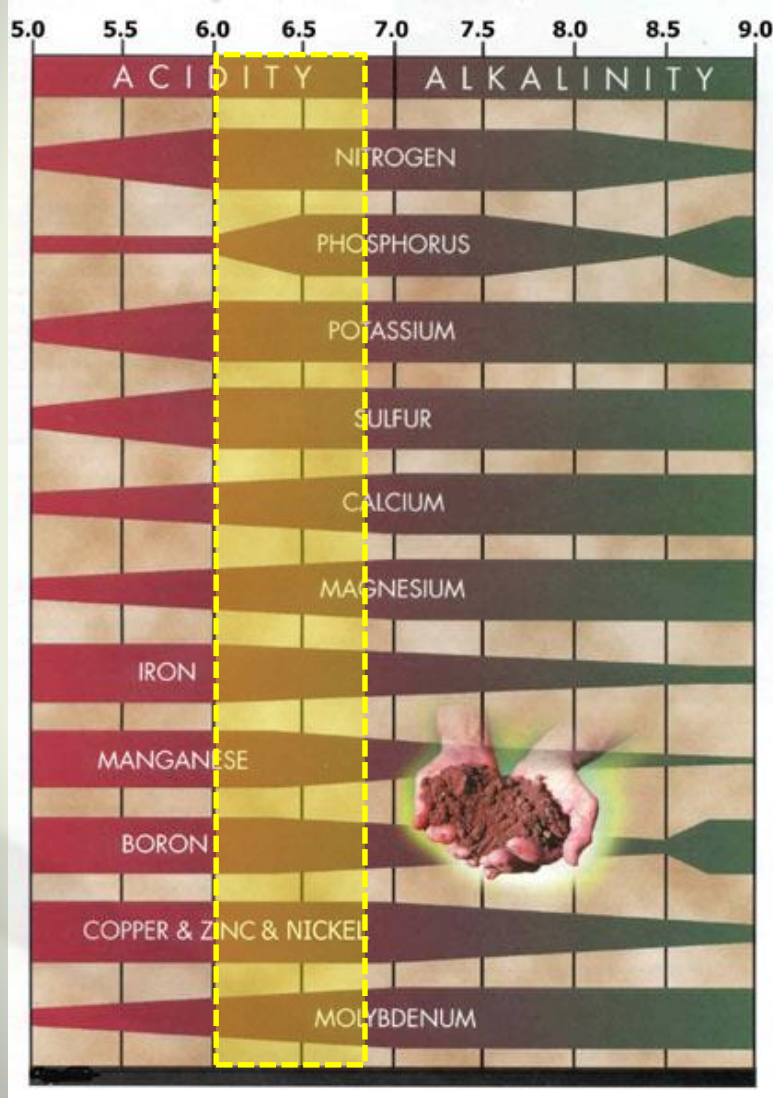
Micronutrient	Range in Soils lbs/A	Removal Rate (2-bale cotton) lbs/A
Boron	20-200	0.05
Copper	4-400	0.03
Iron	10,000– 200,000	0.07
Manganese	100-10,000	0.3
Molybdenum	1-7	0.02
Zinc	20-600	0.06

10-300 ppm

Micronutrient deficiencies are becoming more common?

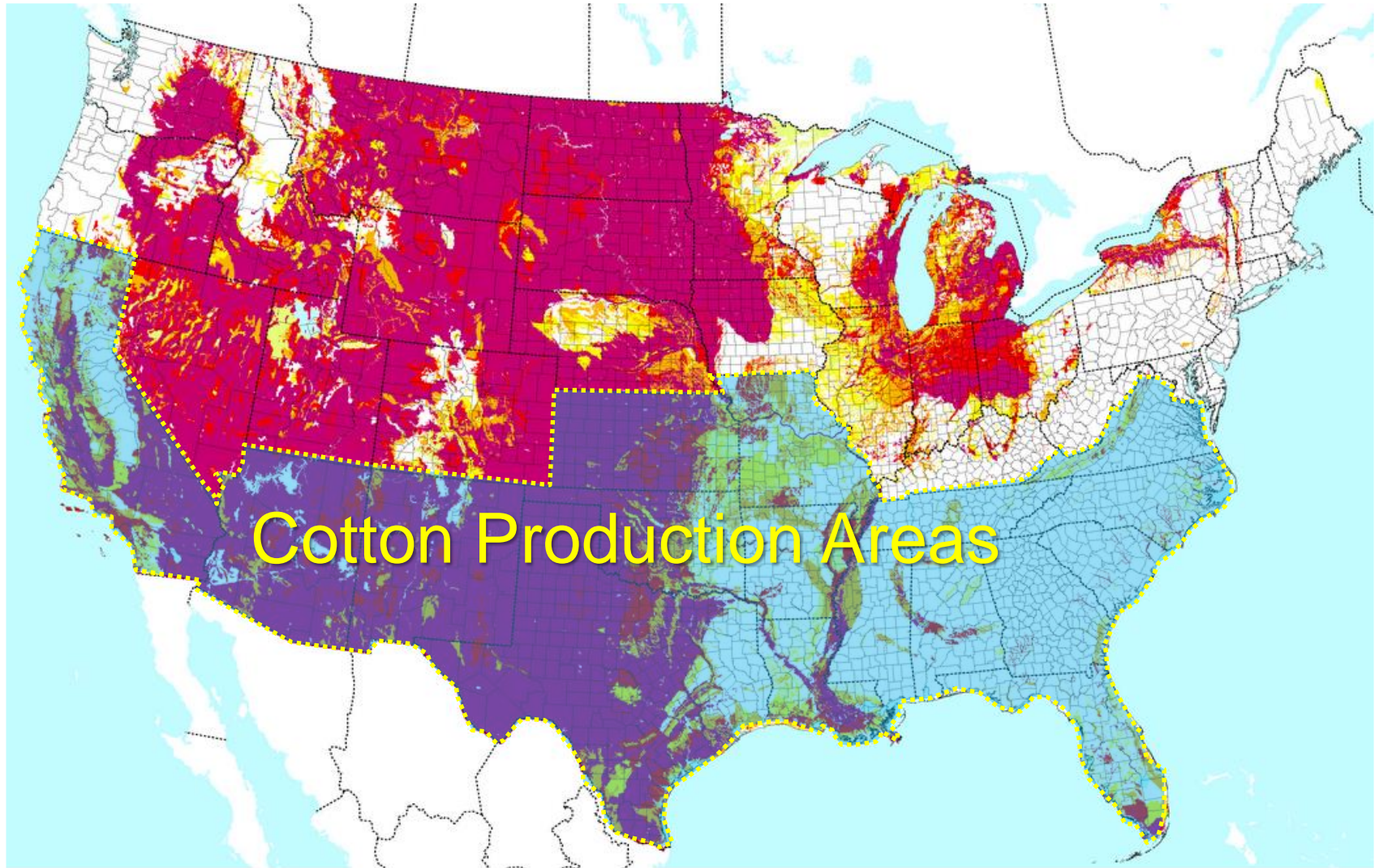
- High analysis of NPK fertilizer – less impurities
- High yield potential of new crop varieties
- Specifically for Zn.....
 - Heavy use of lime on acid soils leads to formation of $\text{Zn}(\text{OH})_2$ which is very insoluble
 - Excess application of P leads to formation of zinc phosphate

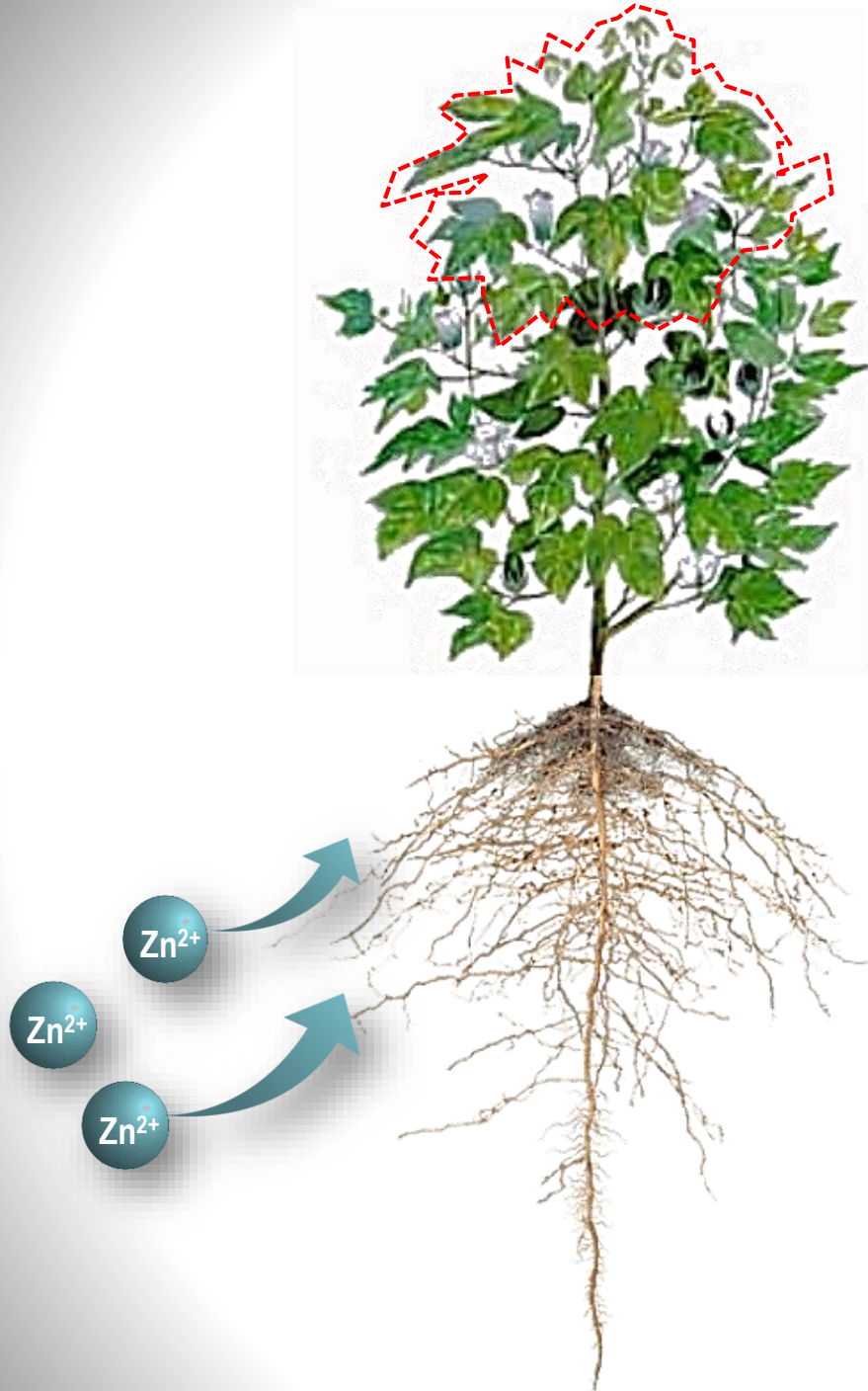
First thing first in crop production – correct soil pH



- Affect the solubility of mineral nutrients
 - Toxicity (metal)
 - Favors precipitation
- Management Practices
 - *Liming* (acidic soil)
 - *Acidulating* (high pH soil)

Basic (high pH) soils in the US





Bioavailability is regulated by:

- Soil pH
- Exchangeable Zn (on colloids or clay exchange site)
- Organic matter

Immobile in plant: Symptoms appear in the young group of leaves

Immobile in soil: Foliar treatment with Zn-containing solution is more effective

Roles of Zn in Plant

Zn is essential in protein synthesis and growth regulation in new growing cells.

Zn is a component of many enzymes essential to metabolism

Zn is needed for synthesize chlorophyll and carbohydrate

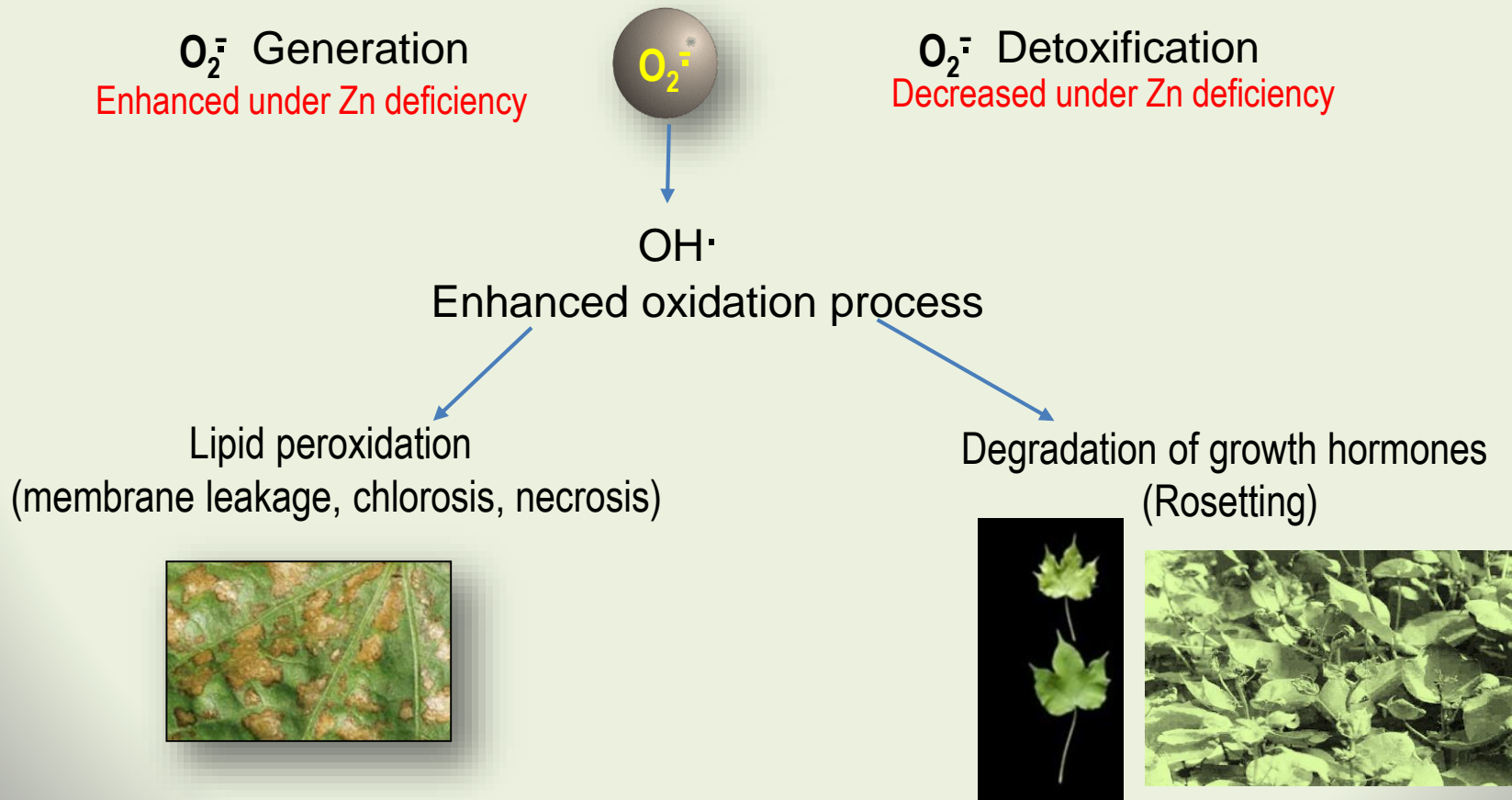


Zn function in plant growth regulation is unique

- Important for production of growth hormones
- Component of many enzymes for reducing oxidative stress

Zn role: plant growth regulation

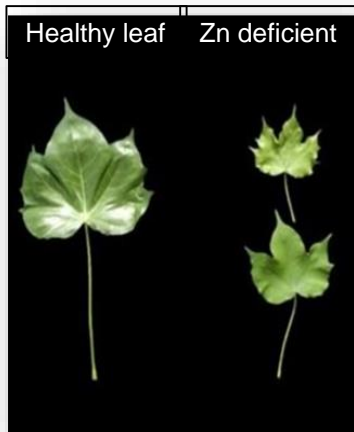
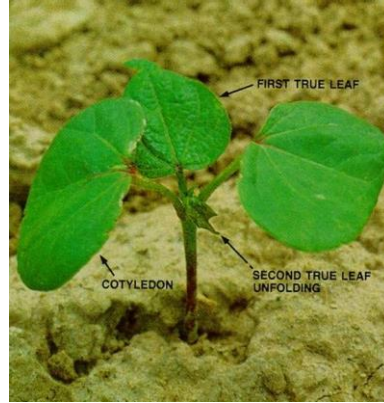
- Important for production of growth hormones
- Alleviate oxidative stress in plant



Zn Deficiency Symptoms in Cotton



Bronzing and interveinal chlorosis of first true leaf



Conditions leading to Zn Deficiency

Soil Factors



High pH
(calcareous,
saline, and sodic
soils)



Too low and too
high organic
matter
content

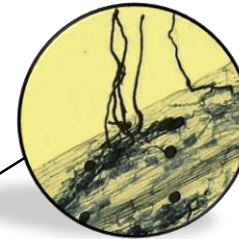
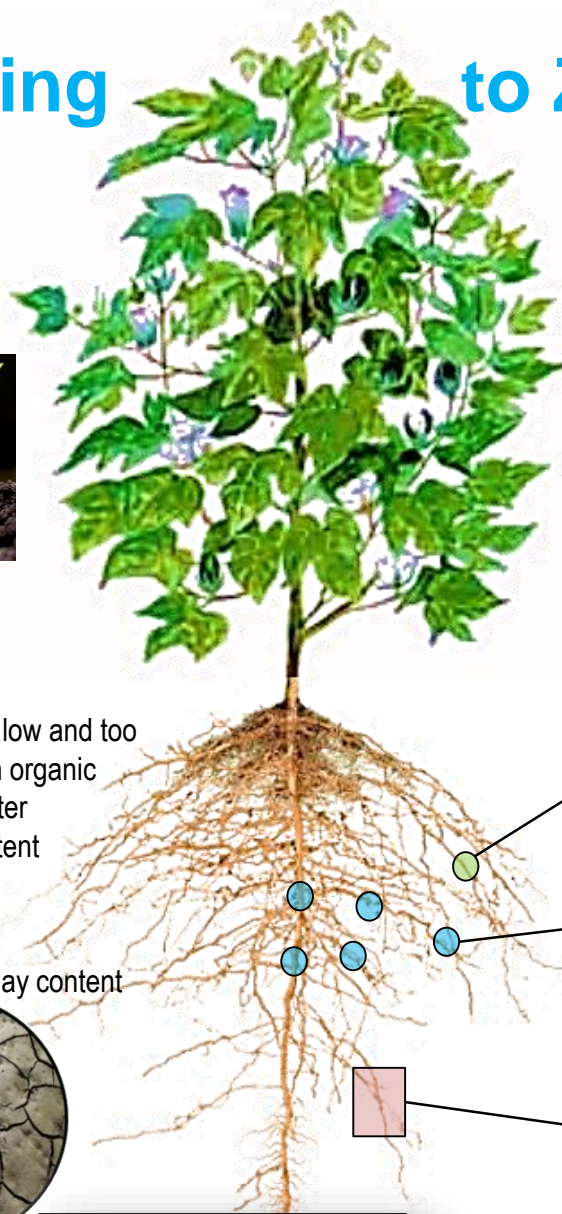


High clay content

Flooded, low temperature

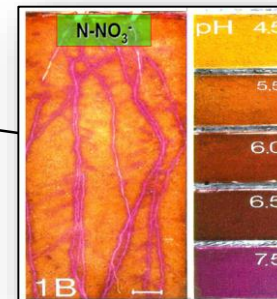


Plant Factors



Restriction of
mycorrhizal growth

High P uptake → ties up Zn
in the roots as Zn-phytate



Increase in
rhizosphere pH.
e.g. absorption of
nitrate by roots

N-NO_3^- co-transport
 H^+ across root
cells.

Basis of Zn Recommendation

- *Plant analysis:*

- Leaf or petiole testing: 20 (25) to 100 mg/kg (ppm)

- *Soil analysis:*

- Mehlich-3: > 2 ppm Zn

- DTPA: >0.28 ppm Zn

Treating Zn Deficiency

- Application of Zn (Inorganic) – injected in-season
 - ZnSO_4 – very soluble and cheaper than Zn chelate (e.g. 34% Zn in dry Zn sulfate)
 - Zn chelate – stays more available than Zn from Zn sulfate (e.g. 10% Zn as Zn-EDTA)
- Reduce pH

Treating Zn Deficiency

- Foliar application of Zn-solution
 - Repeated applications
 - Complete canopy coverage (Zn is immobile in the plant)
 - Sources
 - 0.5% Zn as ZnSO₄ in 100 gal water
 - Chelated Zn
 - Organically bound Zn



Prevent Future Problem

- Soil test regularly
 - Every 2-3 years
 - Apply recommended rates
 - Inorganic Zn – 1 to 10 lbs/ac
 - Chelate or organic – 0.5 to 2 lbs/ac
 - Most cropping systems, 10 lbs/ac of Zn can be effective for 2 to 3 years.
- Correct soil pH
- Increase organic matter or apply manure

Thank You!



btubana@agcenter.lsu.edu

Mobile: 225-252-6025

Office: 225-578-9420