EVALUATION OF FOLIAR FERTILIZER IN LOUISIANA COTTON

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Abstract

Fertility management in cotton production systems can be challenging. Louisiana cotton has historically been grown on silt loam soils, but today cotton is predominately grown on clay soil types characterized by high water holding capacities and poor internal drainage. Excessive spring rainfall like that of 2019 can lead to prolonged saturated soil conditions that deplete soil oxygen levels leading to reduced plant and root growth. A reduced root system could limit the soil volume that the roots are able to take up nutrients from. Producers consider applying foliar fertilizers as a way to “jump start” plant growth following adverse growing conditions. Therefore a study was conducted to evaluate the use of several common foliar fertilizers on a clay soil with saturated soil conditions in the spring. The study was conducted at the LSU Agcenter’s Northeast Research Station on a Sharkey clay soil type. The area received 7.51” rainfall in May and 6.41” in June which most likely lead to reduced root and crop growth. The study was conducted as a randomized complete block design with 4 replications. Treatments included applications of CoRoN (25-0-0), K-Leaf (0-0-30), ENC Flex (11-6-5), and Megafol (3-0-8) at different rates, combinations, and number of application times. No fertilizer treatment significantly affected cotton fiber analysis or lint turnout percent. Cotton yield ranged from 1129.8 to 1338.5 lb lint/acre, but there were no yield differences between treatments. The lack of significant yield and fiber analysis differences in this study may have been masked because a preplant application 0-26-26 fertilizer was applied across the entire study site. However, nitrogen losses would have been likely since 6.3” of rainfall was received after fertilization on June 6 (80 units of nitrogen, 28-0-0-5). Further research is needed.

Introduction

Cotton fertility management can be a challenge in cotton production. Cotton requires about 60 lb of nitrogen, 20 lb phosphorus (P_2O_5), 60 lb potassium (K_2O), and 8 to 12 lb sulphur per bale (480 lb) per acre (Hake et al., 1991). Nitrogen management can be especially difficult since cotton is a perennial plant with an indeterminate growth habit. Cotton, therefore, can respond negatively when too much nitrogen is applied by producing excessive vegetative growth and delay maturity. In Louisiana, in the Mississippi River Delta region, cotton has historically been grown on silt loam soils (a.k.a. “ice cream soils”). Today, however, cotton is predominately grown on clay soil types that are characterized by high water holding capacities and poor internal drainage. Cotton production on clay soils can also be a challenge in itself. Excessive spring rainfall events, like that of 2019, can lead to prolonged saturated soil. Prolonged saturated conditions (48 hrs) will quickly deplete soil oxygen levels leading to reduced plant and root growth. A reduced root system could result from these conditions which will limit the soil volume that the roots are able to take up nutrients from. Producers often ask about applying foliar fertilizers as a way to “jump start” plant growth following adverse growing conditions or to reduce the impact of stressful conditions when they occur. Limited research has been conducted in Louisiana evaluating foliar fertilizers. One reason is the plethora of foliar fertilizer products on the market. Many factors could contribute to a yield response from foliar applied fertilizers. For instance, a yield response may be observed when growing conditions (hot and dry weather, prolonged cloudy days, and saturated soil conditions) are poor and if the inherent soil fertility is medium to low. Plant uptake of foliar fertilizers is usually high, but this could depend on the drying time of the product once it is on the plant leaf. Usually only small amounts of actual product can be delivered due to potential crop injury. Another limitation is that the cost per unit of the fertilizer is often expensive. The wet May (7.51”) and June (6.41”) of 2019 most likely reduced root and crop growth. Considering the growing conditions and the above information we evaluated several common foliar fertilizers.

Materials and Methods

In 2019, a field trial was conducted at the LSU Agcenter's Northeast Research Station located near St. Joseph. Delta & Pine Land 1646 cotton variety was planted May 3, 2019 on a Sharkey clay soil type. The study was conducted as a randomized complete block design with 4 replications. Plot size measured 13.33' by 45'. During the month of May, the study area received 7.51" of rainfall in 6 events all within 10 days after planting. In June, 6.41" of rainfall was accumulated in 10 rain events over 24 days. Treatments were applied using a JD 6000 high boy equipped with a multi-boom. A total of 10 treatments were evaluated including: CoRoN (25-0-0), K-Leaf (0-0-30), ENC Flex (11-6-5), and Megafol (3-0-8). The rates and application timings can be found in Table 1. Cotton defoliant was applied October 1, 2019 using 4 oz/a Def plus 2 oz Drop and a second shot of 12 oz/A of Def was applied on October 8, 2019. The center two rows from each plot were harvested on October 30, 2019 using a JD 9965 two-row plot picker equipped with a weighing system. Yield was converted to pounds of lint per acre using the lint turnout percentages from each plot. Data were analyzed using JMP statistical software at a 0.05 significance level.

Table 1. Treatments and Application Dates of Foliar Fertilize Products.

Treatment	7/31	8/7	8/13	8/19	8/26	9/3
Non-treated	-	-	-	-	-	-
CoRoN (1 GPA)	1 qt/a	1 qt/a	1 qt/a	1 qt/a	-	-
K-Leaf (0.5 GPA)	1 qt/a	1 qt/a	-	-	-	-
K-Leaf (1 GPA)	1 qt/a	1 qt/a	1 qt/a	1 qt/a	-	-
K-Leaf (1.5 GPA)	1 qt/a	1 qt/a	1 qt/a	1 qt/a	1 qt/a	1 qt/a
CoRoN (0.25 GPA) + K-Leaf (0.25 GPA)	1 qt/a + 1 qt/a	-	-	-	-	-
CoRoN (1 GPA) + K-Leaf (1 GPA)	1 qt/a + 1 qt/a	1 qt/a + 1 qt/a	1 qt/a + 1 qt/a	1 qt/a + 1 qt/a	-	-
CoRoN (1 GPA) + Megafol (0.25 GPA)	1 qt/a + 1 qt/a	1 qt/a (CoRoN)	1 qt/a (CoRoN)	1 qt/a (CoRoN)	-	-
ENC (0.25 GPA) + Megafol (0.25 GPA)	1 qt/a + 1 qt/a	-	-	-	-	-
ENC (0.75 GPA) + Megafol (0.25 GPA)	1 qt/a + 1 qt/a	1 qt/a (ENC)	1 qt/a (ENC)	-	-	-

Results and Discussion

Lint turnout percent was not affected by any foliar fertilizer treatment. Lint turnout ranged from 45 to 46% shown in Figure 2. Cotton yield ranged from 1129.8 to 1338.5 lb lint/acre (Figure 1). Although yield differences were not observed among treatments, numerical yield increases/decreases for treatments are: CoRoN (1GPA) = 0.8%, K-Leaf (0.5 GPA) = 3.3%, K-Leaf (1 GPA) = 8.4%, K-Leaf (1.5 GPA) = -0.7%, CoRoN (0.25 GPA) + K-Leaf (0.25 GPA) = 8.1%, CoRoN (1 GPA) + K-Leaf (1 GPA) = -8.4%, CoRoN (1 GPA) + Megafol (0.25 GPA) = 6.2%, ENC (0.25) + Megafol (0.25 GPA) = 5.2%, ENC (0.75 GPA) + Megafol (0.25 GPA) = 0.03%. No foliar fertilizer treatments affected fiber analysis (Table 2). The lack of significant yield and fiber analysis differences could be masked in this study because prior to planting a 0-26-26 fertilizer was applied across the study site. However, nitrogen losses would have been likely since 6.3" of rainfall was received after fertilization on June 6 (80 units of nitrogen, 28-0-0-5). Yield responses were expected from the foliar fertilizer treatment considering the early season growing conditions. An earlier application timing may have benefited yield. Further research is needed evaluating foliar fertilizers and under what conditions are they economically justified.

Table 2. In-Season Fertilizer Effects on Cotton Fiber Length, Uniformity, Strength, Elongation, Micronaire and Maturity.

Treatment	Length	Uniformity	SFI	Strength	Elongation	Micronaire	Maturity
Non-treated	1.2	84.9	7.2	30.0	5.2	5.0	83.3
CoRoN (1 GPA)	1.2	85.2	6.9	29.2	5.3	5.0	83.3
K-Leaf (0.5 GPA)	1.2	85.4	7.2	29.5	4.9	5.0	83.3
K-Leaf (1 GPA)	1.3	85.6	7.2	29.0	5.3	5.0	83.0
K-Leaf (1.5 GPA)	1.2	85.5	7.3	30.5	4.9	4.9	83.3
CoRoN (0.25 GPA) + K-Leaf (0.25 GPA)	1.2	85.1	7.4	30.0	5.2	4.9	82.8
CoRoN (1 GPA) + K-Leaf (1 GPA)	1.2	85.3	7.3	29.5	5.1	4.9	82.8
CoRoN (1 GPA) + Megafol (0.25 GPA)	1.3	85.7	6.9	29.1	5.6	5.0	83.0
ENC (0.25 GPA) + Megafol (0.25 GPA)	1.2	85.2	7.2	29.2	5.2	4.9	83.0
ENC (0.75 GPA) + Megafol (0.25 GPA)	1.2	85.5	7.1	29.4	5.5	5.0	83.0

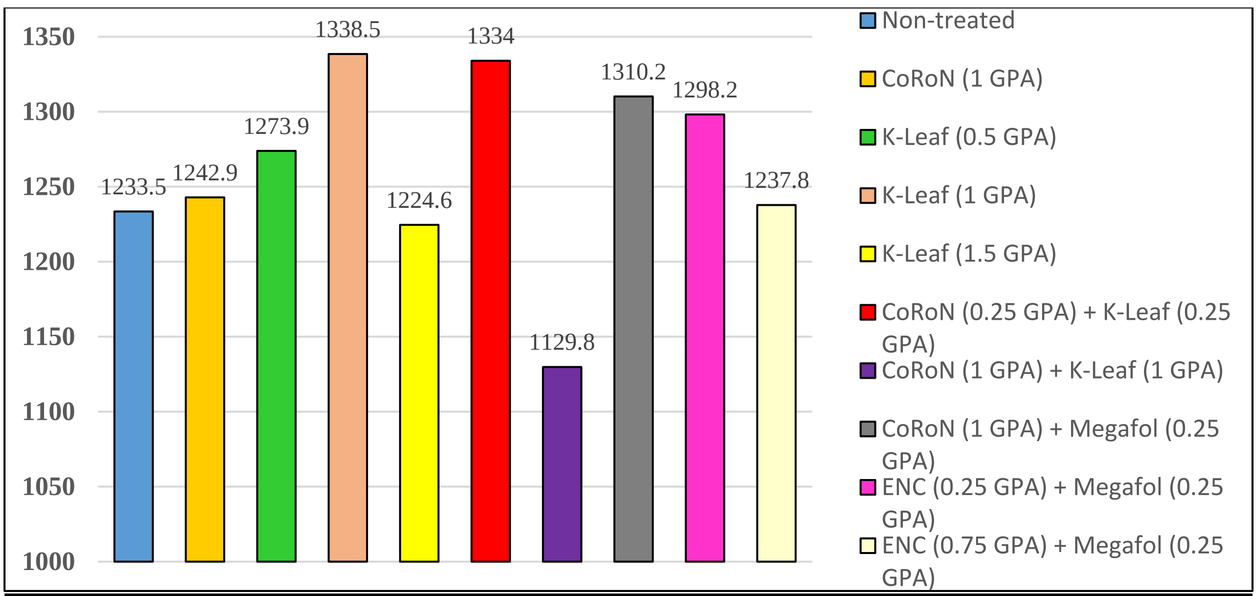

Figure 1. The Effect of Foliar Fertilizers Applied to Cotton Beginning at Early Bloom on Lint Yield per Acre.

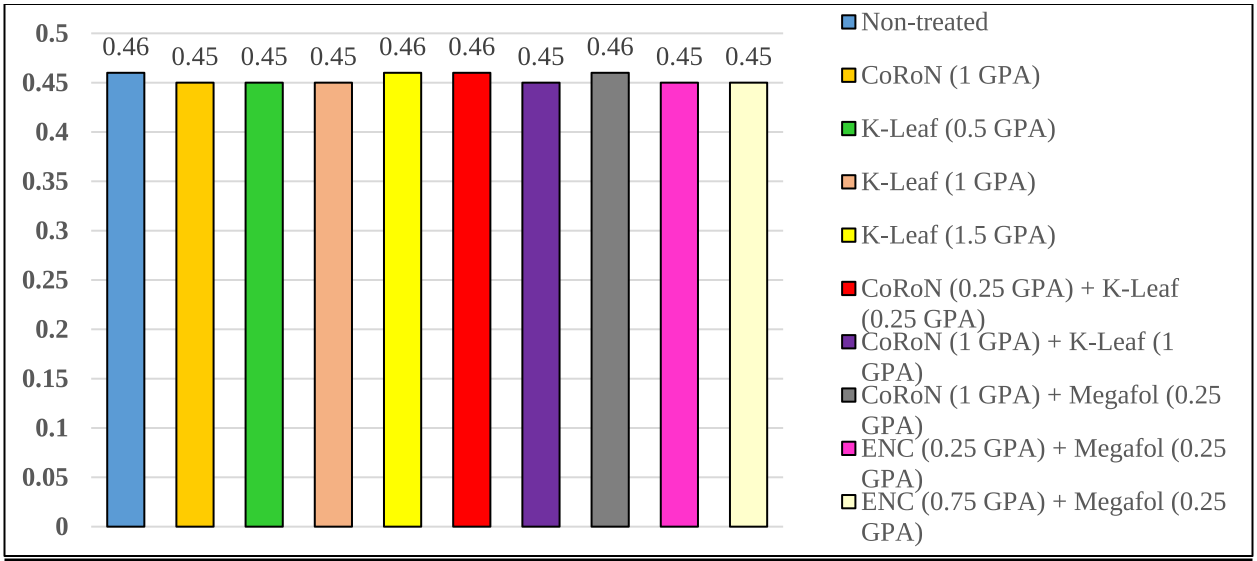

Figure 1. The Effect of Foliar Fertilizers Applied to Cotton Beginning at Early Bloom on Lint Yield per Acre.

Summary

Foliar fertilizer applications are costly and delivering sufficient amounts of fertilizer might require multiple applications due to the potential of crop injury. This study found no differences in cotton lint turnout, fiber analysis or lint yield. Other studies have been conducted that indicate foliar fertilizer can benefit cotton production in favorable growing conditions. Roberts et al. (2006) conducted a study that evaluated the economics of soil and foliar applied nitrogen in cotton production. This study found that foliar applications of CoRoN alone had the highest yield, and although yield of the foliar application alone was not significantly different than a full rate of soil applied nitrogen, the CoRoN treatment still provided the highest net revenue compared to the full rate of soil applied nitrogen. Ooesterhuis et al. (1991) states that the uptake of fertilizers through cotton leaves is often decreased drastically under stressed conditions, which are typically the conditions that incite producers to consider a foliar nutrient application. Ooesterhuis et al. (1991) recommends that the best use of foliar fertilizers would be to supplement a good soil-based fertilizer program. Soil testing is essential in maintaining proper soil nutrient levels and is necessary to determine efficient use of soil fertilizers. While research has shown that cotton can use foliar fertilizers efficiently in favorable conditions, further research is needed to determine if applications of foliar fertilizer would benefit cotton yield specifically following adverse growing conditions.

References

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