

A wide-angle photograph of a vast cotton field under a cloudy sky. The rows of cotton plants stretch far into the distance, with some pink flowers visible. The field is the central focus of the slide.

A Closer Look at Potassium Deficiencies in Cotton

Mississippi Row Crop Short Course
4 Dec 2018

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K deficiency



Fayette Co 2018

K deficiency

Lauderdale Co 2017



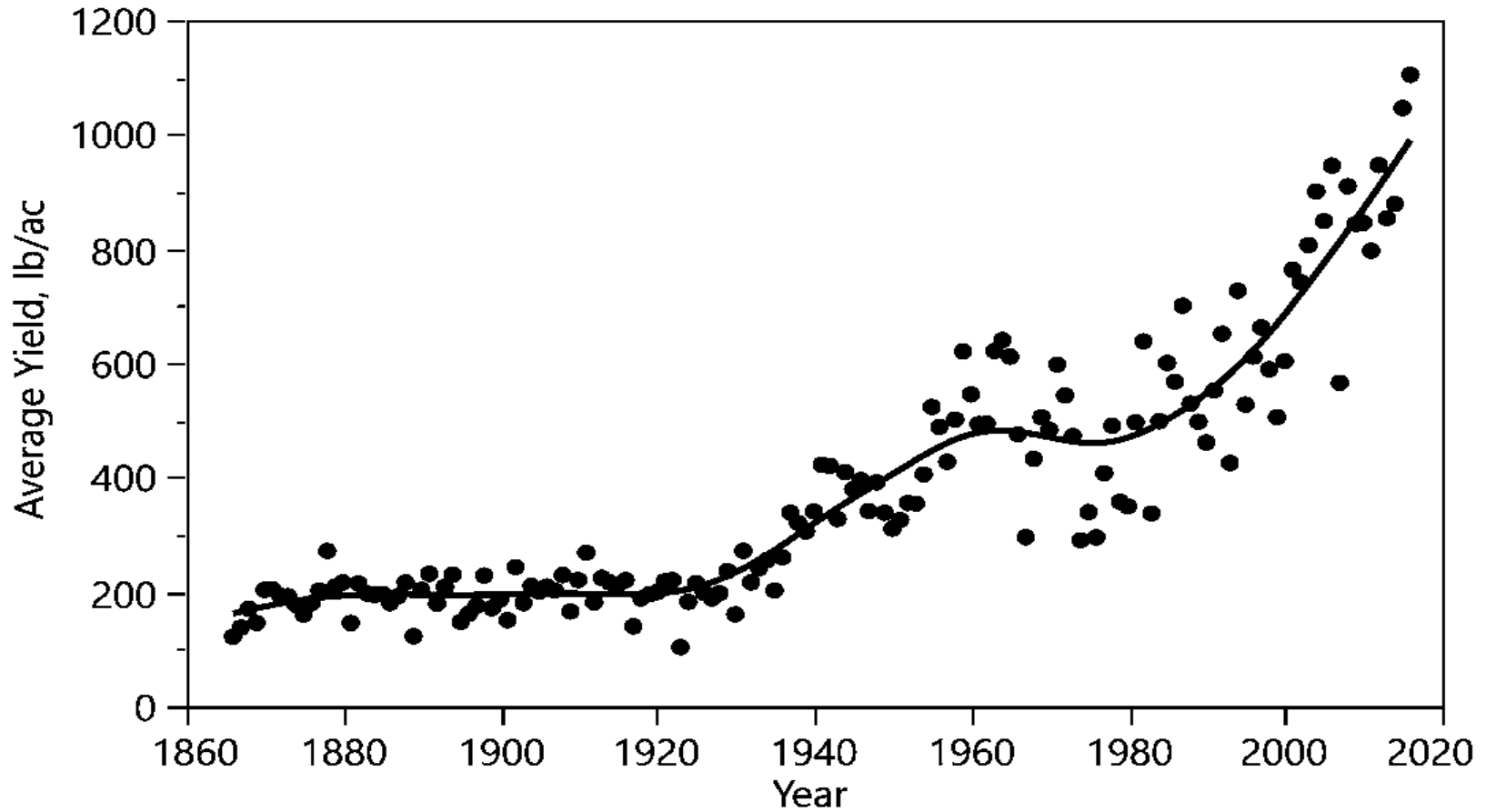
Haywood Co 2017



Crockett Co 2017



K Importance/Response to K



Characteristics



Characteristics



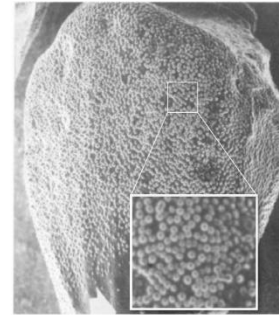
Why should we care about K?

- Important catalyst in 60+ enzyme reactions
- Role in:
 - respiration
 - photosynthesis
 - protein synthesis
 - metabolism of carbohydrates
 - translocation
 - osmotic adjustment
 - aids in tolerance to abiotic & biotic stressors
 - boll formation & fiber elongation

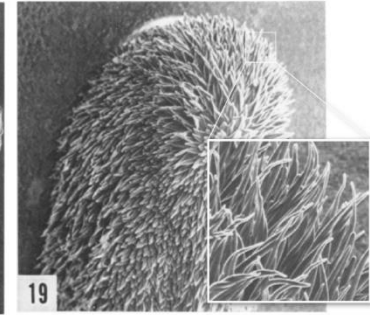


Role of K in Fiber Development

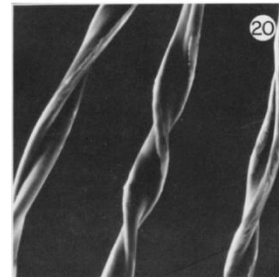
- A seed hair
- Composed of a single, hyper-elongated cell
 - Expands to over 25,000 times its original size



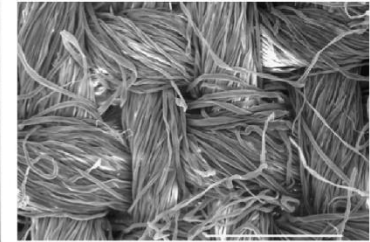
Cotton seed: Day 1



Cotton seed: Day 3



Mature cotton fibers: Day 60



Woven cotton fabric

Stewart, J.M. (1975). Fiber initiation of the cotton ovule (*Gossypium hirsutum*). *American Journal of Botany*, 62:7, 723-730.



Why worse in cotton?

It is hypothesized that the interaction of 3 factors has driven cotton K deficiency issues:

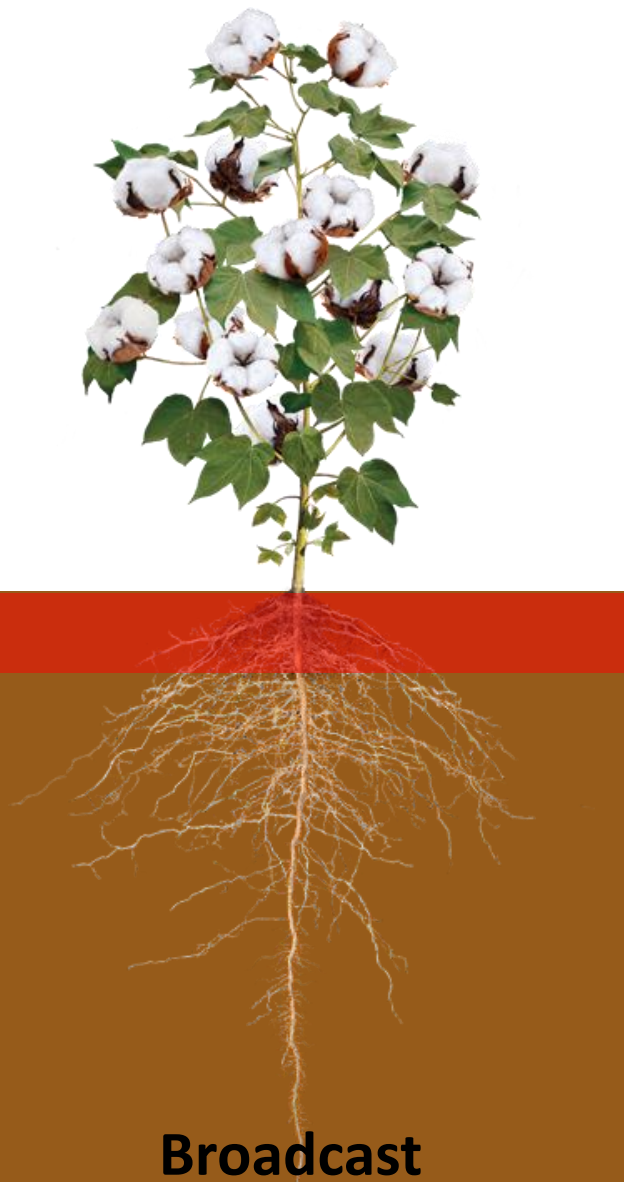
1. Depletion of subsoil K and stratification of the nutrient near the soil surface
2. Relative inefficiency of cotton, relative to other row-crops, to absorb K
3. Increase in early-season demand for K associated with modern, high-yielding cotton varieties



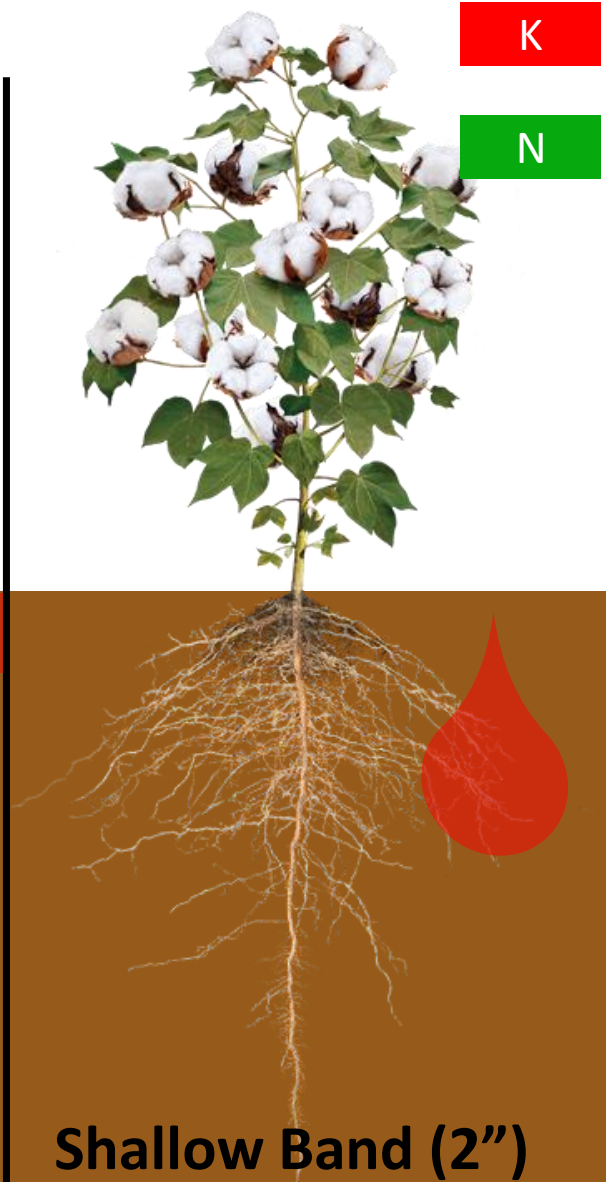
Hypothesis

Better placement of K within the effective rooting zone will increase fertilizer K use efficiency.

K Placement



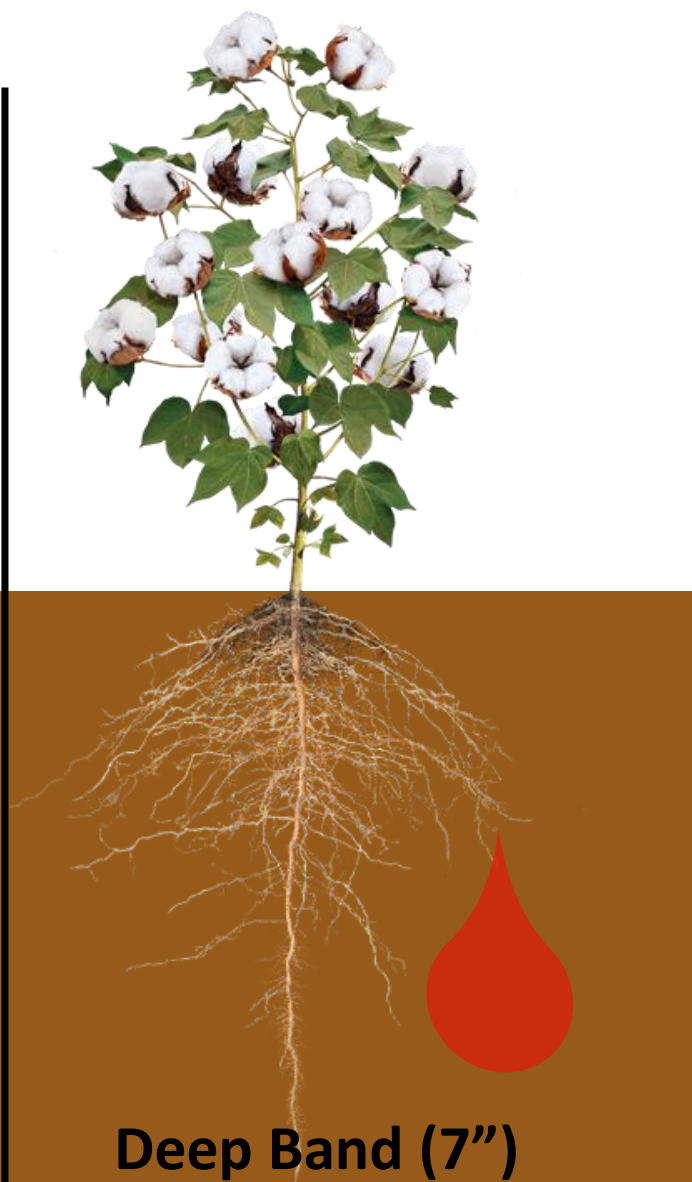
Broadcast



K

N

Shallow Band (2")



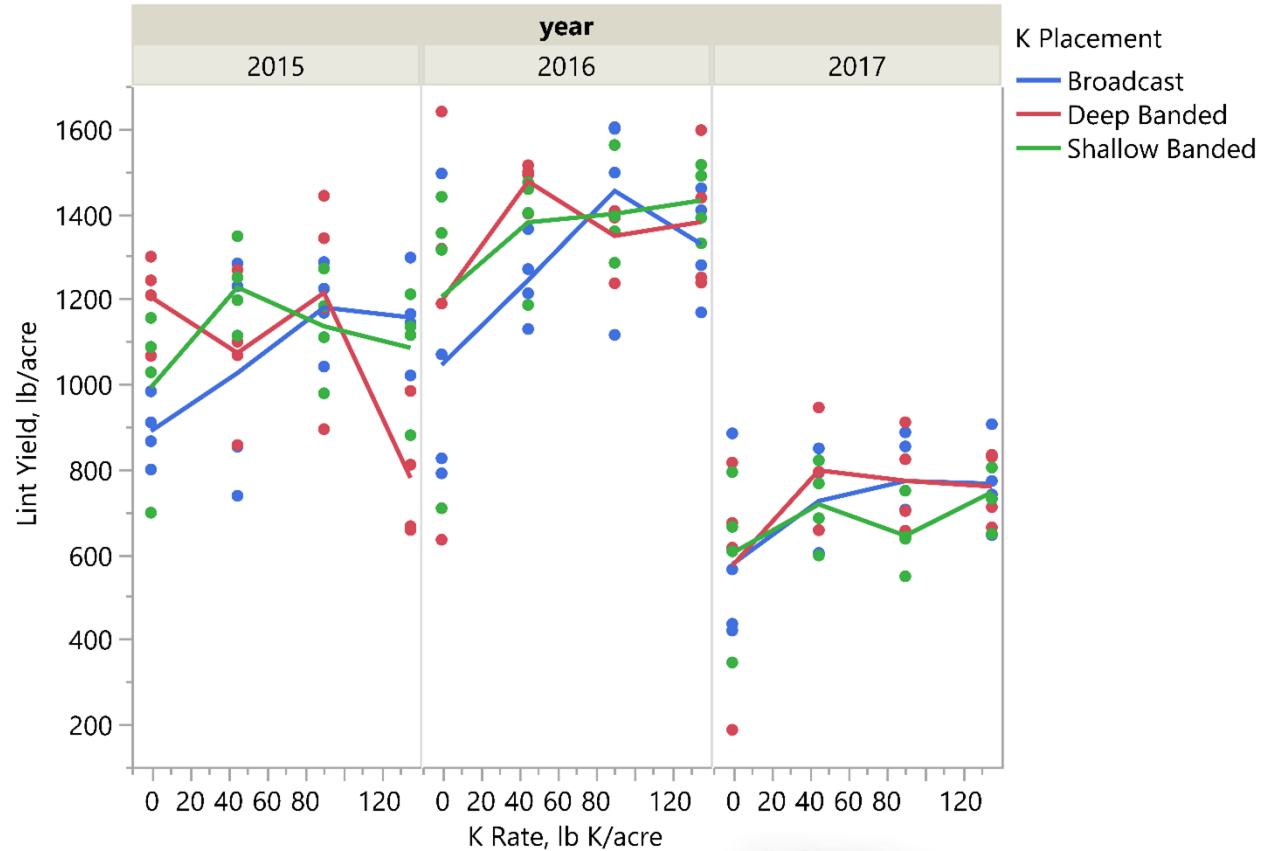
Deep Band (7")

K Management: Fertilizer Rate

2015 Milan REC; 2016-2017 West TN REC

Milan, TN; Jackson, TN

Silt Loam; 115-135 mg/kg K, Mehlich 3; soil test medium in K



Ames Plantation K Deficiencies



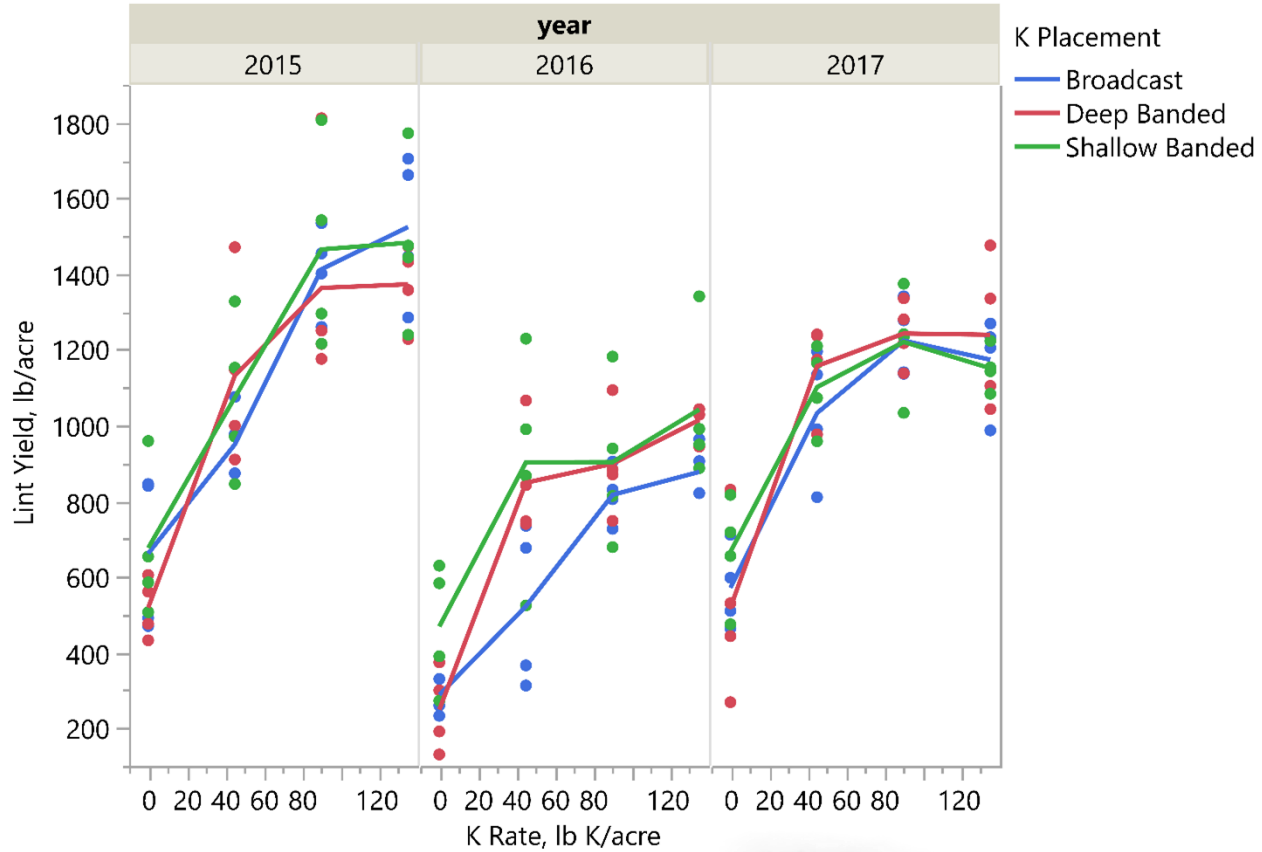
Ames Plantation K Deficiencies



K Management: Fertilizer Rate

2015-2017 Ames Plantation REC Grand Junction, TN

Collins Fine Sandy Loam; 70 mg/kg K, Mehlich 3; soil test low in K



K Placement x K Rate

- Across 5 of 6 site-years, we found no significant increase in fertilizer K use efficiency with banded placements over broadcast applications.
- At the 2016 Ames Plantation site-year, we saw an increase in fertilizer K use efficiency when K was banded (either shallow or deep) versus broadcast applied.



Conclusion

Better placement of K within the effective rooting zone ~~will~~ **can** increase fertilizer K use efficiency **if moderate drought stress is experienced.**

Take home

- Broadcast applications appear to be the most efficient method of soil application.
 - K banding? May only increase KUE in dry years
- Soil applied K rates appear adequate
 - An issue of uptake, not availability
 - Will evaluate more foliar K applications in 2019
- Potassium deficiencies are most often observed in high yielding cotton



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