A Closer Look at Potassium Deficiencies in Cotton

Mississippi Row Crop Short Course
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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

![Graph showing the trend of average yield in lb/ac over years from 1860 to 2020. The yield shows a significant increase from the early 1900s onwards.](image)
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

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

Shallow Band (2”)

Deep Band (7”)

Cotton plant courtesy Croplan: https://www.croplan.com/Crops/Cotton/Home
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
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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 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