EVALUATION OF COTTON YIELD TO IN-SEASON SOIL APPLIED POTASSIUM

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Abstract

The increased yield potential of new cultivars have pushed cotton yields in Arkansas to 3 - 4 bales/acre. Such high yields put a substantial demand on the cotton root systems' ability to take up sufficient potassium (K) and other nutrients especially in soils with shallow rooting. The objective of this study was to evaluate application timing and rates of K on cotton yield and quality. The on-farm study from 2016 to 2020 near Judd Hill was a conventional-tilled, furrow irrigated field. The producer's standard K fertility program timings consisted of pre-plant, 4 to 6 leaf, and 1 week prior to first flower. Alternative strategies consisted of shifting the in-season K applications to either the 4 to 6 leaf or the one week prior to first flower timing. A treatment which consisted of no in-season applications represented the current university recommendation. While no statistical yield differences were observed within years, it appears that a trend for improved yields may be obtained when shallow rooting conditions exist especially during boll fill.

Introduction

New and improved cultivars and better management practices have pushed cotton yields in Arkansas to 3 - 4 bales/acre. Such high yields put a substantial demand on the cotton root systems' ability to take up sufficient potassium (K) and other nutrients. The frequency and severity of K deficiency symptoms also has increased on highly-productive soils over the past decade especially in soils with shallow rooting. Insufficient K levels as a result of shallow rooting could decrease yields and fiber quality and lead to decreased grower profits. The objective of this study was to evaluate application timing and rates of K on cotton yield and quality. Based on these findings soil K recommendations will be re-evaluated and modified as appropriate to optimize yields.

Materials and Methods

An on-farm study site was selected at Judd Hill based on cooperators and consultants desire to address their questions on K needs of cotton on their soil and yields. The site was a conventional-tilled, furrow irrigated Mhoon Silt Loam field. The four-year study was conducted using a RCBD with 4 replications. Plots were 6 rows (38") wide and 1200 foot long. The producer's standard fertility program consisted of pre-plant, 4 to 6 leaf, and 1 week prior to first flower (Table 1). Alternative strategies consisted of shifting the in-season K applications to either the 4 to 6 leaf or the one week prior to first flower timing. A treatment which consisted of no in-season applications (all pre-plant) of K represented the current university recommendations (Table 2). Seedcotton was hand-picked from four plants (one hill) in each plot to calculate percent lint and provide samples for HVI fiber analysis. Plots were machine harvested.

Results and Discussion

A trend was observed for increased yield associated with in-season K applications in 2016, 2017, 2019, and 2020 in which dry condition were observed during much of boll fill. When dry conditions during boll fill are experienced, the lack of water infiltration below six inches with furrow irrigation often results in the loss of deep roots shifting the plant into a shallow rooting/poor uptake situation. No advantage was observed in 2018 when significantly above average rainfall was received during boll fill allowing the plants to maintain a deeper effective rooting zone.

Table 1. Producer standard fertilizer application timings and rates of nutrient applications season long at Judd Hill in 2016 to 2020.

	Application Timing			
Nutrient	Pre-Plant (lb/A)	4 to 6 Leaf (lb/A)	1 week prior to First Flower (lb/A)	Season Total (lb/A)
Nitrogen	18	46	46	110
Phosphorus	46	0	0	46

Potassium	60	30	30	120
Sulfur	0	12	12	24
Boron	0	0.5	0.5	1.0

Table 2. Alternative strategies evaluated for K-Study application timings and lint yield lb/A at Judd Hill in 2016-2020 keeping all other nutrient rate and timings consistent with each strategy.

K Timing	Lint Yield (lb/A)					
	2016	2017	2018	2019	2020	Average
In-season Early + Late	1627	1643	1640	1733	1754	1676
In-season Late Only	1459	1650	1745	1618	1686	1629
In-season Early Only	1572	1588	1590	1671	1715	1623
Pre-plant Only	1413	1581	1740	1669	1474	1580

Summary

While no statistical yield differences within years were observed in this study, it appears that a trend for improved yields may be obtained when the effective rooting depth is restricted during boll fill. More research is needed to fully evaluate the impact of soil moisture in plants response to soil applied K.

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