Cotton Yield, Quality, and Plant Growth Response to Soil-Applied Potassium


An Extension Cotton Specialist Project
Introduction

• More common reports of K deficiency symptoms from across the Cotton Belt.

• Todays varieties-increased yields and in many cases faster fruiting-more with more K demand in a shorter amount of time.

• K deficient plants more prone to foliar diseases.
Distribution of 1st Position Bolls

Main-stem Node

Whitaker, Collins, and Ritchie
All Cotton Yield
United States

Fertilizer use in U.S. agriculture, 1960-2011

Lint Yield Response
Stiles Farm Foundation, Williamson County, 2012

P>(F)=0.0001; LSD=153; CV=23.9
ROI - Williamson 2012

Soil test = 60 ppm

<table>
<thead>
<tr>
<th>Treatment lbs./A</th>
<th>Dollars/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 lbs. injected</td>
<td>A</td>
</tr>
<tr>
<td>80 lbs. injected</td>
<td>B</td>
</tr>
<tr>
<td>40 lbs. injected</td>
<td>B</td>
</tr>
<tr>
<td>120 lbs. broadcast</td>
<td>C</td>
</tr>
<tr>
<td>80 lbs. broadcast</td>
<td>C</td>
</tr>
<tr>
<td>40 lbs. broadcast</td>
<td>C</td>
</tr>
<tr>
<td>untreated</td>
<td>C</td>
</tr>
</tbody>
</table>
Late season foliar disease

0 lb/a K₂O

120 lb/a K₂O
Lint yield

2012-2015: Williamson, Wharton, and Hill Counties

Current threshold
Fiber Quality – Texas Locations

• >200 ppm K
  – Micronaire, strength, and length were non-responsive to treatments

• <200 ppm K
  – Length was non-responsive in all years
  – Micronaire response in liquid treatments in 2012&2013
  – Bundle strength responded in both application methods in 2012, but only liquid application in 2013&2014
CottonBelt Potassium Project
2015

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Materials and Methods

Variety - DP 1321 B2RF

Soil analysis for each plot
- 0-6”
- 7-12”
- 13-24”

Melich III Extraction – all locations

Leaf K analysis at first bloom
Lint yield
Fiber quality
Texas 2015 Treatments

1. No additional K – injected
2. Injected 0-0-15 at 40 lb K$_2$O/A
3. Injected 0-0-15 at 80 lb K$_2$O/A
4. Injected 0-0-15 at 120 lb K$_2$O/A
5. Injected 0-0-15 at 160 lb K$_2$O/A
6. No additional K - disked
7. Broadcast incorp. 0-0-60 at 40 lb K$_2$O/A
8. Broadcast incorp. 0-0-60 at 80 lb K$_2$O/A
9. Broadcast incorp. 0-0-60 at 120 lb K$_2$O/A
10. Broadcast incorp. 0-0-60 at 160 lb K$_2$O/A

Arizona used Potassium sulfate

All plots received equivalent amounts of Nitrogen and Phosphorous
Applications

Liquid
- 4” x 6” from seed furrow
- 2-4 weeks before planting

Broadcast incorporated
- various mechanisms (> 3”)
- 2-4 weeks before planting
Lint Yield – Delta Region

- Mississippi
- Arkansas – St. Francis
- Louisiana
- Arkansas - Desha
- Missouri
- Tennessee

Lint yield (lb/a) vs. Potassium (lb/a)

- Injected
- Broadcast
Lint Yield – Southwest

Lint yield (lb/a)

Potassium (lb/a)

- Arizona
- Lubbock
- Texas - Wharton
- Texas - Williamson

Injected
Broadcast
Conclusions

• Despite the sites in Southeast and Delta regions being at or below 125 ppm threshold and high yields, no consistent yield response was observed from either application method.

• The Southwest location with less than 125 ppm was responsive and high rates of injected K at the Lubbock site.

• In previous research, yield lint response has been more consistent in limited moisture years. Excessive moisture in most locations in 2015 likely contributed to the inability to obtain a response.
Soil K level with depth

Threshold: 125 ppm K

- Soil K ppm
  - <150
  - 150-200
  - 200-250
  - 250-300
  - 300-350
  - 350-400
  - >400

0-15 cm

15-61 cm

61-122 cm
Future Research

• Four locations will be evaluated to K depletion and replenishment over 3 years.

• Mineralogy survey of the sites to better understand the exchangeable and non-exchangeable K.

• Meet with Texas A&M Soil Testing Lab to determine the need for modification of current K threshold.
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CottonBelt Potassium Project
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