EVALUATION OF 10-34-0 FERTILIZER APPLIED IN-FURROW IN LOUISIANA COTTON PRODUCTION

Peters Egbedi
Ana P Campos
Owen Clark
Melanie Netterville
Josh Copes
LSU AgCenter Northeast Research Station
Saint Joseph, LA
LSU School of Plant, Environmental and Soil Sciences
Baton Rouge, LA

Abstract

Cotton yields could potentially be improved when planted early, however field conditions at this time of year are usually wet and cool which could impede cotton growth and establishment. In addition, cotton is susceptible to injury from thrips species from emergence to approximately the 5-leaf growth stage. From planting to 5 nodes requires from 300 to 360 heat units for cotton not under stress (Kerby et al., 1987; Oosterhuis, 1990). In 2019, from 26 to 31 days were required depending on whether the cotton was planted in mid-April or mid-May to progress through the 5-leaf growth stage. As a rule of thumb cotton seed insecticide treatments protect the seedling for approximately 10 to 14 days, depending on the environment (Personal Communication Dr. Sebe Brown). The use of starter fertilizers may help cotton develop more rapidly when the soils are cool and wet compared to no starter fertilizer. This in turn could hasten cotton development through the 5-leaf growth stage while the seed treatment is still providing thrips control. Knowing the method and optimum rate of application of a starter fertilizer like ammonium polyphosphate has many advantages in that it reduces input cost through efficient use of fertilizer and prevent salt injury to the crop (Randall, 1985). Therefore, we conducted two trials to evaluate ammonium polyphosphate starter fertilizer (10-34-0) on cotton growth, development, and yield using two placement methods at different application rates. The in-furrow placement method was applied at rates of 1.5, 2.0, 2.5 and 3.0 gallons per acre (GPA) while the 2X2 placement method was applied at 3.0, 5.0 and 7.0 GPA. In both studies, the results showed no significant difference in plant height in relation to in-furrow and 2X2 placement at the different application rates. Similarly, in both studies, there was no difference in early season plant vigor. In field trial 1 plant vigor ratings ranged from 6.75 to 7 and plant vigor ratings ranged from 6.75 to 8 in field trial 2. In field trial 1 stand counts and yields were variable among treatments, however, no distinct trend was observed. The yield from field trial 1 ranged from 834.74 to 998.88 lint lb per acre. Stand counts for field trial 1 ranged from 42,875 to 60,357 plants per acre. Similar to field trial 1, field trial 2 stand counts were variable and ranged between 45,588 to 52,722 plants per acre, but no trend was observed.

Introduction

Cotton growers continue to look for ways to improve production efficiency and yields. In Louisiana, cotton acreage is likely to decline in 2020 with cotton farmers citing insect infestation, low yields and increased production costs as some of their major constraints (Fromme, 2019). Growers begin planting cotton around mid-April in Louisiana. Early season growing conditions in Louisiana can often be characterized by cool and wet soil conditions. Thrips, primarily tobacco thrips (*Frankliniella fusca*), are an early season pest of cotton. Cotton is typically most sensitive to feeding by thrips from emergence through the 5-leaf stage. During this time period cotton, especially early-planted cotton is slow growing as air temperatures are typically cool and saturated soil conditions are common. The slow growth of cotton under these growing conditions may extend the exposure period of the crop to thrips injury (i.e. it will take longer to progress from emergence to 5 true leaves). Because of this, at least one insecticide application is often warranted for thrips control. Starter fertilizers consists of small amounts of nutrients in a concentrated zone applied close to seeds at planting (Hergert et al., 2012). They are used to maximize crop yield potentials and can be applied in various ways such as 2X2 placement and in-furrow placement. The 2X2 placement involves placing the fertilizer 2 inches to the side and 2 inches below the seed with the soil in-between offering some level of safety to the seed. In-furrow (pop-up) placement involves placing the fertilizer in direct contact with the seed with the aim of making nutrients more accessible to the plant in early season. In-furrow placement, however, can result in salt injury to the

germinating seed if the application rates are too high and soil is dry. It is crucial, therefore, to determine optimum application rates in relation to application methods that will enhance early season growth and development of cotton. In Louisiana, ammonium polyphosphate (10-34-0) is widely used as a starter fertilizer to improve early season corn yields but in cotton production, use has been limited. Although some studies have shown that applying ammonium polyphosphate starter fertilizer does not consistently increase cotton yields (Kovar et al. 1994), cotton yields have been shown to increase following prolonged cool soil conditions after planting (Bednarz et al. 2000). Although yield increases may not be consistent, Kovar et al. (1994) reported that early season cotton growth was more vigorous under certain conditions. An increase in overall growth rate may improve cottons ability to "out run" or compensate for thrips damage, and potentially increase yield when growing conditions are not optimal. In addition, using a starter fertilizer may eliminate an insecticide application to control thrips. Given the response of cotton to ammonium polyphosphate varies widely, research was conducted to evaluate in-furrow starter application rates and starter fertilizer placement and their effect on cotton growth and yield.

Objective

Evaluate in-furrow application rates and fertilizer placement methods for ammonium polyphosphate starter fertilizer (10-34-0) in cotton production and its effects on growth, development, and yield.

Materials and Methods

Two field trials were conducted in 2019 at the LSU Agcenter's Northeast research Station near St. Joseph. Both field trials were planted to Delta and Pine Land 1646 variety on May 23, 2019 on a Commerce silt loam soil. Both studies were conducted in a RCB design with 4 replications and plots measured 13.3 feet X 45 feet. Field Trial 1 evaluated six rates of ammonium polyphosphate (10-34-0) fertilizer: 1.5, 2.0 and 2.5 gallons per acre (GPA) applied in-furrow; and 5.0 and 7.0 GPA applied in a 2X2 method and a non-treated. In-furrow fertilizer was placed in direct contact with the seed at planting while 2X2 places the fertilizer 2 inches to the side and 2 inches below the seed. Field Trial 2 evaluated five in-furrow rates of ammonium polyphosphate (10-34-0) fertilizer: non-treated, 1.5, 2.0, 2.5, and 3.0 GPA.

Data Collection

Stand counts of cotton was collected from a 10 ft section from each of the center two rows on June 4, 2019. Plant vigor was assessed 11 days (June 3, 2019) after planting and rated on a scale of 1 to 9 with 1 being low vigor and 9 being high vigor. Plant heights were collected from the two center rows approximately every 2 weeks after planting (6/3, 6/16, 7/2, 7/16, 7/24 and 8/14) using a ruler. At maturity, about 16 weeks after planting, the two center rows of each plot were harvested using a John Deere 9965 inline picker. Yield of cotton from each plot was weighed and recorded in lb/plot. Yield was converted to lb/a based on the lint turnout percentage.

Results

In field trial 1, ammonium polyphosphate starter fertilizer 10-34-0 did not affect plant height at any measurement date (Figure 1). There were no significant differences in stand counts and plant vigor ratings among treatments (Table 1). Plant stand counts ranged from 42.875 for the 5.0 GPA treatment applied 2X2 to 60,357 for the 7.0 GPA treatment applied 2X2. Plant vigor ratings ranged from 6.75 in the 2.0 GPA treatment applied in-furrow to 7.00 in the 7.0 GPA treatment applied 2X2. Also, cotton yield was not significantly different among treatments (Figure 3). Yields ranged from 834.74 lint lb per acre in the 5.0 GPA treatment applied 2X2 to 998.88 lint lb per acre in the non-treated treatment (Figure 3).

In field trial 2, the results showed that plant heights were not significantly different among treatments at each collection time (Figure 2). The highest stand count of 52,722 plants per acre was recorded from the 2.5 GPA treatment applied in-furrow while the lowest being 45,588 plants per acre was recorded in the 3.0 GPA treatment applied in-furrow (Table 1). Plant vigor ratings ranged from 6.75 to 8.0 with the non-treated being the highest although not significantly different (Table 1).

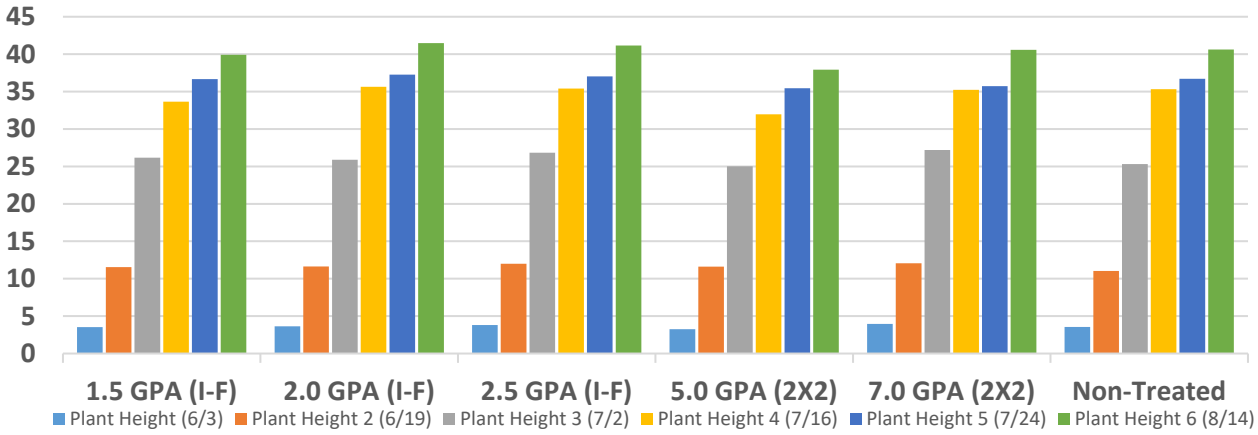

Figure 1. Field Trial 1. The Effect of 10-34-0 Starter Fertilizer Applied at 1.5, 2.0, and 2.5 Gallons per Acre in-furrow and 5.0 and 7.0 Gallons per Acre Applied 2X2 on Cotton Plant Heights (inches).

.

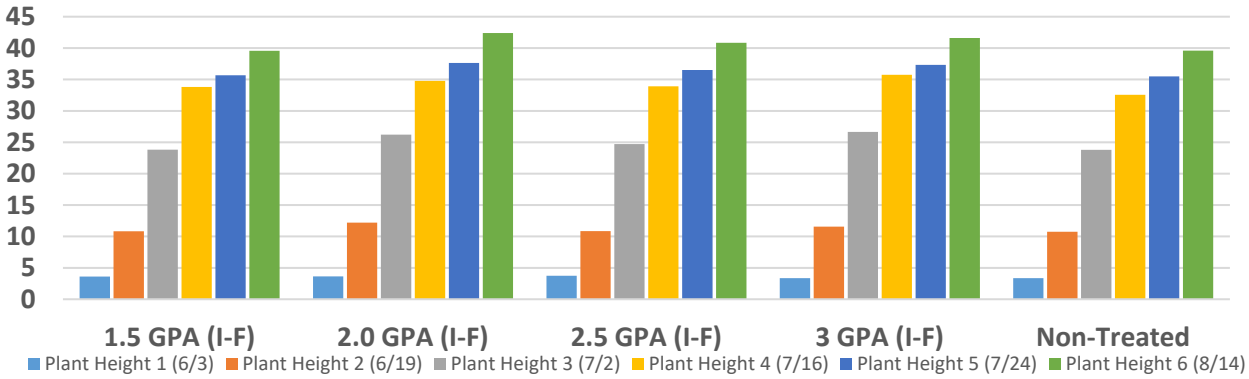

Figure 2. Field Trial 2. The Effect of 10-34-0 Starter Fertilizer Rates 1.5, 2.0, 2.5, and 3.0 Gallons per Applied in-furrow on Cotton Plant Heights (inches).

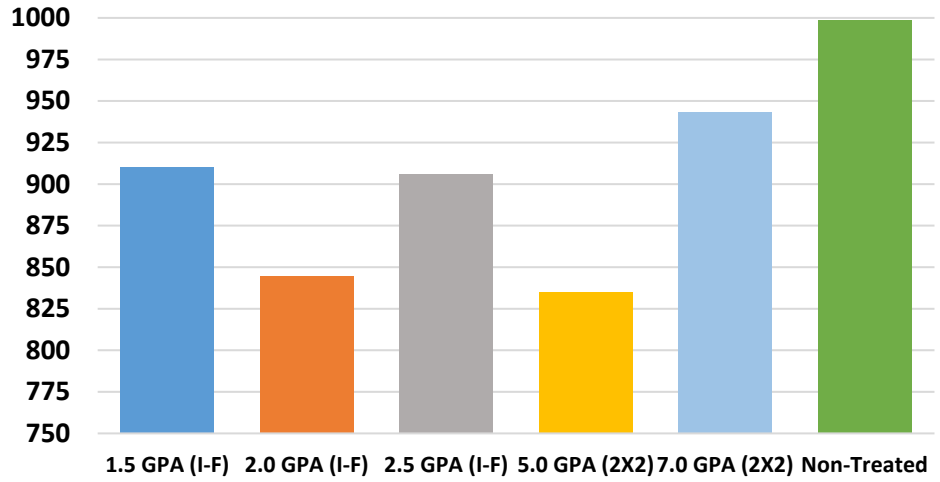

Figure 3. Field Trial 1. The Effect of 10-34-0 Starter Fertilizer Applied at 1.5, 2.0, and 2.5 Gallons per Acre in-furrow and 5.0 and 7.0 Gallons per Acre Applied 2X2 on Cotton Yield (lb per acre).

Table 1. Stand Counts (Plants/acre) and Vigor Ratings for both Field Trial 1 and 2.

Treatment	Field Trial 1	
	Stand Count	Plant Vigor
1.5 GPA (I-F)	57,678	7.00
2.0 GPA (I-F)	53,297	6.75
2.5 GPA (I-F)	49,107	6.75
5.0 GPA (2X2)	42,875	6.75
7.0 GPA (2X2)	60,357	7.00
Non-Treated	47,142	6.75
Treatment	**Field Trial 2**	
	Stand Count	**Plant Vigor**
1.5 GPA (I-F)	50,326	6.75
2.0 GPA (I-F)	47,875	7.33
2.5 GPA (I-F)	52,722	6.75
3.0 GPA (I-F)	45,588	6.75
Non-treated	50,326	8.00

I-F = In-furrow; 2X2 = 2 inches to the side and 2 inches below the seed: Plant vigor rating scale is 1 to 9 where 1 = low and 9 = high; Stand counts = number of plants per acre.

Discussion and Conclusions

The results from the two field trials show no significant difference in the parameters measured in this study. In field trial 1, ammonium polyphosphate at 1.5, 2.0, 2.5 and 3.0 GPA applied in furrow and 5.0 and 7.0 GPA applied 2X2 did not significantly affect plant height, stand counts, early season plant vigor, or cotton lint yield. The growth rate of cotton observed in this study is in accordance with Robertson et al. (2007) findings which states that, cotton prior to the first square, which is between 27 to 38 days, is unresponsive to various best management practices.

In field trial 2, no significant differences were observed for plant height, stand counts and early plant vigor. Previous findings from similar studies show varying results. A two-year study in Alabama by Touchton et al. (1986) evaluated

urea ammonium nitrate, ammonium polyphosphate and muriate of potash applied as a starter on cotton in silt and sandy loam under two placement methods. The 2X2 increased plant height more than the 6X8 placement method in sandy loam. In the silt loam no difference in plant heights for both placement methods were observed. This implies that soil type and placement method could influence starter fertilizers effect on cotton plant growth. These findings support those of Bednarz et al. (2000) study on starter fertilizer sources in the coastal plains of Georgia where they reported that the most suitable starter fertilizer for cotton probably depends on the soil type and weather conditions at planting and stand establishment. In 13 of 18 locations in Mississippi, Funderburg (1988) in a three-year study on starter fertilizer 10-34-0 banded into the soil at 12 GPA reported an increase in cotton lint yield. An average yield of 1,093 lb per acre was recorded in plots with starter fertilizer compared to 1,000 lb per acre recorded in the no starter fertilizer treatment.

Overall, the results are consistent with previous studies on starter fertilizers which show that cotton response to ammonium polyphosphate are inconsistent. Starter fertilizers could be part of the overall fertility program in cotton production. One thing to note is that we were unable to plant the study early, planted on May 23, due to unfavorable weather conditions. We theorize that 10-34-0 starter fertilizer would likely be more beneficial to cotton development when planted early since unfavorable weather conditions often exist in April and early May.

In future research, we hope to plant cotton in mid-April. Also, we plan to evaluate the use of ammonium polyphosphate fertilizer in reduced tillage systems. These studies will help to determine the best use and application of starter fertilizer use in cotton production.

References

Bednarz, C. W., Harris, G. H., & Shurley, W. D. (2000). Agronomic and economic analyses of cotton starter fertilizers. Agronomy Journal, 92(4), 766-771.

Fromme, D. (2019) www.farmprogress.com › cotton › louisiana-cotton-acreage-decline-2.

Funderburg, E.R. (1988) Effect of starter fertilizer on cotton yields in Mississippi. p. 496. *In* Proc. Beltwide Cotton

Prod. Res. Conf., New Orleans, LA. 3-8 Jan. 1988. Natl.Cotton Counc. Am., Memphis, TN.

Hergert, G.W., Wortmann, C.S., Ferguson, R.B., Shapiro, C.A., and Shaver, T.M. 2012. Using starter fertilizers for corn, grain sorghum, and soybeans.University of Nebraska -Lincoln Extension publication G361. http://ianrpubs.unl.edu.

Kerby, T. A., Johnson, S., & Keeley, M. (1987). Growth and development of Acala cotton. Bull., 121, Univ. of California Exp. Sta, Davis

KovarKovar J.L, Eddie R. Funderburg R.E and Robert L. Hutchinson R.L (1994) Starter Fertilizer Can Improve Growth and Yield of Cotton www.ipni.net › publication › bettercrops.nsf.

Oosterhuis, D. M. 1990. “Growth and development of a cotton plant”. In Nitrogen Nutrition of Cotton: Practical Issues Edited by: Miley, W. N. and Oosterhuis, D. M. 1–24. Madison, WI: ASA.

Randall, G. W., Wells, K. L., & Hanway, J. J. (1985). Modern techniques in fertilizer application. Fertilizer technology and use, 521-560.

Robertson, B., Bednarz, C., & Burmester, C. (2007). Growth and development: first 60 days. Cotton Physiology Today, 13(2), 1-5.

Touchton, J.T., D.H. Rickerl, C.H. Burmester, and D.W.Reeves. 1986. Starter fertilizer combinations and placement

for conventional and no-tillage cotton. J. Fert. Issues 3:91-98.