CAN UREA AND POTASSIUM FERTILIZER (23-0-30) APPLIED DURING BLOOM INCREASE YIELD AND QUALITY OF COTTON GROWN ON A SHARKEY CLAY SOIL

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Abstract

In Louisiana cotton production systems, potassium (K) and nitrogen (N) management can be challenging. Mid- to late- season K and N deficiencies are also commonly observed in cotton fields, and producers are concerned that yield is being reduced as a result. In an attempt to better manage K and N fertility, some producers will apply a urea plus potash blend to cotton at 1 to 3 weeks after bloom. Since root growth has essentially stopped by first bloom, coinciding a fertilizer application at a growth stage that will provide available nutrients to the active root zone at peak K and N uptake time may increase cotton lint yield and quality. Therefore, a trial was conducted evaluating if a urea/potash fertilizer blend applied at first week of bloom and two weeks later would affect cotton growth and yield. In 2018, a field trial was conducted at the LSU AgCenter Northeast Research Station near Saint Joseph, La on a Sharkey clay soil. The field trial was conducted in a strip-trial design replicated three times. The plots were 26.67 feet wide and measured 310 feet in length. Treatments included 23-0-30 applied during the first week of bloom (July 6), 23-0-30 applied three weeks after the first week of bloom (July 30), and a non-treated. No significant differences were found between treatments for cotton plant mapping components, cotton plant height, and lint yield. Optimal growing conditions and/or fertilizer treatments occurring too late in the season may have negated the K and N fertilizer benefits.

Introduction

In Louisiana cotton production systems, potassium (K) and nitrogen (N) management can be challenging. Mid- to late- season K and N deficiencies are also commonly observed in cotton fields. Producers are concerned that yield is reduced as a result. Cotton uses about 60 lb K and N per acre per 480 lb bale (Stewart 1998). Producers typically side-dress with urea ammonium nitrate (UAN 28 or 32%) shortly after cotton emergence. Typical nitrogen rates, applied in LA, range from 85 to 120 lb N per acre. The majority of N uptake occurs after first bloom, peaking during fruiting (Stewart 1998). Approximately 70% of K uptake occurs after first bloom (2 to 3 lb K per acre per day). Nitrogen management concerns are related to actual and perceived losses that can occur as a result of rainy weather. In Northeast LA, cotton is predominately grown on clay soil types, where denitrification losses are a concern for producers. Denitrification can lead to nitrogen deficiencies later in the growing season. Some producers compensate for the potential denitrification losses by applying more nitrogen at side-dress. The problems arise with too much nitrogen, which can lead to excessive vegetative growth in addition to reduced fruit set and yield. With low cotton yields the last several growing seasons, producers are questioning the need for increased application of N fertilizer. There have been reports of up to 150 units of N being applied at side-dress. It seems that producers are applying more nitrogen in order to make up for yield and perceived nitrogen losses. This amount of N applied near cotton emergence will likely lead to excessive vegetative growth and reduced yield. Late-season potassium deficiencies can be observed in most fields each year. As with nitrogen, producers are concerned that these deficiency symptoms are resulting in yield loss. In an attempt to better manage K and N fertility, some producers will apply a urea plus muriate of potash blend to cotton at 1 to 3 weeks after bloom. They feel that the cotton plant has enough of a fruit load at this point to prevent excess fruit shed and excessive vegetative growth. However, in dryland fields a rainfall will be required to incorporate the urea/potash blend into the active root zone. Since root growth has essentially ceased by first bloom, coinciding with a fertilizer application at a growth stage that will provide available nutrients to the active root zone at peak K and N uptake time may increase cotton lint yield and quality. This strategy may minimize fruit shed and excessive vegetative growth caused by too much N applied during vegetative growth. However, applications such as this could be better suited for irrigated fields and clay soils. Therefore, a trial was conducted evaluating if a urea/potash fertilizer blend applied at first week of bloom and three weeks after bloom would affect cotton growth and yield.

Materials and Methods

In 2018, a field trial was conducted at the LSU AgCenter Northeast Research Station near Saint Joseph, La on a Sharkey clay soil. The field trial was conducted in a strip-trial design replicated three times (Figure 1). The plots were 26.67 feet wide and measured 310 feet in length. Deltapine 1646 cotton variety was planted May 18, and was side-dressed with 80 units of nitrogen on June 4. Treatments included 23-0-30 applied during the first week of bloom (July 6), 23-0-30 applied three weeks after the first week of bloom (July 30), and a non-treated. The fertilizer, a blend of urea and muriate of potash, was broadcast at a rate of 100 pounds per acre, 50 lb urea + 50 lb potash. The treatments were applied using a JD 6000 Hiboy equipped with a spreader. Rainfall amounts after application dates are shown in Table 1. The first defoliation was applied September 14, using 80 oz/a Folex (phosphorotrithioate) plus 2 oz/a Freefall (thidiazuron), and the second defoliation was applied on September 20, using 80 oz/a Folex plus 32 oz/a Super Boll (ethephon). On October 19, five random plants from each plot (strip) was selected and plant mapping data was recorded for each. The center four rows were harvested from each 8 row strip on October 22 using a JD 9870 inline picker. A weigh buggy was used to record weights of individual plots. Data was subjected to ANOVA using the MIXED procedure of SAS® software (SAS 2018). A mixed model with treatments as fixed effects was used. Treatment comparisons were made using LSMEANS and pdiff procedure.

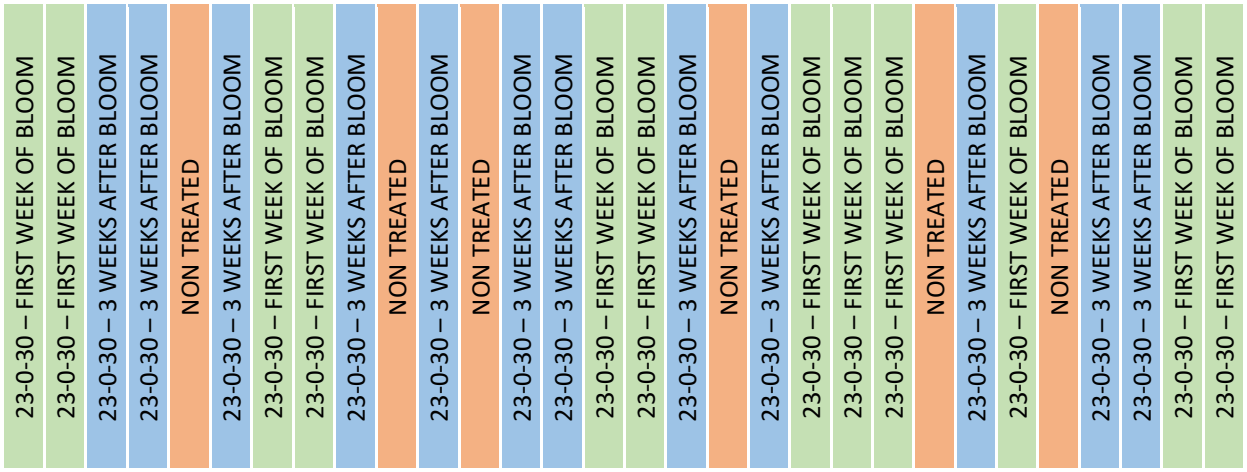

Figure1. Illustration of Field Trial Layout. Plot size was 26.67 feet wide by 310 feet in length.

Table 1. Rainfall amounts from July 6 to August 31.

Date	Rainfall (Inches)
July 6[1] to 10	1.07[a]
July 11 to 15	0.10
July 16 to 20	3.15
July 21 to 29	0.73
July 30[2] to August 3	0.25[b]
August 4 to 8	0.0
August 9 to 13	0.51
August 14 to 31	2.37

[1]Application date of the First Week of Bloom Treatment
[a] 0.64 inches of rain fell within 2 days of application
[2] Application date of the 3 Weeks After First Bloom Treatment
[b] 0.24 inches of rain fell within 2 days of application.

Results and Discussion

No significant differences were found between treatments for the cotton plant mapping components measured (Table 2), cotton plant height, and lint yield (Table 3). Rainfall amounts of 0.64" and 0.25" was received within two days of the First Week of Bloom and Three Weeks After First Bloom treatments, respectively (Table 1). Total rainfall amounts were 5.63", 2.95", and 2.02" in July, August, and from September 1 to 11, respectively (data not

shown). Irrigation, therefore, was not required to incorporate the fertilizer treatments or preserve cotton yield. Inherent soil fertility and optimal growing conditions may have influenced why the fertilizer treatments had no effect on cotton yield. Fertilizer treatment application timing may have occurred too late in the growing season to be beneficial for increasing yield.

Table 2. Fertilizer Treatment (23-0-30) Effect on Plant Mapping Components: Total Node Number, Upper Most Cracked Boll, Upper Most Harvestable Boll, and Number of Fruiting Branches.

Fertilizer Treatment	Total Node Number[1]	Upper Most Harvestable Boll[2]	Number of Fruiting Branches[3]
1st Week of Bloom	28[4a]	19	21
4th Week of Bloom	27	19	20
Non-Treated	26	19	19

[1] Total Node Number – total node number per plant.
[2] Upper Most Harvestable Boll – upper most harvestable on the first fruiting position.
[3] Number of Fruiting Branches – total number of fruiting branches per plant.
[4] There was no significant treatment effect for total number of nodes per plant, first position upper most cracked boll, upper most harvestable on the first fruiting position, or number of fruiting branches per plant.
[a] Data was collected on October 19th.

Table 3. Fertilizer Treatment (23-0-30) Effect on Cotton Plant Height, % Lint Turnout, and Lint Yield.

Fertilizer Treatment	Plant Height	% Lint Turnout	Lint Yield (lb/a)
1st Week of Bloom	52	45.5	1,687
4th Week of Bloom	51	45.3	1,736
Non-Treated	51	45.5	1,741

[1] Plant Height – final plant height.
[2] Percent Lint Turnout –percent lint from seed cotton sample (lint weight ÷ seed cotton weight).
[3] Lint Yield (lb/a) – lint yield.
[a] Cotton harvested on October 22.

Summary

Cotton fertility needs will vary based on the yield potential of a field in a given year. Favorable growing conditions during the season may dictate the need for supplemental N and K applications in order to realize top-end yields. Also, by applying supplemental N and K in season rather than all at or before planting, may would allow a grower to respond to growing season conditions, therefore saving some money. The results of this study, however, did not find any benefit to applying urea and potash to cotton during the bloom period. Growing conditions were optimal during the 2018 growing season, which was reflected in the high yields across the cotton growing areas in Louisiana. Soil fertility conditions and adequate rainfall may have masked the benefit of the fertilizer treatments in this trial. Also, the timing of fertilizer treatments may have occurred too late in the growing season for a yield response.

Applying in-season supplemental K and N fertilizer may potentially be better suited for irrigated fields and clay soil types. Irrigation would ensure the timely incorporation of the fertilizer into the soil solution and also ensure nutrient availability during dry years.

In order to determine the utility of in-season fertilizer, questions remain on application timing, amount of fertilizer, and how this compares to foliar applications. In 2019, an earlier application timing will be added to the treatments as well as an additional fertilizer rate. The trial will be replicated on a silt loam soil, as well.

Acknowledgements

Special thanks to Dr. Syam Dodla for help with data analysis, and Mr. Warren Ratcliff and farm crew for help in conducting the experiment.

References

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