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Cotton Research Report

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(Alabama A&M University and Auburn University)

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Confidential Report

Table of Contents

I. Cotton Variety Trials

Enhancing Cotton Variety Selection (CI # 14-126AL)

T. Cutts, W. Birdsong, and T. Sandlin

Justification

Modern cotton varieties are continuing to increase in genetic diversity. Advanced breeding techniques have led to rapid turnover in cotton varietal development, as well as an increasing number of biotechnology traits which are offered in various trait packages. The backcrossing techniques used in the Trait Integration process often result in recovered lines containing different genetic backgrounds even among a given variety, depending on the combination of traits introgressed. All of these developments have led to great differences in genetic yield potential and fiber quality. Variability of varietal performance is compounded by the fact that differing environmental conditions cause genetic characteristics to express if different ways. This makes it increasingly difficult for cotton producers to predict performance of different varieties across environments or management system. Data is needed that reduces environmental "noise" and demonstrates to producers which varieties are top performers regardless of environmental or management conditions.

Objectives

On-farm trials conducted through Auburn University and Alabama Cooperative Extension aim to provide producers with un-biased, relevant information of top cotton varieties being marketed in Alabama across companies. Trials will be designed to identify the most stable performing varieties across a wide range of environmental and management conditions. This will enable growers to make informed seed buying decisions to increase their productivity and profits.

Methods

A common set of 12 varieties planted large "strip" plots at 20 on-farm locations across Alabama. Each variety had a minimum of 2 replications with an area of at least 0.5 acres each. Individual replications were harvested where practicable. These trials were placed in production environments that were managed consistent with the cooperator's standard management practices for maximum yield. Raw cotton yield data was collected either through a calibrated boll buggy or weighing of round bale on platform scales depending on the cooperator's harvest method. Grab samples were collected and ginned on a 10-saw standing research gin at Auburn University. Relative turn-out was determined and used to derive lint yield, and fiber samples will be sent for classing through the USDA. In order to identify varieties that perform consistently well through a wide range of environmental conditions, data from all locations will be combined and analyzed through appropriate statistical models that minimize environmental variance effects on yield and fiber quality data.

Variety trial information transfer to producers.

We continue to strive to reduce the time required for ginning, data analysis, and fiber quality results. In order to process data more rapidly, support is critical for labor to derive raw data in a time critical manner. Rapid delivery of results can then follow with statistical analysis, creation of data tables and commentary, and release through various electronic formats including alabamacrops.com. Development of a "Variety Comparison" database for grower access to multi-environment, multi-year yield trial data was successfully accomplished and awaits full data entry. It will go live on the new Extension Website.

Summary

Due to the lateness of the 2017 cotton season, current on-farm data is incomplete as of Dec 21st. However, Tables 1 and 2 show preliminary yield data from 14 locations. No data has been reported from Southeast Alabama. Further analysis is needed to make any conclusive statements.

Table 1. Yields by location

	Location	Mean Seed Cotton Yield (lbs/A)	Mean Lint Yield (lbs/A)
1	Talladega	4080.82	1731.89
2	Cherokee	3596.45	
3	Lincoln TN	3564.57	1458.26
4	Fairhope	3420.33	
5	Blount	3293.51	
6	Baldwin	3233.93	
7	Lee	3169.55	1402.18
8	Centre	3132.13	
9	Hale	2917.71	
10	Franklin	2721.77	1205.09
11	Elmore	2492.77	978.83
12	Shelby	2408.76	1052.43
13	Lawrence	2223.25	
14	Fayette	1993.18	
	Averages	**2933.14**	**838.73**

Table 2. Yields by variety

Variety	Mean Seed Cotton Yield (lbs/A)	Mean Lint TO	Mean Lint Yield (lbs/A)
ST6182GLT	2858.17	47%	896.06
DP1646B2XF	3105.28	45%	884.14
PHY444WRF	2979.53	44%	869.80
DP1538B2XF	2993.92	44%	827.52
DP1518B2XF	3008.84	42%	815.56
NG5007B2XF	2811.70	43%	809.42
PHY330W3FE	2977.04	43%	808.30
PHY340W3FE	2965.32	44%	807.39
ST4949GLT	2714.51	45%	788.44
ST5115GLT	3155.55	41%	774.63
NG4601B2XF	2795.25	44%	734.12
DG3445B2XF	2625.39	41%	718.35

Development of Plant Growth Regulator Management Strategies for current Cotton Varieties in Multiple Alabama Environments

T. Cutts, T Sandlin, W. Birdsong, and F. Browne

Justification

Several environmental factors can have a major impact on the efficacy of plant growth regulator products such as soil fertility, temperature, soil moisture, amount of irrigation, cotton growth stage, field history, and cotton variety. Not all cotton varieties have the same response to plant growth regulators and while some varieties respond well to heavy management, others may be sensitive to plant growth regulator applications impacting development, growth, and yield. New commercial varieties are constantly introduced to the market making research for individual plant growth regulator regimes necessary in order to maximize yield. Yield responses to the same PGR regime may be erratic due to differences among environments and management conditions. Growth parameters, lint yield, and fiber quality are responses that should be monitored to assess the growth potential of individual varieties without herbicide, with a mild plant growth regulator regime, and with a heavy plant growth regulator regime. The response of cotton cultivars to plant growth regulators depends largely on the environmental conditions for which the crop is being grown, specifically temperature and rainfall. There is likely an interaction between the genotype of the cultivar, environmental factors (temperature, moisture, and nutrient status) and the plant growth regulator applied which needs further investigation.

Objectives

Investigate PGR x Variety x Environment interactions to elucidate what effects each of these plays in developing a PGR management strategy. Also, to refine management options on current cotton varieties and develop recommendations for plant growth regulator decision making in order to maximize profitability for cotton producers in Alabama.

Methods

Studies were established at 3 locations across Alabama including Headland, Shorter, and Belle Mina. Seven treatments combinations of mepiquat chloride were applied to a set of 10 current market varieties with a range of maturities and growth habits. Treatments were replicated 3 times on each variety. Because PGR applications are usually very dependent several variables for application and no definitive recommendations exist for every condition, these treatments were derived from 3 common PGR strategies including Early Bloom, Low-Rate Multiple Application, and Modified Early Bloom.

Summary

Some key preliminary results are shown in Tables 1-4. Further site-years are needed to fully elucidate PGR x Variety x Environmental effects, however some key indications can be taken away from the first years data. For fruit retention, data indicates that the node of first retained fruit is influenced by genetics, or variety, rather than any PGR regime. Noted in Table 2, fruit retention in the non-treated control did not differ from any PGR treatment tested. Table 3 shows the variability in node of first retained fruit across varieties tested. Another key takeaway confirms other PGR research across the cotton belt over a number of years and environments that PGR's do not influence yield. Our preliminary data may suggest that a late, heavy rate treatment can cause a yield penalty in certain environments, but more data is needed to confirm this.

Table 1. Treatments

TRT NO.	TRT NAME	RATE G AI HA-1
1	NTC	
2	8 OZ PINHEAD SQAURE FB 12 OZ EARLY BLOOM	24.52 + 36.78
3	8 OZ PINHEAD SQUARE FB 16 OZ EARLY BLOOM	24.52 + 49.03
4	8 OZ PINHEAD SQUARE FB 8 OZ EARLY BLOOM FB 16 OZ 3 WEEKS AFTER BLOOM	24.52 + 24.52 + 49.03
5	16 OZ PINHEAD SQUARE FB 16 OZ EARLY BLOOM FB 16 OZ 3 WEEKS AFTER BLOOM	49.03 + 49.03 + 49.03
6	16 OZ EARLY BLOOM	49.03
7	12 OZ EARLY BLOOM	36.78

Table 2. Fruit Retention across treatments at maturity

	NODE OF FIRST POSITION RETAINED FRUIT (#)		
TREATMENT	LIMESTONE COUNTY	HENRY COUNTY	MACON COUNTY
NTC	7.84 A	7.72 ABC	7.53 A
8 OZ PS FB 12 OZ EB	7.91 A	7.70 ABC	7.26 A
8 OZ PS FB 16 OZ EB	7.91 A	7.45 C	7.62 A
8 OZ PS FB 8 OZ EB FB 16 OZ 3 WAB	7.95 A	7.79 AB	7.11 A
16 OZ PS FB 16 OZ EB FB 16 OZ 3 WAB	7.99 A	7.55 BC	7.35 A
16 OZ EB	8.16 A	7.59 BC	7.33 A
12 OZ EB	7.95 A	7.91 A	7.36 A

*MEANS FOLLOWED BY THE SAME LET DO NOT DIFFER SIGNIFICANTLY BASED ON A MIXED MODEL ANALYSIS OF VARIANCE (P=0.05).
**TREATMENT X LOCATION INTERACTION WAS OBSERVED (P=0.0250).

Table 3. Fruit Retention Across Varieties

VARIETY	NODE OF FIRST POSITION RETAINED FRUIT (#)
DP 1646 B2XF	7.82 ABC
DP 1538 BSXF	7.64 DC
DP 1518 B2XF	7.40 E
ST 4949 GLT	7.43 ED
DG 3445 B2XF	7.47 ED
ST 6182 GLT	7.69 BC
PHY 444 WRF	7.91 AB
PHY 330 W3FE	7.63 DC
PHY 340 W3FE	7.71 ABC
NG 4601 B2XF	7.94 A
*MEANS FOLLOWED BY THE SAME LET DO NOT DIFFER SIGNIFICANTLY BASED ON A MIXED MODEL ANALYSIS OF VARIANCE (P=0.05). *NO VARIETY X LOCATION INTERACTION WAS OBSERVED (P=0.1656).	

Table 4. Yield Response by Treatment

	YIELD (KG/HA)		
TREATMENT	LIMESTONE COUNTY	HENRY COUNTY	MACON COUNTY
NTC	3991.89 A	3382.54A	5365.46AB
8 OZ PS FB 12 OZ EB	4305.65 A	3343.48 A	5035.40 C
8 OZ PS FB 16 OZ EB	4266.07 A	3322.65 A	4899.34 C
8 OZ PS FB 8 OZ EB FB 16 OZ 3 WAB	4134.57 A	3400.77 A	5452.03 A
16 OZ PS FB 16 OZ EB FB 16 OZ 3 WAB	4216.33 A	3627.31 A	5552.29 A
16 OZ EB	4356.68 A	2804.46 A	4976.16 C
12 OZ EB	4152.02 A	3252.34 A	5108.96 BC
*MEANS FOLLOWED BY THE SAME LET DO NOT DIFFER SIGNIFICANTLY BASED ON A MIXED MODEL ANALYSIS OF VARIANCE (P=0.05). *TREATMENT X LOCATION INTERACTION (P=0.0062).			

Impact of variety selection, Cropping practices, fungicide inputs, and crop rotation on cotton yield and quality as influenced by target spot, hard lock, and bacterial blight

A. Hagan

Project Overview: Target spot, hardlock, and bacterial blight pose a significant threat to the yield and quality of Alabama's cotton crop. Management practices in combination with fungicide inputs are required to minimize the risk of damaging target spot outbreaks in Alabama cotton. For hardlock and bacterial blight, selection of resistant or tolerant cotton cultivars along with management practices need to be examined to establish effective control programs for both diseases.

At the Brewton research station, BARU, the efficacy of registered and experimental fungicides was evaluated for the control of target spot and hardlock on PhytoGen 499 cotton. Overall, defoliation attributed to target spot was lower in 2017 compared with the previous years. The delay in disease onset may be attributed frequent late spring and early summer showers which slowed plant top growth and delayed canopy closure and resulted in a sizable reduction in defoliation levels as compared with previous years. Significant reductions in final % defoliation were recorded for all fungicide programs except for Velum Total in-furrow treatment compared with the non-fungicide treated control. The low % defoliation levels noted for the four application Priaxor + Bravo WeatherStik positive control was equaled by the two application 6 fl oz/A Priaxor, Topguard, Miravis, Amistar Top, and the experimental fungicide A20259. When compared with the non-fungicide treated control, significant ($P \leq 0.10$) yield gains were recorded for all programs except for Velum Total alone, Amistar Top, 6 fl oz Priaxor, and Quadris. The high yields obtained with Velum Total + Propulse and the Priaxor + Bravo WeatherStik positive control were matched by all programs except for Velum Total alone. While superior season-long target spot control was obtained with the 6 than 4 fl oz/A Priaxor, seed yields for these two programs were similar. In addition, the influence of growth regulator inputs, cotton cultivar, and fungicide inputs on target spot severity and hardlock incidence was also assessed at BARU. As indicated by a significant variety × fungicide program interaction, final % defoliation levels for target spot differed by cotton cultivar and fungicide program. Other interactions between variables on target spot-incited defoliation were not significant.

Final % defoliation for target spot was not influenced by PGR program. For the non-fungicide treated control along with the single and two application Priaxor programs, greater target spot-incited premature defoliation was observed on PhytoGen 499 WRF than Deltapine 1646 B2XF. On both varieties, lower defoliation levels were recorded for both Priaxor programs compared with the non-fungicide treated control. The two application Priaxor program on PhytoGen 499 WRF and the Deltapine 1646 B2XF non-fungicide treated control had similar target spot-incited defoliation ratings. Areolate leaf spot was first noted on the 2nd week of Sep and some disease intensification, including premature defoliation, was observed. As indicated by a significant cultivar × PGR × fungicide program, areolate leaf spot intensity differed across all variables. With the exception of the aggressive PGR program on PhytoGen 499 WRF, % defoliation attributed to areolate leaf spot was greater on both cultivars for the non-fungicide treated control than both of the single and two application Priaxor programs, which had similarly low defoliation ratings. While significantly greater yields were recorded for Deltapine 1646 B2XF than PhytoGen 499 WRF, similar yield were noted for both PGR and all three fungicide programs. At BARU, the cultivar screening study had uneven growth and failed to lap the middles. As a result, target spot development was minimal and the study was not harvested for yield.

At FCU, the influence of fungicide inputs on the yield and target spot severity on nine cotton cultivars was assessed. The significant cultivar × fungicide program interaction for final % defoliation illustrated the differential response of cotton cultivars to the Priaxor + Bravo WeatherStik umbrella program. With the exception of Deltapine 1538 B2XF, lower % defoliation levels were observed on the remaining cultivars with the 'umbrella' Priaxor + Bravo Ultrex fungicide program than the non-fungicide treated control. Significant differences in % defoliation were noted among cultivars regardless of the fungicide program. The non-fungicide treated Stoneville 6182 GLT had higher final % defoliation ratings than all other cultivars except for PhytoGen 490 W3RF and PhytoGen 499 WRF, while non-fungicide treated Deltapine 1747 B2RF suffered less defoliation than the latter three cultivars. Under the umbrella fungicide program, greater final % defoliation was recorded for PhytoGen 490 W3RF than all cultivars except for Stoneville 6182 GLT. The low defoliation level noted for the fungicide-treated Deltapine 1747 B2RF was equaled by Deltapine 1553 B2XF, Stoneville 6446 GLB2, PhytoGen 333 WRF, and PhytoGen 499

WRF. The high yield recorded for Stoneville 6448 GLB2 was matched by PhytoGen 333 WRF and Deltapine 1553 B2XF ($P \leq 0.10$). PhytoGen 499 WRF had similarly low yields compared with all cultivars except for higher yielding Stoneville 6448 GLB2 and Deltapine 1553 B2XF. In addition to significant reductions in target spot final % defoliation levels for most cultivars, greater yields were obtained despite light to moderate target spot pressure with the 'umbrella' fungicide program than the non-fungicide treated controls. Absence of a significant cultivar × fungicide program interaction indicates that yield gains (224 lb seed cotton/A) were obtained from the 'umbrella' fungicide program across all cotton cultivars. A fungicide application × timing study was also conducted at FCU in 2017. The impact of applications of Priaxor at 6 fl oz/A at pinhead square, 1st, 3rd, and 5th week of bloom as well as at pinhead square + 1st week, 1st and 3rd week, 3rd and 5th week, and 5th and 7th week of bloom on target spot-incited defoliation and yield of PhytoGen 499 WRF was assessed. Disease pressure across all treatments, including the non-fungicide treated control was low and no statistical differences in yield were noted between the above fungicide programs was noted. Priaxor application number did significantly impact cotton seed yield. Greater yields were obtained for all of the two but not the single Priaxor application programs when compared with the non-fungicide treated control.

Six target spot studies were established at Gulf Coast research center, GCREC. Due to excessive late spring and early summer rains, cotton growth and maturity across all studies was greatly delayed and the cotton failed to lap the middles, which resulted greatly delayed and minimal target spot development. Due to the near absence of target spot attributed to poor crop growth, differences in yield were not observed between fungicide treatments. In the seeding rate study, Deltapine 1555 B2XF significantly outyielded PhytoGen 499 WRF. In addition, similar yields were noted across both of the above cultivars at seeding rates of 2, 3, and 4 seed per foot of row.

The influence of fungicide inputs on the yield and target spot severity on nine cotton cultivars was assessed at the Prattville Research field, PARU. Given the frequent showers in July and August, the level of target spot-incited defoliation, which did not exceed 10%, was considerably below expectations. As indicated by a significant cultivar × fungicide interaction, defoliation levels varied by cotton cultivar and fungicide program. For all cultivars except for PhytoGen 444 WRF and Stoneville 5115 GLT, % final defoliation was significantly lower for the fungicide- than the non-fungicide-treated control. For the non-fungicide treated cotton, PhytoGen 499 WRF had higher % final defoliation ratings than PhytoGen 333 WRF, Deltapine 1538 B2XF, Stoneville 5020 GLT, Stoneville 5115 GLT and Stoneville 4946 GLB2 but not Deltapine 1252 B2RF, Deltapine 1555 B2RF, and PhytoGen 444 WRF. With the umbrella fungicide program, higher % final defoliation was noted for the PhytoGen 444 WRF than PhytoGen 499 WRF, Deltapine 1555 B2RF, Deltapine 1252 B2RF, PhytoGen 333 WRF, and Stoneville 4946 GLB2. The high yield of 4045 lb seed cotton/A recorded for Stoneville 5115 GLT was equaled by PhytoGen 444 WRF, PhytoGen 499 WRF, Deltapine 1555 B2RF, and Stoneville 4946 GLB2, while Deltapine 1538 B2XF, PhytoGen 333 WRF, and Deltapine 1252 B2RF had similarly low yields. Yield was higher for the fungicide- (3808 lb seed cotton/A) than non-fungicide treated cotton (3560 lb seed cotton/A). Absence of a significant cultivar × fungicide interaction indicates that yield gains were obtained across all cotton cultivars.

The irrigated early and full season flex OVT cotton cultivar trials at the WREC were monitored for target spot incited defoliation. As was previously noted, defoliation levels were lower than anticipated despite frequent afternoon showers in July and August at WREC. In the early flex OVT trial, defoliation levels exceeded the 20% level in Stoneville 6182 GLT, PhytoGen 450 W3RF, Stoneville 5020 GLT, Americot NG 4601 B2XF, and PhytoGen 300 W3RF. In contrast, Stoneville 5517 GLT, PhytoGen 444 WRF, and several PhytoGen advanced breeding lines displayed less than 11% defoliation. For the full season flex OVT trial, Stoneville 6182 GLT, Stoneville 4949 GLB2, Stoneville 5020 GLT and a PhytoGen advanced breeding line suffered greater than 20% defoliation, while Stoneville 5517 GLT along with Deltapine 1646 B2XF and a PhytoGen advanced breeding line suffered less than 10% defoliation. Yields and lint quality ratings are not yet available for either of the above OVT trials. Overall, Stoneville 6182 GLT and Stoneville 5020 GLT appear to be highly sensitive to target spot but Stoneville 5517 GLT displayed the least defoliation across both trials. Target spot defoliation was also assessed in the irrigated OVT early flex and full season flex cultivar trials at PARU and TVREC. At both locations, disease pressure was very low and minimal differences in disease activity were noted among the cotton cultivars and advanced breeding lines.

Impact of Variety selection, Cropping Practices, Fungicide Inputs, and Crop Rotation on Cotton Yield and Quality as Influenced by Target Spot, Hardlock, and bacterial Blight

A. K. Hagan and K. L. Bowen

Target spot is widespread and damaging disease on cotton, particularly in South and to a lesser extent Central Alabama. In 2016, potential target spot-incited yield losses, as estimated from field trials conducted at the Gulf Coast Research and Extension Center and Brewton Agricultural Research Center, on susceptible (up to 350 lb lint/A) and tolerant (up to 200 lb lint per acre) cotton varieties across South Alabama ranged from $14 to 28 million. While losses in lint yield were also reported in one of three trials at the Field Crops Unit, overall losses to target spot except on intensively managed irrigated cotton were low in Central AL and negligible in North AL. In addition, a yield decline in excess of 600 lb/A recorded at the BARU for 2016 as compared with 2014 and 2015 was attributed to hardlock. Similarly high hardlock lock-related yield losses were also noted in trials at the Gulf Coast Research and Extension Center. Over the 30,000+ acres in Baldwin and Escambia Co., the above hardlock-related yield decline represent an estimated $13.5 million loss in farm gate income in 2016. Similarly high losses likely occurred in Covington, Mobile, Monroe, and Geneva Co, which received the same heavy rains through mid-August. Hardlock incidence was, however, lower in Southwest Alabama than in the previous year in 2017. Finally, severe bacterial blight outbreaks were observed in Georgia and Mississippi cotton with much lighter outbreaks seen in AL. Over the past four years, the reaction of most mid-late and late maturing cotton varieties to target spot as well as fungicide inputs has been established. With the introduction of phenoxy herbicide tolerance technology and advanced Bt traits, new varieties are and will continue to be released and the now obsolete varieties retired. Tolerance of newly released varieties to target spot need to be determined as does to their yield response to fungicide and management inputs as well as their response to fungicide inputs also needs to be assessed. Fungicides continue to be a treatment option for target spot in the southern third of Alabama. Application number and timing need to be clarified to insure the most cost effective use of fungicides on cotton for target spot control as well as determine the efficacy of fungicides for the control of hardlock. While preliminary results suggest that seeding rate and planting date are not effective tools for managing target spot in cotton, additional information is needed to clarify the their relationship target spot-incited defoliation along with lint yield and quality. Additional studies concerning the impact of growth regulators on canopy architecture of multiple cotton varieties, target spot severity, hardlock incidence, as well as lint yield and quality. Finally, the impact of planting date, seeding rate, tillage and canopy management with plant growth regulators on the incidence of hardlock also needs to be determined.

Experimental Studies by Location:

Wiregrass Research and Extension Center:

The early and full-season flex OVT variety trials will be monitored for bacterial blight, target spot, and hardlock. Lint yield and quality will be recorded. A randomized complete block design of four replications with individual four row plots for each cotton variety with rows 30 ft in length and 3 ft row spacing arranged in four replications will be used. Impact of cotton cropping frequency will be assessed in an established rotation study. Rotations with continuous cotton, as well as cotton cropped behind one or two years of peanut are included. A factorial design with cotton cropping frequency as the main plot and cotton variety as the split plot. Due to the presence of the cotton root knot nematode, test varieties will be PhytoGen 490, PhytoGen 487NR, Deltapine 1646, and Deltapine 1774NR. Target spot, hardlock, and bacterial blight activity will be monitored during the production season as will cotton root knot nematode populations. Yields will be recorded.

Gulf Coast Research and Extension Center:

The early and full-season flex OVT variety trials will be monitored for target spot and hardlock. Lint yield and quality will be determined. Efficacy of registered (Headline 2.09SC, Twinline, Topguard, Priaxor, and Quadris 2.08SC) as well as registered carboxamide (i.e. Elatus et al) fungicides will be screened for the control of target spot on a Phytogen 490 (susceptible) and Deltapine 1646 (tolerant). A factorial arranged in a split plot of four replications with individual four row plots with rows 30 ft in length and 38 inch row spacing will be used. Target spot defoliation over time as well as yield and lint quality data will be recorded. Hardlock incidence will also be determined. One or two additional studies assessing the efficacy of experimental fungicides for the control of target spot and hardlock will also be assessed. Impact of application timing (preventative, ondemand, and rescue programs) on the efficacy of Priaxor @ 6 fl oz/A against target spot will be also be conducted on a susceptible and resistant variety. Impact of planting date (late April and Mid-May) and seeding rate (2, 3, and 4 seed/ft) on target spot intensity and yield of PhytoGen 490, PhytoGen 444, and Deltapine 1555 will be evaluated. Planting date is the whole plot and cotton variety will be the split plot, while cotton variety will be the whole plot and seeding rate will be the spit plot treatment in the second study. The impact of fungicide inputs (Priaxor @ 6 fl oz/A) on target spot intensity and yield of PhytoGen 499, PhytoGen 444, PhytoGen 490, Deltapine 1555, Deltapine 1553, Deltapine 1646, Stoneville 5115, Stoneville 4946, and Stoneville 6182 will be evaluated. The experimental design will be a factorial with varieties as the whole plot and Priaxor @ 8 oz/A as the split plot treatment. Also, the influence of canopy architecture with varying applications rates and timing with mepiquat plant growth regulator on target spot and hardlock as well as yield parameters on a target spot susceptible and resistant variety will be evaluated. The experimental design will be a factorial with varieties as the whole plot and Priaxor @ 8 oz/A as the split plot treatment. All studies will be irrigated.

Brewton Agricultural Research Unit:

A study to assess the impact of fungicide inputs (Priaxor @ 6 fl oz/A) on target spot intensity and yield of PhytoGen 499, PhytoGen 490, PhytoGen 444, Deltapine 1252, Deltapine 1553, Deltapine 1646, Stoneville 5020, Stoneville 5115 and Stoneville 6182 will be evaluated. Efficacy of registered (Topguard, Priaxor, Headline 2.09SC, Twinline, and Quadris 2.08SC) as well as unregistered carboxamide fungicides will be screened for the control of target spot and hardlock on a Phytogen 490 and Deltapine 1555. For the above studies, either a factorial design arranged in a split plot or randomized complete block of four replications with individual four or six row plots with rows 30 ft in length and 36 inch row spacing will be used. Disease intensity over time as well as yield and lint quality data will be recorded. All studies will be irrigated.

EV Smith Field Crops Unit/Plant Breeding Unit:

At FCU, the OVT early and full-season flex cotton variety trials will be rated for their reaction to target spot over time and yield. Impact of planting date and variety selection will be repeated. The experimental design is a factorial with cotton variety (PhytoGen 490, PhytoGen 339, and Deltapine 1555) is the main plot and umbrella fungicide program of three applications of Priaxor @ 6 fl oz/A is the split plot treatment. A study to assess the impact of fungicide inputs (Priaxor @ 6 fl oz/A) on target spot intensity and yield of PhytoGen 490, PhytoGen 339, PhytoGen 444, Deltapine 1538, Deltapine 1555, Deltapine 1646, Stoneville 5020, Stoneville 5115, and Stoneville 6182 will be evaluated. A factorial design arranged in a split plot with four replications in four row plots that are 30 ft in length on 36-inch row spacing will be used. Efficacy of rates of Priaxor applied through the line with a VR irrigation system will be assessed on several commercial cotton varieties, such as PhytoGen 490, Phytogen 339, Deltapine 1555, and Deltapine 1646. A conventional ground applied treatment using a 'high boy' or Hagie VR sprayer will also be included. A factorial design arranged in a split-plot with four replications of large 30 ft x 150 ft plots will be used for all studies. All studies will be irrigated.

Prattville Agricultural Research Unit:

Early and full season flex OVT cotton variety trials will be evaluated for their reaction to target spot and yield parameters. Additional studies may be relocated from Field Crops to this location pending space requirements. A study to assess the impact of fungicide inputs (Priaxor @ 6 fl oz/A) on target spot intensity and yield of Phytogen 490, Phytogen 339, Phytogen 444, Deltapine 1252, Deltapine 1538, Deltapine 1646, Stoneville 4946, Stoneville 5020, and Stoneville 5115 will be evaluated. A factorial design arranged in a split plot with four replications in four row plots that are 30 ft in length on 36-inch row spacing will be used.

Planned Outputs and Activities

1. Reports of disease activity in OVT and other variety trials will be disseminated via Twitter and other social media.
2. Publication of web-based Timely Information reports summarizing research projects as well as production of YouTube Videos covering the diagnosis and control of target spot in cotton.
3. Publication of short summary reports in annual AAES Cotton Research Report.
4. Publication of research reports on Plant Disease Management Network.
5. Farm and AAES research unit tours to review current disease situation as well as on-going research projects.

6. Presentations at county, regional, and state meetings as well as Cotton Beltwide to review progress of target spot research program.

Budget	Amount
Research Assistant (1.5 month salary)	$7,600
Research Assistant Benefits (32%)	$2,432
Salary Subtotal	$10,032
Travel (PI's and Technical Personnel)	$5,000
Supplies and Seed	$2,000
Total Budget for 2018	$17,000

Evaluation of DeltaForce Down Force for Cotton

C. Hicks

The trial was conducted at E.V. Smith Research Center in Shorter, AL on a Cahaba sandy loam soil type. Cotton was planted May 17, 2017. The two cotton varieties used were ST 6182 and DP 1646. Stand Counts were taken in a 20' section of the row on May 26 and June 8. Moisture readings were taken immediately after planting with a POGO Pro meter. Rainfall occurred before I could complete the all replications, therefore that data will not be reported. Heavy rainfall occurred on this field 1 and 2 days after planting. Data were subjected to analysis of variance in SAS. Means compared using Tukey's mean separation with $P \geq .05$.

Table 1. Cotton plants emerged May 26

Pounds of Down Pressure	Stand Counts/20' section of row
50	45 a
100	50 a
150	53 a
190	49 a
Auto Standard	50 a

Table 2. Cotton plants emerged June 8

Pounds of Down Pressure	Stand Counts/20' section of row
50	46 a
100	46 a
150	52 a
190	48 a
Auto Standard	48 a

Table 3. Cotton plants emerged by variety May 26

Variety	Cotton plants emerged in 20' section
ST 6182	49 a
DP 1646	49 a

Table 4. Cotton plants emerged by variety June 8

Variety	Cotton plants emerged in 20' section
ST 6182	48 a
DP 1646	48 a

No significant differences were evident in 2017, either by variety or by treatments.

Breeding Cotton for Yield and Quality in Alabama

J. Koebernick

The 2017 season began with inventory of cold storage and gathering data on Weaver's existing material. Unidentified material was incorporated into new trials to evaluate its usefulness. These consisted of F2 lines, which were tested, in a replicated early generation test at PBU. Advanced lines entered a "second chance" Advanced 2.0 trial at both Brewton and PBU. All other material selected from the 2016 year, went into the preliminary or advanced trials in both Prattville and PBU.

Crossing- The two main goals in selecting parents when crossing were yield and disease resistance. Twenty-one crosses were made in a crossing block planted on campus. These F1's were planted in the greenhouse or sent to the winter nursery for seed increase.

Breeding Trials- Five breeding test (RBTN, Advanced, Advanced 2.0, Preliminary and Early generation tests) were planted in Tallassee. The RBTN was the most northern test having 1 AU entry. These trials had extensive defoliation due to a combination of nematodes, potassium deficiency and target spot onset. Hurricane Irma produced strong winds which naturally defoliated a large portion of these trials and they were picked in late September.

Fusarium Wilt- I took over the fusarium nursery from Kathy Glass this season. The trial consisted of lines from 7 breeders. Seed of M315, resistant FOV line and control for the test, was increased.

Target Spot- Field studies on Target Spot consisted of screening the Official Variety Trials and RBTN. The RBTN was planted at Fairhope in 10 ft plots and 8 replications. It was inoculated with target spot in August and scored on September 8th prior to hurricane Irma. The inoculum was made in collaboration with Kathy Lawrence. Our crew spent time learning the disease ratings with Austin Hagan, these rating did provide significant genotype differences between the lines. The cotton OVTs were rated in both Tallassee and Headland.

Reniform- Specific projects focused on cultivar by management of reniform nematode. Advanced breeding lines with moderate resistance were planted in a nematode and non-nematode field with Velum Total as a treatment. The results showed that the level of resistance was statistically the same as the Velum application. Planting one of these lines does not require an application of Total for protection against nematodes. This is promising work and will be repeated in 2018.

Sundries- A large equipment grant was received through the AAES and a laboratory gin and seed counter were purchased. Travel to national meetings consisted of the Beltwide Cotton Conference in Dallas, Tx, the National Association of Plant Breeders conference in Davis, CA, and the Cotton Inc Breeders tour in Phoenix, AZ. All three of these events allowed for building relationships and initiating collaboration with fellow breeders and researchers, private industry and international entities.

2017 NE Alabama On-Farm Cotton Variety Trial Results

E. McGriff

Variety selection is one of the most important decisions in cotton production. Increasing genetic potential and rapid cycle breeding allow seed companies to bring an ever-increasing number of top performing varieties to market each year. Although the yield benefits from selecting the right variety can be great, selecting the wrong variety for a particular environment can cause a huge loss in profit potential. Variety performance is heavily dependent on environment. Environmental conditions not only change with geography, but also from season to season on a given farm. It is important for growers to make variety selections based on multi-year, multi-location data and not make a decision on a single farm or year. Yield stability over multiple environments helps to ensure performance through varying geographic and climate conditions. Each farm has unique challenges and benefits, and no variety is the best for all situations. It is important for producers to know what their yield limiting factors are and choose an appropriate variety for their circumstances. Diversifying varieties across a growers' acreage is also an important strategy.

Three cotton variety trials were conducted in NE Alabama in 2017. The three locations were the Nick and Randall McMichen farm in Cherokee County; Rich Lindsey farm in Cherokee County; and the Jimmy and Lance Miller farm in Blount County. They were large-scale "strip" variety trials replicated twice. The farm locations were selected on representative cotton acreage in NE Alabama and the trial entries were based on top performing varieties for Alabama. The 2017 on-farm variety trials were highly successful and reflected the tremendous yields seen across NE Alabama if cotton was planted timely. A percentage of NE Alabama's cotton was planted late or replanted due to the frequent rains during April and May. The late-planted cotton did not have the heat units to fully mature and poor harvest conditions caused their yields to suffer.

These trials depend heavily on our farmer cooperators for success and without their dedication; this information would not be possible. I would also like to thank the Alabama Cotton Commission and Cotton Incorporated for their generous financial support, as well as the companies whose entries are represented in the trials for the donation of seed.

The results are presented in the following tables. Seed cotton weights are presented due to the late harvest season and lint yields are not available yet. The lint yields and grades will be presented as soon as they are available.

2017 CHEROKEE COUNTY COTTON ON-FARM VARIETY TRIAL

Cooperators: Nick & Randall McMichen

Row Pattern: 2 X 30-Inch Rows with Single Row Skip

Planted: May 10

Harvested: October 13

Management: No-tilled into Soybean Stubble

Environment: Dryland

Harvest Method: Round Bale

Variety	Reps	Total Acreage for all Reps (acres)	Cottonseed Yield
Phytogen 444	2	1.2293	4444
Phytogen 340	2	1.2293	4650
NG 5007	2	1.2293	4212
Stoneville 6182	2	1.2293	4465
DPL 1538	2	1.2293	4391
Phytogen 330	2	1.2293	4506
DPL 1518	1*	.6147	2135
DPL 1646	1*	.6147	2264
NG 4601	1*	.6147	2136
Stoneville 4949	1*	.6147	2151
Stoneville 5115	1*	.6147	2297

*Rep 2 drowned out.

2017 CHEROKEE COUNTY COTTON ON-FARM VARIETY TRIAL

Cooperator: Rich Lindsey
Row Pattern: 38 inch
Planted: May 9
Harvested: November 27
Management: No-tilled into Cotton Stubble
Environment: Dryland
Harvest Method: Round Bale

Variety	Acreage	Picker Weight	Scale Weight
DG 3445	.7111	2277	1940
Phytogen 444	.7086	2950	2560
Phytogen 330	.7111	2718	2340
Stoneville 4949	.7086	2557	2240
NG 5007	.7086	2363	2020
Phytogen 340	.7090	2551	2140
Stoneville 5115	.6970	2784	2320
DPL 1646	.6925	2557	2200
DPL 1518	.6855	2551	2220
NG 4601	.6847	2383	2000
DPL 1538	.6847	2478	2120
Stoneville 6182	.6830	2520	2160

2017 BLOUNT COUNTY COTTON ON-FARM VARIETY TRIAL

Cooperators: Jimmy and Lance Miller
Row Pattern: 38 inch
Planted: May 11
Harvested: November 16
Management:
Environment: Dryland
Harvest Method: Round Bale

Variety	Reps	Acreage	Seed Cotton Wt
DPL 1518B2XF	2	.6634	2203
Phytogen 330 W3FE	2	.6569	2186
Stoneville 4949GLT	2	.6503	2018
Stoneville 5115GLT	2	.6438	2279
DG 3445BXF	2	.6372	1938
Phytogen 340W3FE	2	.6342	2020
NG 4601B2XF	2	.6272	1945
DPL 1538B2XF	2	.6202	2073
DPL 1646B2XF	2	.6113	2195
NG 5007B2XF	2	.6063	2021
Stoneville 6182GLT	2	.5993	1994
Phytogen 444WRF	2	.5923	1960

Varietal Response of Glufosinate Tolerant Cotton to Glufosinate and Other Tank Mixes

T. Sandlin and J. Ducar

Nine varieties of cotton were evaluated in this study for tolerance to glufosinate in combination with other tank mixes. Cotton varieties were from three different companies and were comprised of Stoneville: 4848 GLT, 4949 GLT; Phytogen: 330 W3FE, Phytogen: 340 W3FE; Deltapine: 1612 B2XF, 1614 B2XF,1725 B2XF, 1646 B2XF, 1820 B3XF. Each set of these varieties were applied with one of the following treatments: (1) 29oz/A glufosinate (Liberty) (2) 29oz/A glufosinate (Liberty) + 16oz/A S-Metolachlor (Dual Magnum) (3) 29oz/A glufosinate (Liberty) + 16oz/A s-metolachlor (Dual Magnum) + 0.5lb/A acephate (orthene). Plots were planted later this year due to excessive rainfall. Plots were planted on June 2 and treatments were applied on July 3 at approximately third true leaf. Percent leaf burn was rated at 4 days after application. Plots were harvested on November 2.

On average, percent leaf burn increased in number for all companies represented when a tank mix application was made versus Liberty alone (Table 1). Percent leaf burn increased in number for all varieties when a tank mix application was made versus Liberty alone (Table 2). Although there were differences in observed leaf burn between some varieties, this did not affect yield in this test. Yield differences that were present are not attributed to treatment effects, but were due to in rep variability (Table 3).

Results from this study indicate that cotton response to glufosinate in combination with the tank mixes in this test differ not only by brand but can also differ by variety within and between brands. Extremes in environmental conditions can play a significant role in the level of crop response observed from the treatments applied in this study.

Table 1. Average percent leaf burn of brand by herbicide treatment four days after application

Brand	Liberty average % leaf burn	Liberty + Dual Magnum average % leaf burn	Liberty + Dual Magnum+ Orthene average % leaf burn
Stoneville	3.7%	19.8%	23%
Phytogen	4.1%	11.8%	12.4%
Deltapine	8.2%	24.4%	24%

Table 2. Percent leaf burn of variety by herbicide treatment four days after application

Variety	Liberty % leaf burn	Liberty + Dual Magnum % leaf burn	Liberty + Dual Magnum+ Orthene % leaf burn
Stoneville 4848 GLT	4.2	21.2	22.3
Stoneville 4949 GLB2	3.2	18.3	23.6
Phytogen 330 W3FE	5	12.4	12.4
Phytogen 340 W3FE	3.2	11.2	12.4
Deltapine 1612 B2XF	6.1	20	18.5
Deltapine 1614 B2XF	6.1	22.4	24.9
Deltapine 1725 B2XF	11.2	31.1	31.2
Deltapine 1646 B2XF	12.4	36.1	34.6
Deltapine 1820 B3XF	5	12.4	11.2

Table 3. Seed cotton yield in pounds per acre of variety by herbicide treatment

Variety	Liberty Seedcotton yield lbs/acre	Liberty + Dual Magnum Seedcotton yield lbs/acre	Liberty + Dual Magnum+ Orthene Seedcotton yield lbs/acre
Stoneville	3191.2	3067.1	3114.4
Stoneville	2776.9	2992.6	2797.9
Phytogen 330	3659.6	4055	4038
Phytogen 340	3764.9	3904.7	3618.5
Deltapine	3917.8	3738.7	3847.2
Deltapine	3674.7	3712.6	3400.3
Deltapine	3263.1	3452.6	3144.2
Deltapine	4070.7	3695.6	3712.6
Deltapine	3464.3	3358.5	3243.5

II. Cultural Management

Nutrient K-Discovery Project

W. Birdsong, A. Gamble, B. Dillard, C. Hicks, and J. Kelton

Purpose:

To implement a discovery of whether the Potassium recommendation levels for Cotton production should be reevaluated by the Auburn Soil Testing Program. New Varieties which have yield potentials of over 4 bales per acre are now available and attainable by Cotton Growers. When a soil sample is analyzed as a “Low” level by Auburn’s lab, the recommendation is 90 lb/ac K. This same sample with a “Low” level receives a recommendation by a private lab of 190 lb/ac K. This leaves the Farmer with extreme questioning as to which lab recommendation to follow since both labs utilize the double acid method of extraction. Many times the grower follows neither lab’s recommendation. This question should be addressed to discover if more refined research is needed to recalibrate the Auburn soil test lab or provide evidence to growers that Auburn’s recommendation is a recommendation that can be adhered to.

Procedure:

This will be collaborative effort between the Alabama Experiment Station and local growers. Plans are for this to be conducted with at least two research stations, most likely E.V. Smith and Wiregrass, as well as two local growers in the proximity to those same soil types and locale. Irrigated fields with low K have been discovered for the grower location and will be placed as such on the research station. Fertilizers used will be commercial fertilizer except for the Poultry Litter treatment. Poultry Litter will match Auburn’s K recommendation. (This will evaluate whether the K availability in litter is comparable to commercial fertilizer K.) The treatments will be duplicated at all locations. Planned treatments are as follows: Four reps on research stations and two to three at on farm locations. Variety will be the same at the Research Station as well as the local on farm Site.

1. Auburn soil Test recommendation for K on a low level soil
2. Commercial Lab recommendation for K on low level soil
3. Split the difference treatment (Average of recommendations)

4. Poultry Litter (to equivalent Auburn's 90 lb/ac K recommendation) at planting with 60 lb/ac N at sidedress (This is a standard fertility regiment by many farmers)

The Discovery K Project was planted in these Locations:

1. EVS Auburn Research Center – Tallassee, AL (4 reps) – Medium K Level Soil Test
2. Local Farm (Lazenby Farm) – Auburn Area – Medium K Level Soil test
3. Local Farm (Jeff Gray Farm) - Samon Al – Low K Level Soil Test
4. Wiregrass Research Center – Low K Site not available in 2017. Will be conducted in 2018

2017 RESULTS: - EVS LOCATION REPORT

Plots are 4 rows X 28'

FCU cotton K/Litter test
Planted 5/15/17 will be trimmed to 25'
Applied 5/16/17
DP 1646 K Rate/ac

trt 1	Litter	2 tons=106 lbs K		$30.00	Value of K
trt 2	AU	40 lbs		$11.20	
trt 3	Waters	100 lbs		$28.00	
trt 4	Average	70 lbs		$19.60	

401 4	**402** 3	**403** 2	**404** 1
301 1	**302** 2	**303** 3	**304** 4
201 4	**202** 1	**203** 2	**204** 3
101 3	**102** 2	**103** 4	**104** 1

	Litter (lbs seedcotton/ac)	AU (Lbs seedcotton/ac)	Waters (Lbs seedcotton/ac)	Average of AU and Waters(Lbs seedcotton/ac)
Rep 1	3590	3605	3488	3183
Rep 2	3779	3314	3532	3735
Rep 3	4230	3823	3503	3765
Rep 4	4288	3343	4070	3532
Average	**3972**	**3521**	**3648**	**3554**

ON FARM LOCATION – Lazenby Farms – Auburn, AL

Lazenby Farm
Cotton K rate/Litter study
Planted 5/11/17
Harvested 11/14/17
30 lbs of N applied 5/12/17

AU rate	40 lbs K	$11.20
Waters rate	105 lbs K	$29.40
Average	73 lbs K	$20.44
2 tons of litter	106 lbs K	$30.00 (Value of K)

Boarders 8 rows	Waters 8 rows	AU 8 rows	Average 8 rows	Litter 8 rows
	105 lbs K	40 lbs K	73 lbs K	106 lbs K
	Seed cotton	Seed cotton	Seed cotton	Seed cotton
	2493	2215	2233	2691

ON FARM LOCATION – Jeff Gray Farm – Samson, AL

Hurricane IRMA with straight line winds deleafed a majority of the field, therefore, the data was considered to be of no value.

Summary

In both the replicated trial at EVS and the on Farm Trial with Lazenby Farms the results were very similar and the order of ranking in Yield between the different treatments was the same. In both test in a pure ranking sense, this was the ranking for both test that were conducted.

1- Litter Treatment (106 lbs/ac K)
2- Waters Laboratory (100 – 105 lbs/ac K)
3- Avrerage between labs (70 – 73 lbs/ac K)
4- Auburn Lab (40 lbs/ac K)

AVERAGE of the two sites (seed Cotton)

	Litter	AU	Waters	Av.
EVS	3972	3521	3648	3554
Lazenby	2691	2215	2493	2233
AVERAGE	**3332**	**2868**	**3071**	**2894**

When comparing the economics from these two trials it certainly appears that the additional cost of K obtained either through the Poultry Litter or the higher rates through the Water's recommendation was cost feasible. The additional K applied between the Auburn Lab and the Water's Lab creating the "Average Treatment "appears to have been a cost neutral to a slight positive effect from the additional K applied to the cotton.

In Summary, I do believe that these results justify further research in regards to examining Auburn's K recommendation for Cotton with the newer more productive varieties. This test will continue during 2018.

Cotton Production with Reduced Inputs

T. Cutts, R. Smith, and C. Hicks

Justification

A reduced input trial was conducted in 2015 at the Prattville Ag Research Unit. In this trial input costs were reduced by approximately 14% or $75 per acre by changing three variables: Technology costs, planting date and seed treatments for thrips control. No controls were applied for the bug complex or caterpillar control. Economic benefits were achieved by utilizing a high yielding conventional variety (UA 222), an early planting date and eliminating the nematode component of the at-planting seed treatment. Other variables need continue to need to be evaluated to investigate possible further reduction in inputs. In 2016, trials were conducted looking at the same varieties with varying levels of insect control. Plant bugs were left untreated compared to a full control treatment. Worm pressure was extremely low so this variable was not able to be examined. Further studies are needed to replicate plant bug control effect on cotton yield, and also to attempt to show how minimum worm control will impact yield in conventional vs BT cotton varieties.

Objectives

To evaluate additional variables in a reduced input cotton production system such as the economic importance of managing the bug complex (plant and stink bugs) and caterpillars (bollworm and budworms).

<u>Experimental Design</u>

Treatments within Blocks:

1. Worm/Bug Control
2. Non-treated

Subplots:

1. Conventional Variety (UA 222)
2. BT Variety (DP 1646 B2XF)

Planting Date: June 8, 2017

Harvest Date: November 28, 2017

Insecticide Treatment Applied			
Date	**Chemical**	**Rate/Ac.**	**Plots**
3-Jul	Diamond	6g	105, 106, 201, 205, 303, 304, 405, 407
25-Jul	Bifenthrin	6.4g	
13-Jul	Diamond	6g	109, 111, 209, 216, 311, 314, 413, 416
25-Jul	Bifenthrin	6.4g	

Worm Samples and Yield			
Treatment	Worm Count 1	Worm Count 2	Plot WT*
UA222 Treated	23.75	21.75	7.825
DP1646 Treated	0.5	2	7.45
UA222 Non-Treated	11.75	26.25	8.275
DP1646 Non-Treated	0.75	1	9.2
**No Significant Differences in Yield*			

Results Summary

Data samples were collected to document the differences between a Bt variety (DP1646) and non-Bt conventional variety (UA222) under scenarios to control worm and bug pressure vs. no worm and bug control. As demonstrated by worm counts taken during peak bloom times, there were massive differences between the two varieties, indicated the efficacy of the Bt trait. The insecticide treatments seem to have little to no effect on worm populations. Interestingly, there was no statistical means separations of seed-cotton plot yield indicated no end of season yield impact between treatments. It's important to keep in mind that this is very limited, preliminary data. Although this is preliminary data, it indicates how effective the Bt traits are at controlling worm populations vs. insecticide control available.

Reduced Inputs Through the Development of Nitrogen Calculator Algorithm for Cotton in Alabama

T Cutts, B. Ortiz, M. Mulvaney, C. Hicks, B. Dillard, and J. Kelton

Justification

The rising costs of farm inputs and the steady depression of commodity prices create the need to reexamine cost efficiencies of current management practices. Currently, cotton growers apply approximately 90 lbs/A of Nitrogen (N) to maximize yield potential. However, many variables come into play such as soil structure and rotational crops among others that effect how much N is already available in some fields. Yield response to N is highly affected by soil texture. This calls into question how profitable it is to apply a uniform high rate of N across entire fields. Studies from Clemson University that have developed yield response prediction equations for a N calculator have demonstrated a 30 to 50% reduction in N usage while maintaining cotton yields. There is a need for this type of application for Alabama cotton producers in order to reduce farm inputs where possible and grow cotton in a more profitable way.

Objectives

Establish small plot studies to develop a yield response prediction algorithm to N for the Gulf Coastal Plain region of Alabama. After repeated for 2-3 cropping cycles, this algorithm can be utilized in a cotton production system using GreenSeeker sensors to calculate N inputs to efficiently maximize yield.

2017 Summary

Studies were established at 3 locations across the Alabama Gulf Coastal Plain in Headland, Brewton, and Fairhope, and 1 location in the North Florida Panhandle at Jay, FL. Nine N Treatments were replicated 4 times and applied to a high yield potential current variety (DP 1646 B2XF). Applications were made at pre-plant timing only (with the exception of the Best Management Practices treatment) due to the objective of quantifying N deficiency throughout the growing season. NDVI data was collected weekly throughout the growing season. Since multiple year NDVI data is needed to construct calculator algorithm, that data is preliminary and not presented. However, preliminary yield data can shed some light on what happened in 2017.

Since location was significant, data is present by location. Figure 1 shows yield means by treatment for the Jay, FL location. This is the only location where there was a significant treatment effect on yield. Predictably, the highest N rate resulted in the highest mean yield. However, Table 2 shows this mean was not significantly different than treatments, 8, 6, 5, or 4, indicating that up to 50% less N could achieve similar yields. At other locations, various factors caused no significant yield differences among treatments and therefore is not presented. Only speculative causes can be made as to why this occured. At Fairhope, the trial location followed a soybean rotation, causing sufficient residual nitrate to maintain good yields and eliminate any effect of extra applied N. These results, while not giving intuitive yield data, is a good reminder of how existing soil N should dictate the N program in any given field and season, and will actually be valuable NDVI data to include in the final algorithm. Fields at Brewton and Headland had various environmental stresses that potentially leached out N treatments, including heavy early season rainfall and multiple tropical weather systems, that reduced yields and suppressed statistical separation.

Table 1. Treatments

Trt	At-plant (lbs N/ac)	Sidedress (lbs N/ac)
1	0	0
2	20	0
3	40	0
4	60	0
5	80	0
6	100	0
7	120	0
8: BMP	20	70
9	20	Clemson rec

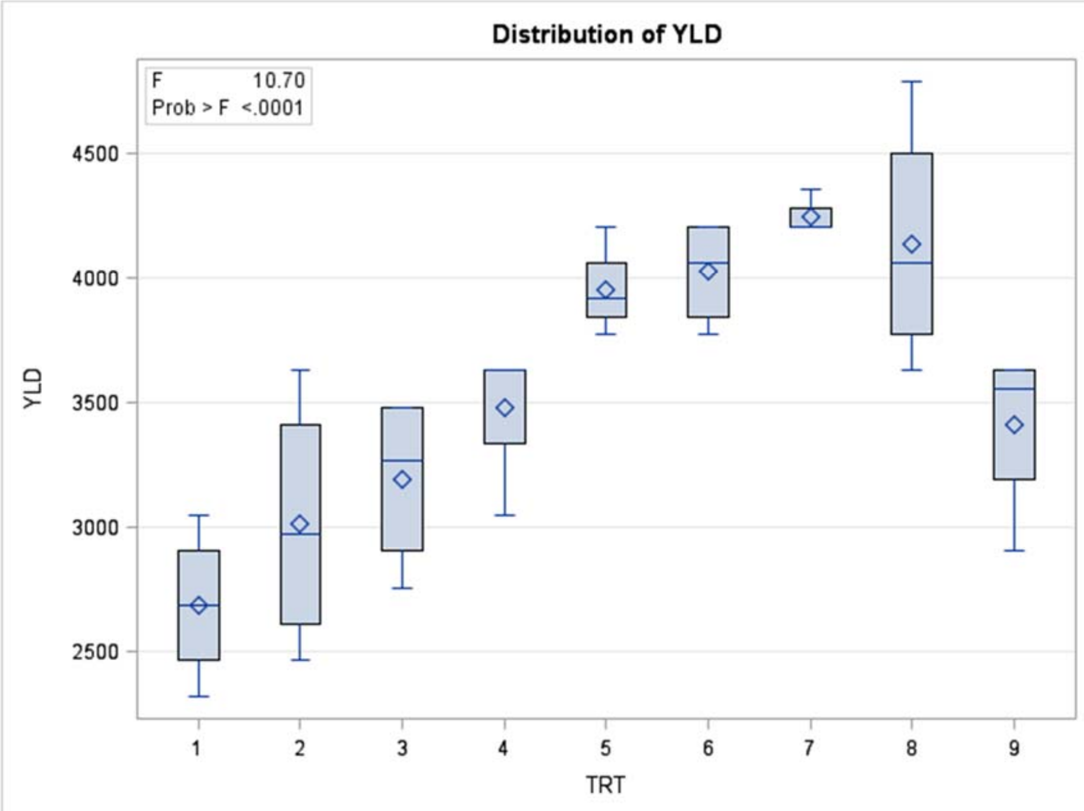

Figure 1. Seed Cotton Yield at Jay, FL

Table 2. Yeild Means at Jay, FL.

1	2686.2	e			
2	3012.9	d	e		
3	3194.4	c	d	e	
4	3484.8	a	b	c	d
5	3956.7	a	b	c	
6	4029.3	a	b		
7	4247.1	a			
8	4138.2	a	b		
9	3412.2	b	c	d	e

* Means with the same letter in the same column are not significantly different (<0.05)

Investigation of Variable Rate Irrigation in Cotton

T. Cutts, J. Koebernick, and G. Pate

Justification

Modern cotton varieties are continuing to increase in genetic diversity. Advanced breeding techniques have led to rapid turnover in cotton varietal development. These developments have led to great differences in genetic yield potential and fiber quality. Variability of varietal performance is compounded by the fact that differing environmental conditions cause genetic characteristics to express if different ways. There is little known about how new varieties respond differentially to variable rates of irrigation. Currently, there are limited recommendations for Alabama soils for irrigation timing and rates. Variable-rate irrigation is showing promise as a more efficient means of watering crops. An increase in irrigated cropland in the state along with the potential for water-use regulations make efficiency a necessity for producers. Early results from studies at the EV Smith Research Center in Shorter, Al indicate possible yield reductions due to overwatering, and also showing a possible reduction in total water needed for similar yields using sensor-based technology versus the conventional checkbook method for irrigation scheduling.

Objectives

Derive updated recommendations on irrigation management strategies of new cotton varieties across a range of maturities and growth habits. Also, to determine any genetic by environment interaction between differing levels of irrigation and current cotton varieties. Plant growth regulator applications will be based on a fixed growth stage trigger in order to derive timing recommendations based on variety and level of irrigation.

Methods

A set of 5 current market varieties was chosen that vary across maturities and plant types. These were planted in strips across a span of the variable rate irrigation pivot at the EV Smith Research Station in Shorter, AL. Five treatments of varying irrigation levels will be applied. Extreme environmental conditions existed in Shorter in 2017. Early season rainfall was excessive. One event occurring on May 20 had radar indicated rainfall levels of nearly 4 inches, less the 24 hours after initial planting. A re-plant could only be made on June 14th due to excess field moisture. The field continued to hold water throughout the growing season, which hampered normal growth. Thus, morphological measurements were aborted. Yield data was collected on December 15th.

Summary

Table 1 shows mean seed cotton yields by variety. These means are not significantly different from one another so therefore no firm comparison can be made. Likewise, in Table 2, which shows mean of irrigated and dryland blocks, there is no statistical difference. In fact, data indicates a higher average in the dryland block. This is indicative of a growing season with extremely high rainfall therefore negating any positive effects of irrigation. Further trials are need to elucidate the stated objectives of this study.

Table 1. Mean yields of cotton varieties in 2017

Variety	Seed Cotton (Lbs/A)*
DP1518B2XF	1293
DP1646B2XF	1160
NG5007B2XF	1197
PHY330W3FE	1125
ST6182GLT	1098

*Means are not significantly different

Table 2. Mean yields of treatment blocks in 2017

Treatment	Seed Cotton (Lbs/A)*
Irrigated	1076
Dryland	1273

*Means are not significantly different

Management Options Following Auxin Injury to Mitigate Yield Loss in Cotton

T. Cutts, S. Li, J. Tredaway, and F. Browne

Justification

New auxin herbicide formulations are now labeled for use on approved tolerant cotton varieties in Alabama for 2017. New formulations of 2,4-D and Dicamba can be applied in season over varieties with the corresponding herbicide tolerant technology. While these formulations have reduced drift and volatilization properties, the potential for off-target movement remains high in cases of application during adverse weather or applicator error. There is no cross-tolerance between 2,4-D and Dicamba varieties. Because these varieties are likely to be planted in close proximity to each other and non-auxin tolerant cotton varieties, the risk of off-target injury is extremely high. While previous studies have estimated potential yield loss with various timings of simulated off-target rates, there remains no clear correlation between early season visual injury estimates and actual yield loss. Also, there are no current management recommendations for mitigating yield loss after a known off-target auxin application. Auxin herbicide mode of action is designed to enhance gibberellin hormone activity in plants to such an extreme extent as to lead to plant death. Pant Growth Regulators (PGRs), namely mepiquat chloride, are designed to reduce vegetative growth in cotton by inhibiting gibberellin activity. Because of this, it is logical to hypothesize that the correct rate and timing of a PGR after an off-target auxin herbicide application may potentially have a corrective effect on gibberellin activity in susceptible cotton varieties. There is a need to explore a practical management solution that would mitigate any potential yield reduction or crop loss after an off-target auxin application in cotton.

Objectives

To explore possible corrective effects of PGRs applied after an off-target auxin herbicide application, and derive a potential recommendation to growers about the correct rate and timing following different timings of auxin injury. This study is designed to be a proof-of-concept that will contain a high number of treatments at 1 or more locations.

Methods

A study examining rates and timings of PGR application following injury from an off-target auxin herbicide application will be established at the E.V. Smith Research Center in Shorter, Al. Two varieties (one dicamba tolerant and one 2-4,D tolerant) will be organized in a split block design. Treatments will be replicated within blocks to include 2 timings of simulated off-target rates of the opposing auxin chemistry, followed by 2 rates and 2 timings of a PGR (mepiquat chloride). Data collection will include injury ratings throughout growth stages, plant height, node counts, and lint yield.

Treatments

Sensitive cotton varieties at 4-leaf stage exposed to 2,4-D choline salt and diglycolamine salt of dicamba at 0.04 kg ai ha^{-1}. Mepiquat chloride was then applied at 0.99 or 2.00 g ai ha^{-1} 1 day after exposure, at visual injury, or in a tank mix. Sensitive cotton varieties at first bloom exposed to 2,4-D choline salt and diglycolamine salt of dicamba at 0.002 kg ai ha-1. Mepiquat chloride was then applied at 2.00 or 4.00 g ai ha-1 1 day after exposure, at visual injury, or in a tank mix.

Summary

Sensitive cotton exposed to 2,4-D choline salt and diglycolamine salt of dicamba at 0.04 kg ai ha^{-1} at the 4-leaf stage resulted in significant injury as early as 1 day after exposure. Mepiquat chloride applications did not decrease injury throughout the growing season. By 28 days after auxin herbicide exposure, no difference was observed between any mepiquat chloride applications and injured cotton that was not treated.

Cotton injury was observed after cotton was exposed to 2,4-D choline salt and diglycolamine salt of dicamba at 0.002 kg ai ha^{-1}. Mepiquat chloride applications had no effect on injury of sensitive cotton exposed at first bloom. Injury did not appear until 14 days after cotton was exposed to auxin herbicides at first bloom. Injury in cotton exposed to both auxin herbicides was similar for cotton treated with mepiquat chloride and those that did not receive the corrective treatment.

Regardless of auxin herbicide exposure at 4-leaf stage or early bloom, mepiquat chloride applications did not result in yield greater than that of injured cotton that did not receive corrective treatments. No advantages were observed from applying mepiquat chloride after auxin herbicide exposure to sensitive cotton at 4-leaf stage or early bloom. If auxin herbicide injury is discovered at these two stages, mepiquat chloride will neither decrease nor increase yield.

TABLES AND FIGURES

COTTON INJURY AFTER 2,4-D EXPOSURE AT 4-LEAF STAGE (DP1646 B2XF)

OFF TARGET TIMING	PGR TRT	3 DAT	7 DAT	14 DAT	21 DAT	28 DAT
4 LEAF	NONE	31.25 A	66.25 ABC	68.75 A	72.50 A	72.50 A
4 LEAF	4 OZ/A 1 DAA	23.75 A	63.75 ABC	65.00 A	73.75 A	71.25 A
4 LEAF	4 OZ/A AT VISUAL INJURY	35.00 A	73.75 AB	72.50 A	76.25 A	73.75 A
4 LEAF	2 OZ/A 1 DAA	35.00 A	77.50 A	56.25 A	81.25 A	75.00 A
4 LEAF	2 OZ/A AT VISUAL INJURY	25.00 A	58.75 BC	62.50 A	72.50 A	72.50 A
4 LEAF	4 OZ/A TANK MIX	25.00 A	52.50 C	56.25 A	70.00 A	67.50 A
4 LEAF	2 OZ/A TANK MIX	26.25 A	57.50 C	65.00 A	70.00 A	70.00 A
NONE	4 OZ/A 1 DAA	0.00 B	10.00 D	0.00 B	0.00 B	0.00 B
NONE	4 OZ/A AT VISUAL INJURY	0.00 B	0.00 D	0.00 B	0.00 B	0.00 B

[A] 2,4-D CHOLINE SALT APPLIED AT 0.04 KG AI HA^{-1} APPLIED ON 8 JUNE 2017.
[B] PGR APPLICATION DATES: 9 JUNE 2017 AND 13 JUNE 2017.
[C] VISUAL INJURY RATING RECORDED ON 13 JUNE 2017, 15 JUNE 2017, 22 JUNE 2017, 29 JUNE 2017, 7 JULY 2017, 21 JULY 2017, AND 27 JULY 2017.
[D] MEANS FOLLOWED BY THE SAME LETTER DO NOT DIFFER SIGNIFICANTLY BASED ON A MIXED MODEL ANALYSIS OF VARIANCE (P=0.05).

COTTON INJURY AFTER DICAMBA EXPOSURE AT 4-LEAF STAGE (PHY 490 W3FE)

OFF TARGET TIMING	PGR TRT	3 DAT	7 DAT	14 DAT	21 DAT	28 DAT
4 LEAF	NONE	16.25 A	33.75 BC	57.50 A	53.75 B	45.00 B
4 LEAF	4 OZ/A 1 DAA	16.25 A	40.00 BC	57.50 A	62.50 AB	46.25 B
4 LEAF	4 OZ/A AT VISUAL INJURY	18.75 A	43.75 BC	65.00 A	70.00 A	55.00 AB
4 LEAF	2 OZ/A 1 DAA	27.50 A	63.75 A	57.50 A	72.50 A	58.75 A
4 LEAF	2 OZ/A AT VISUAL INJURY	16.25 A	27.50 C	52.50 A	57.50 B	47.50 B
4 LEAF	4 OZ/A TANK MIX	22.50 A	52.50 AB	66.25 A	71.25 A	55.00 AB
4 LEAF	2 OZ/A TANK MIX	18.75 A	36.25 BC	55.00 A	58.75 B	45.00 B
NONE	4 OZ/A 1 DAA	0.00 B	0.00 D	0.00 B	0.00 C	0.00 C
NONE	4 OZ/A AT VISUAL INJURY	0.00 B	0.00 D	0.00 B	0.00 C	0.00 C

[A] DIGLYCOLAMINE SALT OF DICAMBA APPLIED AT 0.04 KG AI HA^{-1} ON 8 JUNE 2017.
[B] PGR APPLICATION DATES: 9 JUNE 2017 AND 13 JUNE 2017.
[C] VISUAL INJURY RATING RECORDED ON 13 JUNE 2017, 15 JUNE 2017, 22 JUNE 2017, 29 JUNE 2017, 7 JULY 2017, 21 JULY 2017, AND 27 JULY 2017.
[D] MEANS FOLLOWED BY THE SAME LETTER DO NOT DIFFER SIGNIFICANTLY BASED ON A MIXED MODEL ANALYSIS OF VARIANCE (P=0.05).

COTTON INJURY AFTER 2,4-D EXPOSURE AT FIRST BLOOM
(DP1646 B2XF)

OFF TARGET TIMING	PGR TRT	3 DAT	7 DAT	14 DAT	35 DAT	48 DAT
FIRST BLOOM	NONE	0.00 B	0.00 B	5.00 A	13.75 AB	11.25 A
FIRST BLOOM	8 OZ/A	0.00 B	0.00 B	3.75 A	11.25 B	12.50 A
FIRST BLOOM	8 OZ/A	0.00 B	0.00 B	2.50 A	17.50 AB	13.75 A
FIRST BLOOM	4 OZ/A	1.25 A	7.50 A	1.25 A	37.50 A	11.25 A
FIRST BLOOM	4 OZ/A	0.00 B	0.00 B	3.75 A	16.25 AB	16.25 A
FIRST BLOOM	8 OZ/A	0.00 B	0.00 B	3.75 A	11.25 B	6.25 A
FIRST BLOOM	4 OZ/A	0.00 B	0.00 B	2.50 A	10.00 B	8.75 A
NONE	8 OZ/A	0.00 B	0.00 B	0.00 A	0.00 B	0.00 A
NONE	8 OZ/A	0.00 B	0.00 B	0.00 A	0.00 B	0.00 A

[A] 2,4-D CHOLINE SALT APPLIED AT 0.002 KG AI HA^{-1} ON 27 JULY 2017.
[B] PGR APPLICATION DATES: 28 JULY 2017 AND 7 AUGUST 2017.
[C] VISUAL INJURY RATING RECORDED ON 30 JULY 2017, 4 AUGUST 2017, 10 AUGUST 2017, 25 AUGUST 2017, 1 SEPTEMBER 2017.
[D] MEANS FOLLOWED BY THE SAME LETTER DO NOT DIFFER SIGNIFICANTLY BASED ON A MIXED MODEL ANALYSIS OF VARIANCE (P=0.05).

COTTON INJURY AFTER DICAMBA EXPOSURE AT FIRST BLOOM
(PHY 490 W3FE)

OFF TARGET TIMING	PGR TRT	3 DAT	7 DAT	14 DAT	35 DAT	48 DAT
FIRST BLOOM	NONE	1.25 A	2.50 A	3.75 A	10.00 A	15.00 A
FIRST BLOOM	8 OZ/A 1 DAA	0.00 B	0.00 B	10.00 A	11.25 A	12.50 A
FIRST BLOOM	8 OZ/A AT VISUAL INJURY	0.00 B	0.00 B	7.50 A	8.75 A	12.50 A
FIRST BLOOM	4 OZ/A 1 DAA	0.00 B	0.00 B	7.50 A	12.50 A	13.75 A
FIRST BLOOM	4 OZ/A AT VISUAL INJURY	0.00 B	0.00 B	6.25 A	8.75 A	16.25 A
FIRST BLOOM	8 OZ/A TANK MIX	0.00 B	0.00 B	7.50 A	13.75 A	12.50 A
FIRST BLOOM	4 OZ/A TANK MIX	0.00 B	0.00 B	5.00 A	10.00 A	11.25 A
NONE	8 OZ/A 1 DAA	0.00 B	0.00 B	0.00 A	0.00 A	0.00 A
NONE	8 OZ/A AT VISUAL INJURY	0.00 B	0.00 B	0.00 A	0.00 A	0.00 A

[A] DIGLYCOLAMINE SALT OF DICAMBA APPLIED AT 0.002 KG AI HA^{-1} ON 27 JULY 2017.
[B] PGR APPLICATION DATES: 28 JULY 2017 AND 7 AUGUST 2017.
[C] VISUAL INJURY RATING RECORDED ON 30 JULY 2017, 4 AUGUST 2017, 10 AUGUST 2017, 25 AUGUST 2017, 1 SEPTEMBER 2017.
[D] MEANS FOLLOWED BY THE SAME LETTER DO NOT DIFFER SIGNIFICANTLY BASED ON A MIXED MODEL ANALYSIS OF VARIANCE (P=0.05).

COTTON YELD AFTER EXPOSURE AT 4 LEAF STAGE

OFF TARGET TIMING	PGR TRT	2,4-D	DICAMBA
4 LEAF	NONE	10.15 A	10.11 A
4 LEAF	4 OZ/A 1 DAA	10.43 A	10.57 A
4 LEAF	4 OZ/A AT VISUAL INJURY	8.61 A	9.26 A
4 LEAF	2 OZ/A 1 DAA	7.56 A	6.86 A
4 LEAF	2 OZ/A AT VISUAL INJURY	10.23 A	10.21 A
4 LEAF	4 OZ/A TANK MIX	17.77 A	8.50 A
4 LEAF	2 OZ/A TANK MIX	9.71 A	9.43 A
NONE	4 OZ/A 1 DAA	11.58 A	10.47 A
NONE	4 OZ/A AT VISUAL INJURY	12.66 A	11.35 A

TABLE 1. COTTON YIELD AFTER AUXIN HERBICIDE EXPOSURE AT 4 LEAF STAGE.
[A] 2,4-D CHOLINE SALT AND DIGLYCOLAMINE SALT OF DICAMBA APPLIED AT 0.04 KG AI HA^{-1} ON 8 JUNE 2017.
[B] PGR APPLICATION DATES: 9 JUNE 2017 AND 13 JUNE 2017.
[C] MEANS FOLLOWED BY THE SAME LETTER IN A COLUMN DO NOT DIFFER SIGNIFICANTLY BASED ON A MIXED MODEL ANALYSIS OF VARIANCE (P=0.05).

COTTON YELD

OFF TARGET TIMING	PGR TRT	2,4-D	DICAMBA
FIRST BLOOM	NONE	11.83 A	10.47 A
FIRST BLOOM	8 OZ/A 1 DAA	11.55 A	12.32 A
FIRST BLOOM	8 OZ/A AT VISUAL INJURY	10.85 A	10.82 A
FIRST BLOOM	4 OZ/A 1 DAA	11.55 A	10.96 A
FIRST BLOOM	4 OZ/A AT VISUAL INJURY	11.46 A	8.86 A
FIRST BLOOM	8 OZ/A TANK MIX	13.20 A	12.27 A
FIRST BLOOM	4 OZ/A TANK MIX	12.06 A	10.83 A
NONE	8 OZ/A 1 DAA	13.31 A	12.51 A
NONE	8 OZ/A AT VISUAL INJURY	9.63 A	10.67 A

TABLE 2. COTTON YIELD AFTER AUXIN HERBICIDE EXPOSURE AT EARLY BLOOM
[A] 2,4-D CHOLINE SALT AND DIGLYCOLAMINE SALT OF DICAMBA APPLIED AT 0.002 KG AI HA^{-1} ON 27 JULY 2017.
[B] PGR APPLICATION DATES: 28 JULY 2017 AND 7 AUGUST 2017.
[C] MEANS FOLLOWED BY THE SAME LETTER IN A COLUMN DO NOT DIFFER SIGNIFICANTLY BASED ON A MIXED MODEL ANALYSIS OF VARIANCE (P=0.05).

Continued Support of Long-Term Crops Research "OLD ROTATION"

D. Delaney, K. Balkcom, A. Gamble, and T. Cutts

THE OLD ROTATION

The "Old Rotation" experiment (circa 1896) is the oldest, continuous cotton study in the world and the third oldest field crops experiment in the U.S. on the same site. With the renewed interest in cover crops, we believe that this is also the oldest cover crop study in the U.S. and it is getting more international attention. Several students at Auburn are using this study for special-problems research, as well as graduate students from other Universities in Alabama, while soils from the Old Rotation have been shared with researchers in other states, as well as the site of tours for international and other campus visitors.

Corn and cotton yields reflect soil moisture and N availability more than any other factors. There was a varied response to irrigation in 2017 by cotton, corn and soybean. Wheat always follows corn and soybean is double-cropped behind wheat. The wheat crop failed to vernalize during the relatively warm winter, and rainfall at maturity delayed harvest, leading to very low yields. Wet spring weather also contributed to delayed planting of summer crops, esp. double-cropped soybeans. Timely summer rainfall, cloudy weather and relatively moderate summer temperatures contributed to little response of corn yields to irrigation, while lush growth on some irrigated cotton plots led to lower yields with irrigation. Some dryland cotton plots in corn and legume rotations were over 3.5 bales/A, showing the value of improved soil health on these plots. Soybean yields were increased by irrigation due to dry September weather during pod fill.

Soil moisture monitors were again installed in irrigated and non-irrigated plots of each summer crop and monitored in 2017 to optimize irrigation amounts and timing. A camera overlooking the Old Rotation allows visitors to the Old Rotation web site to view a live image of crops growing on the Old Rotation.

http://cses.auburn.edu/old-rotation/live-cam/

Crop yields on the OLD ROTATION in 2017.											
Plot No.	Description	Clover dry matter* (lb/a)		Wheat (bu/a)	Corn (bu/acre)		Cotton lint (lb/acre)		Soybean (bu/acre)	
		Irrigated	Non-irrigated		Irrigated	Non-irrigated	Irrigated	Non-irrigated	Irrigated	Non-irrigated
1	no N/no legume	-	-				375	321		
2	winter legume	5390	3709				892	1049		
3	winter legume	4719	3250				1324	1144		
4	cotton-leg-corn-leg	5690	5306		141	143				
5	cotton-corn + N	3884	7317		192	185				
6	no N/no legume	-	-				310	293		
7	cotton-leg-corn-leg	4705	6399				1277	1768		
8	winter legume	5105	4465				1483	1541		
9	Ctn-leg-corn-leg+N	5061	2979				1690	1853		
10	3-year rotation	-	-	12.9*			1333	1607		
11	3-year rotation	0	6502		216	216				
12	3-year rotation	5200	-						60	46
13	cont. cotton/no legume, +N	-	-				1108	1380		
	Mean	**4969**	**4991**		**183**	**181**	**1088**	**1217**		
*Winter legume and wheat are not irrigated. Long-term average total N fixed by legumes is 60 lb. N/acre.										

Continued Support of Long-Term Research "CULLARS ROTATION"

D. Delaney, K. Balkcom, A. Gamble, and T. Cutts

The Cullars Rotation (circa 1911) is the oldest, continuous soil fertility study in the Southern U.S. This study is non-irrigated and yields reflect growing conditions during the season.

Due to timely rainfall and moderately warm summer weather, differences due to fertilization were observed on this sandy soil in 2017. The wheat crop failed to vernalize during the relatively warm winter, and rainfall at maturity delayed harvest, leading to very low yields. Wet spring weather also contributed to delayed planting of summer crops, esp. double-cropped soybeans. Corn and cotton yields were moderated by short periods of dry weather on this sandy soil, although timely rainfall prevented severe drought conditions during the summer.

Soybean yields were better than expected with the late (July) planting, with late September and October rains leading to better than average double-cropped yields for this site.

All P and K fertilizers are applied to the cotton and wheat crops. Corn receives 120 lb. N/acre in addition to the fixed N by the winter legume cover crop. Wheat is top dressed in late winter with 80 lb. N/acre. The Cullars Rotation Experiment is an excellent site to see dramatic nutrient deficiencies compared to healthy crops each year. This type of comparison does not exist anywhere else in the USA. Numerous national and international groups were hosted at this experiment, and 3 A.U. classes visited the site in 2017. Many visitors to the adjacent Art Museum walk over to observe the crops, and we have had many educational opportunities with them.

Crop yields on the CULLARS ROTATION in 2017.						
Plot	Treatment description	Clover/Vetch dry wt.	Wheat	Corn	Cotton lint	Soybean
		-lb/acre-	-bu/acre-	-bu/acre-	-lb/acre-	-bu/acre-
A	no N/+legume	3059	6.3	48	614	46
B	no N/no legume	-	4.4	6	614	50
C	Nothing added	-	0	31	350	0
1	no legume	-	18.1	134	860	40
2	no P	688	4.7	82	567	11
3	complete	2085	20.9	108	907	54
4	4/3 K	2201	12.4	130	993	54
5	rock P	2589	19.4	107	1200	48
6	no K	1211	9.4	23	57	12
7	2/3 K	1706	22.7	72	889	54
8	no lime (pH~4.9)	0	0	16	0	0
9	no S	1020	39.4	91	983	49
10	complete+ micros	3024	25.4	109	1040	56
11	1/3 K	1766	24.8	74	378	49
	Mean of treatments	**1759**	**14.8**	**74**	**675**	**37**

Potassium Fertilization for Southeastern Cotton: An Additional Evaluation of Alternative Foliar K Sources

E. Guertal and T. Cutts

Justification:

- K deficiencies may be observed in fields that do not test low in soil K (Cassman et al., 1989)
- Foliar K may (Pettigrew et al., 1996; Howard et al., 1998b) or may not (Coker et al., 2009) increases in lint yield (and/or quality).
- The impact of foliar K is affected by soil K levels and soil water (Cassman et al., 1989)
- New and emerging K sources for cotton need further study (Oosterhuis and Howard, 2008)
- Three years of K fertility work in Alabama with soil-applied K (PPI) demonstrated slight but significant increases in lint yield. Would applications of foliar K create additional increases in yield?

Potassium sources for cotton production are a topic of much interest for southern cotton growers, and the varying K sources potassium nitrate, potassium chloride, potassium sulfate and potassium thiosulfate (http://www.tessenderlo.com/binaries/LiquidVisions_Vol1Issue1_tcm9-5808.pdf) are always a topic of discussion at grower meetings.

Objectives:

Because the literature for K fertilization of cotton is inconsistent in K fertilizer recommendations, and because K source and rate information is still lacking, the objective of this research proposal was to study the combined and separate effects of foliar K rate and source for high-yield cotton production.

Specific Objective:

This research examined the foliar K sources: 1) Humic acid K (tradename Buffer K), 2) potassium nitrate, 3) potassium carbonate-hydroxide (tradename Katalyst), 4) potassium acetate (tradename LoKomotive), and, 5) potassium thiosulfate (KTS tradename Trisert K) for cotton yield and performance.

Methods:

The experiment was conducted at the Field Crop Research Unit, located in Tallassee, AL. The research area tested 'Medium' for soil test K (95 lb/A), with a soil pH of 6.3, and soil-test P of 62 lb/A ('High'), Ca of 861 lb/A and Mg of 104 lb/A. The site was irrigated as needed, with only one application required, on August 10th (0.55 inches applied). The only fertilizers applied (in addition to the K treatments) were 33-0-0 at 40 lbs N/A on 18 May, and 28-0-05 on 27 June, to supply 60 lb N/A.

Phytogen 444 was planted on May 15th 2017 with each plot consisting of 4 rows of cotton (36 inch row spacing, 25 foot long plots with a harvest area of two rows) with four replications of each treatment. Treatments were the five K sources previously mentioned: 1) humic acid K, 2) potassium nitrate, 3) potassium carbonate-hydroxide (Katalyst), 4) potassium acetate (LoKomotive), and, 5) potassium thiosulfate (Trisert K), all at three K rates (8, 16 or 24 lbs K/acre in total), applied as four split applications of 2, 4 or 6 lbs K weekly beginning 2 weeks after mid bloom. Specific application dates were July 26th, August 7th, August 23rd, and September 6th, with all the foliar products applied in a 10 gpa spray volume. Please note that K rates are expressed as K, and not K_2O.

A zero K (no foliar K treatment was also included. Treatments were not adjusted for the N or S applied in some of the products (KTS and KNO_3). In all there were 64 plots in the study (5 K sources at 3 K rates plus a zero K control plot; 4 replications of each). Cotton was harvested on October 26th, 2017, with grab samples saved for ginning. At this date only seed-cotton yield has been determined, and so this report contains only lint yield data, calculated using an estimated ginning percentage of 44 percent.

Data Collection:

The following data was collected:

1) yield (seed and lint), 2) ginning percent, 3) fiber quality, and, 4) damage to plants at 24 hr after each foliar spray. Leaf samples will be taken at 24 hr after each foliar spray, with those samples analyzed for K content. This report contains only estimated lint yield data, as all other data is not yet analyzed this early in the reporting period.

Results:

Table 1. Analysis of variance for the effect of K Rate and K Source on lint yield of cotton, EV Smith Field Crops Unit, AL, 2017

Source of Variation	Pr > F
K Source	0.70
K Rate	0.65
K Source x K Rate	0.02

Because there was a significant interaction between K source and K rate the data must be shown by K source, within each K rate.

Table 2. Interaction of K Rate and K Source on the lint yield of cotton, EV Smith Field Crops Unit, AL, 2017

K Rate (lbs K/A)	**K Source (trade name in parentheses)**				
	Humic (Buffer K)	**KNO_3**	**KOH (Katalyst)**	**Acetate (LoKomotive)**	**KTS (Trisert)**
	lint yield (lb/A)				
0	1459	1459	1459	1459	1459
8	1350	1454	1220	1406	1517
16	1481	1280	1467	1261	1382
24	1362	1416	1592	1370	1345

Note – total K applied is shown. This K was applied in 4 split application as 2, 4 and 6 lbs K/A at each application.

Table 3. Mean lint yield, by treatment. Means separation conducted at an alpha of 0.05

K Source	**K Rate**	**Yield**
	lb K/A in total	**lb/A**
Humic Acid (Buffer K)	8	594 abcd
Humic Acid (Buffer K)	16	652 abc
Humic Acid (Buffer K)	24	599 abcd
Potassium Nitrate	8	640 abcd
Potassium Nitrate	16	563 bcd
Potassium Nitrate	24	623 abcd
Potassium Acetate (LoKomotive)	8	619 abcd
Potassium Acetate (LoKomotive)	16	555 cd
Potassium Acetate (LoKomotive)	24	603 abcd
Potassium carbonate-hydroxide (Katalyst)	8	537 d
Potassium carbonate-hydroxide (Katalyst)	16	645 abcd
Potassium carbonate-hydroxide (Katalyst)	24	701 a
Potassium Thiosulfate (Trisert K)	8	667 ab
Potassium Thiosulfate (Trisert K)	16	608 abcd
Potassium Thiosulfate (Trisert K)	24	592 abcd
Control	0	642 abcd

Conclusion:

No one K source or K rate consistently improved yield of cotton, when compared to the unfertilized (no K) control.

Effects of Cover Crops on Mycorrhizal Fungi and In-Crop Water Holding Capacity in an On - Farm Situation

C. Hicks

The trial was conducted on a farm in Lee County, AL on Orangeburg loamy sand and Cecil sandy loam soil types. Plots consisted of 4 or 8 rows of cotton with 38" row spacing. Plots were .39-.78 acre in size and not replicated. Cover crops were planted December 10, 2016. Cotton was planted May 21, 2017. Cotton was harvested December 2, 2017. Cover Crops were not fertilized. Two tons of chicken litter was applied to the field for prior cotton crop.

Table 1. Cover Crops Used

Seed	Seeding Rate (lb/ac)	AU Cost/acre
Hairy Vetch	20	$35.60
Wrens Abrozzie Rye	75	$13.50
Triticale	76	$21.28
Wheat	86	$18.49

Table 2. Cotton Lint Yields/acre

Cover	Lint Yield/ac	Turnout	Mic	Len	Str	Unif
Hairy Vetch	1177	.44	3.9	1.24	29.7	85.1
Rye	1259	.44	3.9	1.23	30.0	84.1
Triticale	1202	.45	4.0	1.25	30.3	84.2
Wheat	1183	.44	4.1	1.22	29.6	84.2
No Cover	1129	.44	3.9	1.25	30.7	85.7

WaterMark moisture sensors were installed in each cover crop plot on June 29, 2017. Each WaterMark consisted of a total of three sensors, one sensor located at the following depths: 6", 12" and 24". Lower numbers indicate more soil moisture (Please see Table 4). Readings are in centibars.

Table 3. Moisture Readings

Cover Crop	6" depth July 7	6" depth July 20	12" depth July 7	12" depth July 20	24" depth July 7	24" depth July 20
Hairy Vetch	20	140	17	185	0	29
Rye	20	123	15	116	3	56
Triticale	31	168	20	157	0	88
Wheat	19	36	13	89	0	19
No Cover	45	199	14	129	2	29

Table 4. Watermark Readings

Centibars	Reading
0 to10	Saturated
10 to 30	Adequately wet (except for coarse sands)
30 to 60	Usual range for irrigation (most soils)
60 to 100	Usual range for irrigation in heavy clay soils
100 to 200	Soil becoming dangerously dry

Ten cotton plants were collect on two separate occasions to determine the mycorrhizal populations. We are still working to develop a suitable mycorrhizal count protocol for the cotton roots. We hope to have the counts available in early 2018.

III. Disease Management

Potassium Rate and Source Effect on Target Leaf Spot

D. Delaney, A. Hagan, and T. Cutts

Target leaf spot in cotton has become a major problem in many areas of south & central Alabama. Soil fertility/plant pathology work in Texas has shown that potassium rate and source can affect leaf retention and improve plant health in cotton. Their results indicate that a liquid formulation of potassium fertilizer applied in a 4 X 4 band one month prior to planting decreased the occurrence of certain leaf spot diseases and increased cotton yield significantly. These benefits were realized even when the soil test level was 'high' and no potash was recommended.

Methods

As part of a regional effort, an experiment was conducted at the EV Smith Field Crops Unit under irrigation with varying application methods and rates of potassium applied preplant.

Soil samples were taken in increments from 0-6, 6-12, and 12-24 inches before K application and sent to a central lab for testing on April 13th.The 10 treatments in the trial included factorial combinations of five rates of K (0, 40, 80, 120, or 160 lb/A) and two application methods (liquid K injected 6-8 inches deep and 4 inches away from the seed furrow, or dry K surface broadcast) applied 3 weeks before planting on April 25th. DP 1646 B2XF was planted in 36-inch rows on May 14th After several heavy rain events during early May, much of the trial was submerged as of May 25th. The trial was burned down and replanted on June 9th. It is difficult to know whether this participation affected K treatments, however it was decided not to re-apply.

Stand counts and early season vigor measurements were taken. Leaf samples were taken at First Bloom + 2 weeks and sent to a central lab for analysis. Ratings were taken of Target Spot when severe enough to rate. This did not occur in 2017.

At maturity, measurements were taken of first fruiting branch, total nodes, plant height and nodes above cracked boll. After defoliation, cotton was harvested and weighed, followed by ginning of samples, with turnout and seed weights recorded. Lint samples were sent for Cotton Incorporated for quality analysis.

Results

Although pre-application soil samples showed K levels rated in the Low to Very Low Ranges, there were no differences in yield ($p < 0.05$) noted between the different K application rates or methods, with lint averaging 1565 lb/A for the trial. There were no other statistical significances in the 2017 trial. As of Dec 21st, lint quality data were not yet available. Target spot was not detected in the 2017 trial and thus not rated. This lack of treatment differences could be attributed to the excessive early and mid-season rainfall seen in 2017.

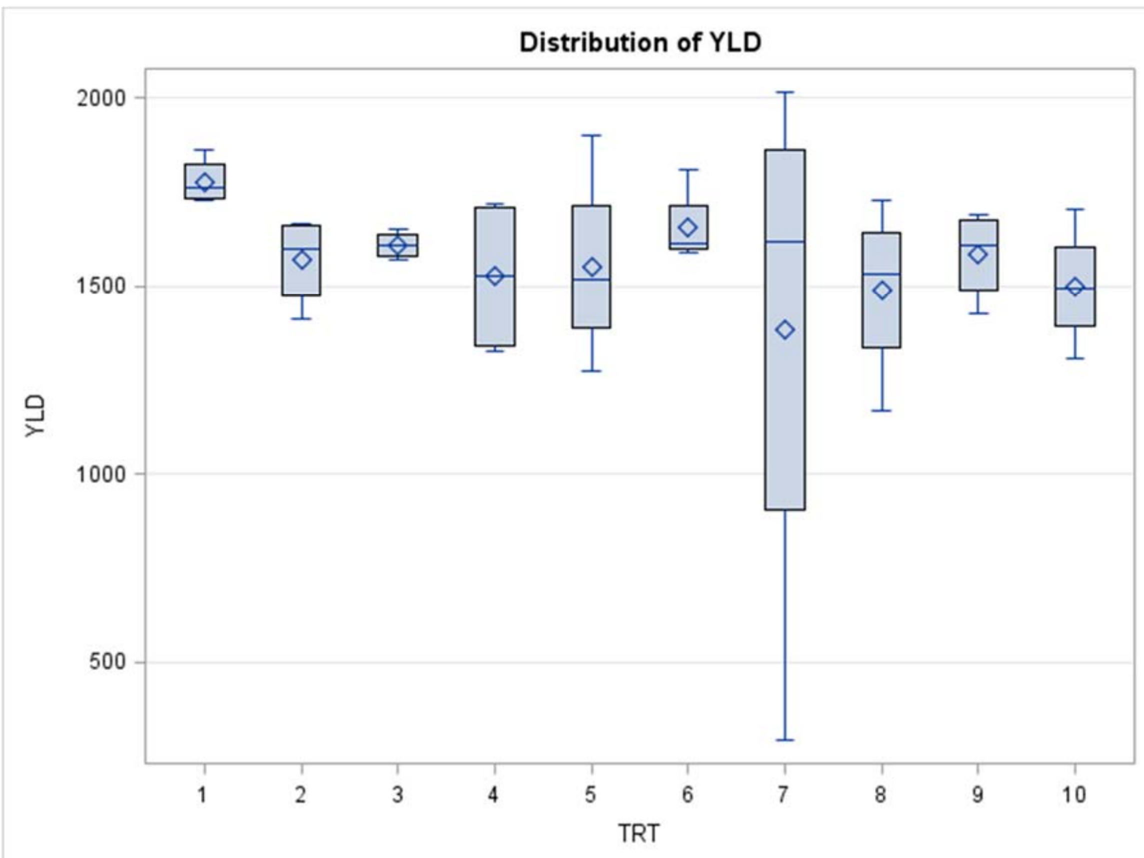

Figure 1. Lint Yields across treatments in 2017

Cotton Variety Evaluation with and without Velum Total for Fusarium Wilt and Root-Knot Nematode Management in Alabama, 2017

D. Dyer, K. S. Lawrence, S. Till, W. Groover, N. Xiang, M. Rondon, and K Gattoni

Ten cotton varieties were evaluated with and without the addition of Velum Total for the control of the root-knot nematode at the Plant Breeding Unit of Auburn University's E. V. Smith Research and Extension Center, which is located near Tallassee, AL. The fields contain a kalmia loamy sand soil type, which consists of 80% sand, 10% silt, and 10% clay. The field was arranged in a randomized complete block design and contained five replications. The plots were planted on 20 April, and seeds were planted at a depth of 2.5 centimeters. Test plots consisted of 4 rows (two treated with Velum Total and two untreated), that were 7.6 meters long with a 0.9-meter row spacing and a 1.8-meter alley between replications. Cotton seeds contained standard seed treatments as sold with each variety. Velum Total was applied as an in-furrow spray at a rate of 1 L/ha to the right two rows of each variety leaving the left two rows untreated. All plots were maintained throughout the season with standard insecticide, herbicide, and fertilizer practices as recommended by the Alabama Cooperative Extension System, and watered as needed with a center pivot irrigation system. Plots were rated for Fusarium wilt by counted dying plants in each plot Nematode population density (eggs/g of root), plant height, and biomass (root fresh weight + shoot fresh weight) were taken 30 DAP by digging up four plants at random for each plot. . Extraction of the nematodes for the cotton roots was done by soaking the roots in a 6% NaOCl solution on a shaker table for 4 minutes and then the nematodes were collected on a 25-µm sieve. The test was harvested and yield data were collected on 17 October. Data were analyzed with SAS 9.4 using PROC GLIMMIX and LS-means were compared using Tukey-Kramer's method ($P \leq 0.1$). Monthly average maximum temperatures from planting in May through harvest in October were 78.8, 82.4, 86, 91.4, 89.6, 84.2, 77°F with average minimum temperatures of 53.6, 57.2, 66.2, 69.8, 68, 62.6, 53.6°F, respectively. Rainfall accumulation for each month was 3.27, 7.75, 7.17, 5.12, 0.16, 0.0, and 2.27 inch with a total of 25.75 inch over the entire season.

Fusarium wilt incidence was very low in 2017 and few wilting plants were observed. Plant height was increased ($P \leq 0.1$) by 2 centimeters when Velum Total was applied; no effect was observed between varieties. Biomass was increased ($P \leq 0.1$) by 7 grams with the addition of the Velum

Total. An increase in biomass was observed for PhytoGen 444 WRF and PhytoGen 333 WRF when compared to Deltapine 1646 B2XF or PhytoGen 490 WRF. Velum Total reduced root knot nematode eggs per gram of root by 72.2% compared to untreated plots. The yield was increased ($P \leq 0.1$) by 168 kg/ha of seed cotton when Velum Total was applied. The highest yielding variety was PhytoGen 490 WRF which produced more ($P \leq 0.1$) seed cotton compared to Stoneville 6182 GLT, and Stoneville 4848 GLT by 321 and 317 kg/ha respectively. All other varieties produced similar yields.

Source of Variation (F-value)	Plant Height (cm)		Biomass[z] (g)		Root knot eggs/g of root		Yield (kg/ha)	
Cotton Variety	0.76[y]		2.17**		0.86		1.68	
Nematicide	38.36****		34.80****		25.99****		12.56***	
Variety x nematicide	0.37		0.85		0.82		0.31	
Nematicide LS-means								
Untreated control	14	b[w]	15	b	3493	a	797	b
Velum Total[x]	16	a	22	a	972	b	965	a
Cotton Variety LS-means								
Deltapine 1646 B2XF	14	a	13	b	2246	a	865	ab
Deltapine 1522 B2XF	15	a	18	ab	2196	a	854	ab
Deltapine 1614 B2XF	16	a	18	ab	2546	a	840	ab
PhytoGen 487 WRF	15	a	19	ab	2668	a	997	ab
PhytoGen 444 WRF	16	a	23	a	2198	a	877	ab
PhytoGen 333 WRF	15	a	22	a	1955	a	863	ab
PhytoGen 490 W3FE	15	a	17	ab	2303	a	1098	a
Stoneville 6182 GLT	14	a	16	b	2665	a	777	b
Stoneville 4848 GLT	15	a	20	ab	2005	a	781	b
Cropland Genetics 3885 B2XF	16	a	21	ab	1542	a	859	ab

[z] Biomass is the sum of shoot fresh weight and root fresh weights.
[y] Significance at the 0.1, 0.05, 0.01, and 0.001 level is indicated by *, **, ***, and **** respectively
[x] Velum total was applied at the time of planting as an in-furrow spray at a rate of 1 l/ha
[w] values present are LS-means separated using the Tukey-Kramer method at $P \leq 0.1$. Values in the same column followed by the same letter, or no letter, do not differ significantly.

Cotton Cultivar Disease Incidence, Severity, and Yields when Challenged with Verticillium Wilt in the Tennessee Valley Region

K. Lawrence, H. Kelly, T. Raper, T. Cutts, T. Sandlin, and B. Meyer

Introduction

Losses from Verticillium wilt for the U.S., according to disease loss estimates, between the years of 1990-2016 are approximately 480 million bales (Lawrence et al., 2017). Verticillium wilt most often occurs in the Tennessee Valley region of Alabama and Tennessee causing a decline in plant health and yield. Two *Verticillium* species have been found in in the Tennessee Valley region, *V. albo-atrum* Reinke and Berthold (Palmateer et. al., 2004) and *V. dahliae* Kleb., (Land et. al., 2016). *Verticillium dahliae* is considered the primary causal agent of Verticillium wilt in cotton and first colonizes the root and then moves upward through the vascular system of the plant (El-Zik, 1985). Typically, symptoms include wilting, lack of lateral growth, and decreases in yield, fiber quality, and seed quality (Wheeler et. al., 2012; Xiao et. al., 2000). Defoliation is thought to lead to yield reductions resulting from the lack of photosynthetic activity. Disease incidence is higher on heavier soils with higher clay and silt content and may be linked to the lower temperatures and higher moisture levels. Moist soils from irrigation enhance the incidence of Verticillium wilt in cotton. Irrigation cools the soil thereby enhancing pathogen survival and increasing infection rates. As the timing intervals of watering regiments increase, so do the disease incidences of cotton plants (Schneider, 1948). There are no fungicides recommended for management of Verticillium wilt in cotton. The only effective management option producers have is to select a Verticillium wilt tolerant cotton cultivar (Raper, et al. 2107) . The number of cotton cultivars available to producers, however, is limited. The life span of cotton cultivars is often less than 5 years thus a producer must constantly look for cultivars that yield well when challenged with Verticillium wilt. The overall goal of this study is to identify cotton cultivars for best management by evaluating cotton cultivars for resistance as measure by disease severity and tolerance measured by yield to Verticillium wilt in the field.

Figure 1. Verticillium wilt symptomatic cotton plant (left) ; foliar symptoms including necrosis and chlorosis of the leaves (middle); and vascular browning discoloration typical of a Verticillium wilt infected cotton plant with a non-symptomatic plant adjacent to it (right) (infected plant on the right side)

Materials and Methods

Cotton cultivars were planted in commercial cotton fields naturally infested with *V. dahliae* to determine cultivar disease response to Verticillium wilt under field conditions. Two field locations were selected for the 2017 tests based on severity of Verticillium wilt and the willingness of growers to participate in this research. Seed of adapted cultivars and experimental lines expected to be released in the next season were provided by AGRI-AFC, LLC of Land O'Lakes (Decatur, AL). Cotton cultivars and lines were planted in a strip plot design with four replications with plots being 1 row with a 1.02 m row spacing by 150 to 200 m plots evenly spaced throughout the field locations. Verticillium wilt disease incidence and severity ratings were conducted near cotton plant maturity from 4 randomly selected 3 m sections of row in each plot. Foliar symptoms of Verticillium wilt were evaluated on a scale from 1 to 5 as depicted in Figure 2. Plants were individually rated and averaged for a total plot disease severity rating. Vascular discoloration was determined by cutting the plant stem longitudinally exposing the vascular cylinder and the number of plants with a discolored vascular cylinder indicated the percent incidence. Stem section with discoloration were collected for fungal isolation to confirm Verticillium spp. presence. Yields were collected at plant maturity from 75 feet of each cultivar within each strip trial using a two row plot cotton picker. Samples were ginned at the UT Cotton MicroGin to determine turnout. Data collected from the field trials were analyzed in SAS 9.4 (SAS Institute, Cary, NC) using the PROC GLIMMIX procedure. LS-means were compared between the cultivars using the Tukey- Kramer test at significant level of $P \leq 0.05$.

Figure 2. Verticillium wilt disease severity ratings were conducted near cotton plant maturity. Foliar symptoms of Verticillium wilt were evaluated on a scale from 1 to 5 with 1 = no foliar wilting, 2 = interveinal chlorosis and necrosis of the leaves, 3 = interveinal chlorosis and necrosis of the leaves with 10-30% of the plant defoliated, 4 = interveinal chlorosis and necrosis of the leaves with 40- 60% of the plant defoliated, and 5 = 70-100% defoliation.

Figure 3. Verticillium wilt crew: from left to right top row: Stephen Till, William Groover, Kaitlin Gattoni, Marina Rondon, Hugh Moye, Robert Smith, Trey Cutts, and Nathan Silvey. Bottom row: Ni Xiang, David Dyer, Mary Foshee, Charlie Burmester , Tyler Sandlin, and Brad Meyer

Results

Verticillium wilt disease incidence and severity ratings were variable between the cottonc ultivars. Disease incidence ranged from 32 to 60 % of the plants of each cultivar with our resistant standard ST 4747 GLB2 with the lowest amount of vascular discoloration. These verity of the Verticillium wilt was also lowest for ST 4747 GLB2, CROPLAN 9608 B3XF and ST5122 GLT although the disease severity of these cultivars were less than only DP 1845 B3FX and DP 1851 B3FX (P>0.01). All the remaining cultivars had similar levels of Verticillium wilt incidence and severity (Fig.3). Yields indicated significant differences between cultivars when challenged with Verticillium wilt (Table1). Seed and lint cotton yields varied by 1429 and 574 lb/A, respectively. Ranking the cultivars by lint yield indicates ST 5471 GLTP, DP 1646 B2FX, CROPLAN 9608 B3XF, and DP 1614 B2FX produced numerically greatest yield under these disease conditions and these cultivar yields were 10% greater than our resistant standard ST 4747 GLB2. Comparing the data between disease incidence and severity indicated a significant positive correlation (R^2=0.5597; P<0.0001) between visual symptoms and the signs of the disease in the vascular system. A correlation between Verticillium wilt incidence and lint cotton yield was significant (R^2=-0.7377; P<0.0001) as well as the Verticillium wilt severity and lint cotton yield (R^2=-0.8109; P<0.0001) indicating that Verticillium wilt contributed to a reduction of 73 to 81% of the cotton yield.

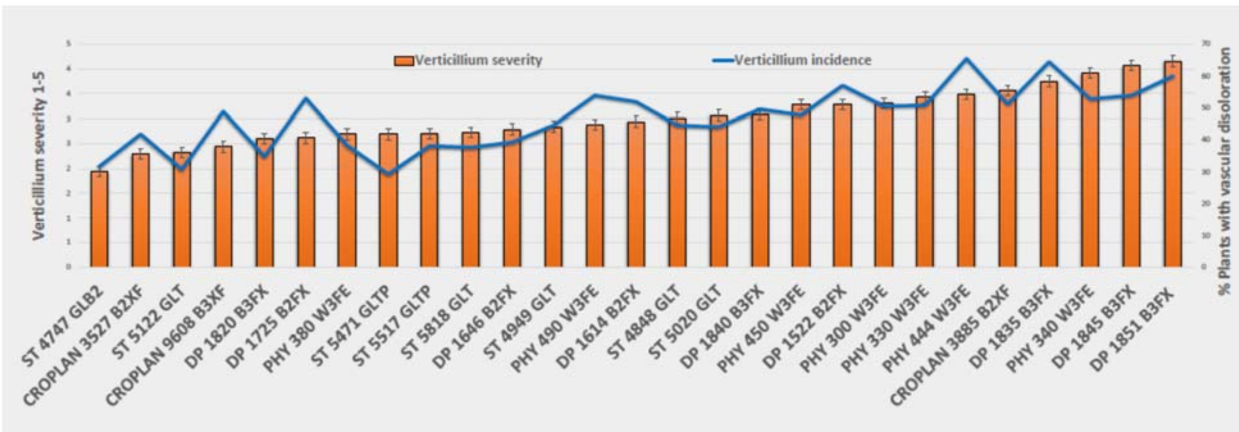

Figure 4. Verticillium wilt disease incidence and severity in the Tennessee Valley region 2017

Table 1. Cotton cultivar seed cotton, lint cotton and turnout percent in the Verticillium wilt fields, 2017

Cultivar	Seed cotton lb/A	Lint cotton lb/A	Turn out %
ST 5471 GLTP	23 a	868 a	37 abcdefg
DP 1646 B2FX	22 ab	855 a	38 abcde
CROPLAN 3527 B2XF	20 abc	784 ab	38 abcdef
DP 1614 B2FX	20 abc	761 ab	38 abcd
ST 4747 GLB2	19 abc	739 abc	37 abcdefg
DP 1820 B3FX	18 abc	729 abc	38 abc
ST 5122 GLT	20 abc	729 abc	36 bcdefg
ST 4949 GLT	18 abc	728 abc d	39 ab
ST 5818 GLT	20 abc	713 abc d	36 cd
PHY 330 W3FE	18 abc	697 abc d	37 abcdefg
PHY 380 W3FE	20 abc	696 abc d	34 gf
ST 5020 GLT	19 abc	688 abc d	35 defg
PHY 300 W3FE	18 abc	686 abc d	37 abcdef
CROPLAN 9608 B3XF	17 abc	686 abc d	39 a
ST 4848 GLT	18 abc	682 abc d	37 abcdefg
ST 5517 GLTP	18 abc	665 abc d	35 defg
DP 1522 B2FX	18 abc	647 abc d	34 gf
DP 1725 B2FX	16 abc	637 abc d	38 abc
PHY 490 W3FE	17 abc	628 abc d	36 abcdefg
DP 1840 B3FX	17 abc	599 abc d	35 defgh
CROPLAN 3885 B2XF	16 abc	575 abc d	35 fg

PHY 450 W3FE	14 abc	517 abc d	35 efgh
PHY 340 W3FE	12 abc	455 abc d	37 abcdefg
DP 1835 B3FX	10 bc	412 bcd	38 abcdef
PHY 444 W3FE	11 bc	405 bcd	35 defgh
DP 1851 B3FX	938 c	323 cd	34 gf
DP 1845 B3FX	909 c	294 cd	32 h

Column LS-mean values with different letters are significantly different by Tukey Kramer's at P > 0.05.

Conclusions

Cotton cultivar selection is very important in a Verticillium wilt infested field. The cultivars which yielded similarly to our standard ST 4747 GLB2 also were moderately susceptible to Verticillium wilt The two lowest yielding cultivars sustained the highest levels of Verticillium wilt.

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Evaluation of Seed Treatments Fungicides for Damping-off Control in Northern Alabama, 2017

M. N. Rondon, N. Xiang, K. S. Lawrence, S. Till, W. Groover, D. Dyer, and K. Gattoni

Seed treatments were evaluated for the control of damping-off caused by *Rhizoctonia solani* on cotton in the field at Tennessee Valley Research and Education Center of Belle Mina, AL. The soil type was a Decatur silt loam soil with 24% sand, 28% clay, and 49% silt. Seed treatments were applied to ST 4946GLB2 seed cotton by Bayer Crop Science. Seed were sowed in the field on 20 April 2017. Plots consisted of two rows, 25 feet long with 40-inch row spacing, and were arranged in a randomized complete block design with five replications. One row of the plot was artificially inoculated with millet seed infested with *Rhizoctonia solani.* Blocks were separated by a 20-foot wide alley. All plots were maintained throughout the season with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Plant stand was determined at 18 and 35 days after planting (DAP) and vigor at 35 DAP. Plots were harvest on 29 September at 162 DAP. Data were analyzed in SAS 9.4 (SAS Institute, Cary, NC) using PROC GLIMMIX and LS-means were compared using the Tukey-Kramer method ($P \leq 0.1$). Monthly average maximum temperatures from planting in April through harvest in September were 79.2, 81.6, 86.5, 91.6, 88.5, and 83.1 ˚F with average minimum temperatures of 55.8, 59.5, 66.6, 71.0, 69.2, and 60.7 ˚F, respectively. Rainfall accumulation for each month was 3.35, 6.01, 6.27, 6.04, 2.38, and 3.82 inches with a total of 27.87 inches over the entire season.

Plant stands at 18 DAP were similar among all the treatments, regardless of inoculation. Gaucho-only insecticide seed treatment was the control treatment in this damping-off fungicide trial. Plant stands at 35 DAP were similar among all the treatments with the presence of the *Rhizoctonia,* but was lower ($P \leq 0.10$) with Gaucho-only seed treatment when non-inoculated. Vigor was similar among all treatments with inoculation of *Rhizoctonia*. The Gaucho-only seed treatment increased plant vigor when non-inoculated. The other four treatments increased cotton yields compared to the Gaucho-only treatment when inoculated; treatment 3 had an increased yield in non-inoculated plots. With the *Rhizoctonia* inoculation*,* treatment 5 provided a yield increase of 1789.9 lb/A compared to the Gaucho-only treatment. When non-inoculated*,* treatment 3 provided a yield increase of 1275.6 lb/A compared to the Gaucho-only treatment. Results suggest that seeds treated with different fungicide combinations increases the cotton yield.

Source of variation	D*f*	F value	Pr > F
Seed Treatment	4	3.49	0.0155
Rhizoctonia inoculation	1	112.95	<.0001
Seed treatment x *Rhizoctonia* inoculation	4	0.04	0.9961

		Rhizoctonia inoculation				Non-*Rhizoctonia*			
Trt	Seed treatment[z]	Stand (18 DAP)	Stand (35 DAP)	Vigor[y]	Yield (lb/A)[x]	Stand (18 DAP)	Stand (35 DAP)[x]	Vigor[x]	Yield (lb/A)[x]
1	Gaucho 600	2	2	3.0	598.8 b	25	21 b	5.0 a	3634.8 b
2	Gaucho 600 + Spera 240 FS + Proline 480 SC + Evergol Prime + Allegiance FL	7	9	2.6	2056.0 a	30	30 a	3.2 b	4695.0 ab
3	Gaucho 600 + Spera 240 FS + Proline 480 SC + Evergol Prime + Allegiance FL + Trilex Advanced FS300	13	12	2.8	2210.2 a	35	33 a	3.2 b	4910.4 a
4	Gaucho 600 + Spera 240 FS + Proline 480 SC + Evergol Prime + Allegiance FL + Evergol Energy	11	10	3.0	2024.4 a	33	30 a	3.6 b	4644.3 ab
5	Gaucho 600 + Spera 240 FS + Proline 480 SC + Evergol Prime + Allegiance FL + Evergol Xtend	12	13	2.6	2388.7 a	37	36 a	3.2 b	4767.8 ab
Tukey-Kramer's HSD		12.3	12.3	0.659	884.69	14.7	7.5	1.221	1196.55
Standard Deviation		7.2	7.2	0.387	519.93	8.6	4.4	0.718	703.21
CV		79.91	77.94	13.83	28.02	27.05	14.72	19.72	15.52

[z]All seed were treated with a base seed treatment of calcium carbonate, suspending agent, Color coat white, Pro-ized blue colorant and Secure plus seed gloss 661. Pesticide (application rates) used: Gaucho 600 (0.375 mg ai/seed), Spera 240 FS (120.6 ml/100 kg), Proline 480 SC (5.0 g ai/100 kg), Evergol Prime (5.0 g ai/100 kg), Allegiance FL (48.9 ml/100 kg), Trilex Advanced FS300 (104.32 ml/100 kg), Evergol Energy (65.2 ml/100 kg), and Evergol Xtend (65.2 ml/100 kg).

[y]Vigor ratings from 1 to 5, with 5 being the best and 1 the worst.

[x]Treatments followed by the same letter(s) within a column are not statistically different based on Tukey-Kramer's groupings ($P \leq 0.10$).

Develop Transgenic Cotton Varieties with Enhanced Resistance to Cotton Leaf Disease Using CRISPER-Cas9 System

Y. Wang, S. W. Park, C. Chen, S. Li, J. W. Kloepper, M. R. Liles, S. Dong, and J. Zhang

1. Accomplishments to date

1.1. Identify the gene clusters relevant to the cotton leaf curl disease (CLCuD)

The 70 kDa heat shock proteins (HSP70s) are a family of conserved molecular chaperones and folding catalysts, which express ubiquitously in almost all prokaryotic and eukaryotic cells [1]. HSP70s assist a wide range of protein folding and assembly processes, including folding and refolding of the native proteins and membrane translocation of proteins [2]. They also involve in folding the non-native proteins [3]. In studies of plant viral diseases, the HSP70 of the plant is proposed to be associated with interaction of capsid protein, replication and cell-to-cell movement and of many plant virus, particularly of geminiviruses [4, 5]. In plants which were infected with tomato yellow leaf curl virus (TYLCV), the downregulation of HSP70 has led to the reduction of viral load and viral movement [6]. In *Gossypium arboreum* with symptom of cotton leaf curl virus infection, the induction of many genes involved in protein processing in endoplasmic reticulum, including heat shock protein HSP70, played a role in interacting with cotton leaf curl virus (CLCuV) proteins and facilitating viral movement between plant cells [7]. Therefore, the downregulation of HSP70 in asymptomatic plants would have negative effects on viral movement proteins, and thus alleviate the CLCuV infection. To make *Gossypium hirsutum* less susceptible to cotton leaf curl virus disease (CLCuD), we decided to knock out HSP70 gene using CRISPR-Cas9 system.

1.2. Develop transgenic cotton varieties with enhanced resistance to CLCuD using the CRISPR-Cas9 system

a. Construct the CRISPR-Cas9 plasmid for knocking out HSP70 gene.

To achieve deletion of HSP70 in *G. hirsutum* using the CRISPR-Cas9 system, two plasmids (pCotton3 and pCotton4) were constructed. The plasmid HBT-pcoCas9 harboring the plant codon–optimized Cas9 gene driven by the hybrid constitutive 35SPPDK promoter was used as the backbone [8]. A 357 bp fragment containing the U6 polymerase III promoter and 20-nt sequence (5'-cggagatgcagcaaagaacc-3') targeting on HSP70 and another 171 bp fragment containing the 20-nt targeting sequence with the terminator were amplified from pUC119-gRNA with primer pairs of YW4059/YW4060, and YW4061/YW4062, respectively (**Error! Reference source not found.**, Lanes 1 and 2; Table 1). The two DNA fragments were inserted into the *Eco*RI site of HBT-pcoCas9 using Gibson Assembly. The positive plasmid was verified through colony PCR (cPCR) and named as pCotton3 (**Error! Reference source not found.**, Lane 4).

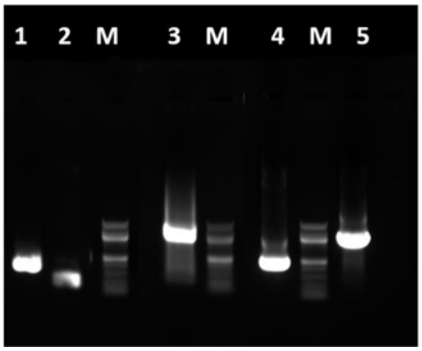

Fig. 1 The gel electrophoresis of the PCR products confirmed the successful construction of pCotton3 and pCotton4.

In plants, genetic mutations can be introduced through two ways, non-homologous end-joining (NHEJ) and homology directed repair (HDR) [9]. Higher repair efficiency was obtained by NHEJ than HDR in *Arabidopsis* [8]. pCotton3 was used for inducing mutations through NHEJ mechanism. To compare the editing efficiency between NHEJ and HDR in cotton, pCotton4 was also constructed with the insertion of homology arms. The upstream and downstream homology regions flanking the targeting sequence were amplified from gBlock, which was synthesized by integrated DNA Technologies (IDT, Coralville, IA). The 1,062 bp homology sequence was amplified with primer pairs of YW4063/YW4064 (**Error! Reference source not found.**, Lane 3; Table 1), and inserted into the *Pst*I site of pCotton3, generating pCotton4. This has also been further verified by colony PCR (**Error! Reference source not found.**, Lane 5).

Table 1. Primers used in this study

Primers	Sequence (5'-3')
YW4059	GATGATAAGCTGTCAAACATGAGAATTCAGAAATCTCAAAATTCCG
YW4060	AAAACggttctttgctgcatctccgAATCACTACTTCGTCTCTAACCATA
YW4061	TGATTcggagatgcagcaaagaaccGTTTTAGAGCTAGAAATAGCAAGTT
YW4062	GAAACAGCTATGACCATGATTACGAATTCTAATGCCAACTTTGTACA
YW4063	TGGACAGGCTAAGAAGAAGAAGTGACTGCAGGATTATTCATTTTCCTTTCTCCCGC
YW4064	CTTTATTGCCAAATGTTTGAACGATCTGCAGGTGTGTTTTATAGTTGCTGCAATCAT

b. Transform the constructed plasmids into cotton.

The developed CRISPR-Cas9 system was transformed into cotton through *Agrobacterium*-mediated transformation as described by Zhang [10]. Before co-culturing of cotton explants with

Agrobacterium, seed coats were manually removed. Then the seeds were sterilized and cultured for germination for 7-10 days under a '14-h day/10-h night' cycle at 28 ºC. After that, the cotyledons and hypocotyls were cut into small segments of 5-7 mm for co-culturing with *Agrobacterium*. While waiting for the seed germination, the plasmids pCotton3 and pCotton4 were respectively transformed into *Agrobacterium* EHA105 through electrophoresis (2,500 V, 400 Ω, 25 uF, within a 0.2 cm cuvette). Single colonies from Luria broth (LB) plates containing rifampicin and ampicillin were picked and cultivated in liquid medium for 24 h.

After cotyledons and hypocotyls were co-cultured with *Agrobacterium* for 10 min, the hypocotyl segment and the cotyledon disk were placed on a filter paper presoaked with the co-culturing medium, and incubated at 22 ºC for 48 h in the dark. Then they were transferred onto fresh medium containing antibiotics, to induce and select the callus. The callus will be further recovered and cultured to grow into plants. Then the genotype and CLCuD resistance of the plants will be characterized.

2. Plan for the next step

Now, we constructed the CRISPR-Cas9 plasmids for HSP70 knockout to enable high tolerance of the cotton to CLCuD. We also carried out the transformation with *Agrobacterium* to obtain the transgenic cell lines. For the next step, we will continue the work as proposed to recover the plants from transgenic cells and characterize the genotype of the transgenic plants. Furthermore, we will characterize the transgenic variety for their resistance to CLCuD.

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Effect of Micro-Climate Control on Target Spot in Cotton Using Cultural Management Practices

T. Cutts, T. Sandlin, and A. Hagan

Results:

Two tests were established in conjunction with one another at Gulf Coast Research and Extension Center to determine the aforementioned effects on cotton canopy micro-climate and target spot. Cultural practices evaluated included 1)PGR regimes 2) nitrogen management regimes 3) fungicide application. Plot treatments ranged from none of the above treatments to combinations of the above treatments at different rates and timings (table 1). This past season was especially challenging with respect to cotton production in the southern part of the state. Excessive rainfall lead to delayed planting, replanting, stunted vigor, and nitrogen loss. Both of these tests had little to no target spot present and in turn, cultural management practice effect on target spot was unattainable. Information was still obtained through one of these tests.

One of these two tests was originally planted on May 10 and then replanted directly into the same location and field using RTK on June 12. Deltapine 1646 B2XF was the variety planted. All nitrogen applications were made at planting on the original planting date. No additional nitrogen was applied at replanting as not to disrupt the current protocol. Nitrogen loss was expected and seemed apparent in the 0 lbs. N/AC and 80 lbs. N/AC plots. Seedcotton yields ranged from 2,236.5 to 3945.3 pounds per acre. All plots receiving the highest nitrogen treatment (160 lbs. N/AC) yielded greater in number than both the 0 lbs. N/AC and 80 lbs. N/AC treated plots. Also, the greatest numerical yield (3,945.3 pounds per acre) was obtained when an aggressive PGR regime was combined with 160 lbs. N/AC. Fungicide applications had no effect on yield in this test.

Although 160 lbs. N/AC would not be a normal recommendation with respect to cotton production, it proved to be substantial on these sandy soils given early season nitrogen losses. When this nitrogen rate was coupled with an aggressive PGR regime, plants were more compact and sunlight was likely maximized. This is worth noting in late replant situations on sandier soils where nitrogen loss can be prevalent.

Table 1: Treatment combinations of cultural management practices tested

Factor A (Plant Growth Regulator)					
1	PGR	NO PLANT GROWTH REGULATOR			
2	PGR	MEPIQUAT CHLORIDE	8	fl oz/a	1ST BLOOM
2	PGR	MEPIQUAT CHLORIDE	16	fl oz/a	1ST BLM+2WK
3	PGR	MEPIQUAT CHLORIDE	8	fl oz/a	PINHEAD SQRE
3	PGR	MEPIQUAT CHLORIDE	16	fl oz/a	1ST BLOOM
3	PGR	MEPIQUAT CHLORIDE	16	fl oz/a	1ST BLM+2WK
Factor B (Nitrogen Fertilizer)					
1	FERT	NO NITROGEN APPLICATION			
2	FERT	80 LBS N/AC			
3	FERT	160 LBS N/AC			
Factor C (Fungicide Applicaition)					
1	FUNG	NO PRIAXOR			
2	FUNG	PRIAXOR XEMIUM	4	fl oz/a	3RD WK BLOOM
2	FUNG	PRIAXOR XEMIUM	4	fl oz/a	5TH WK BLOOM

IV. Weed Management

Evaluate Cotton Responses and Weed Control of Gramoxone-Based Preplant Burndown Without PRE

S. Li

Objectives:

1. Evaluate cotton growth and yield responses to various preplant burndown treatments followed by early POST (EPOST) applied over the top of very young cotton seedlings.
2. Determine if full rates of residual herbicides applied very near planting may replace preemergence treatments to offer more management flexibility.

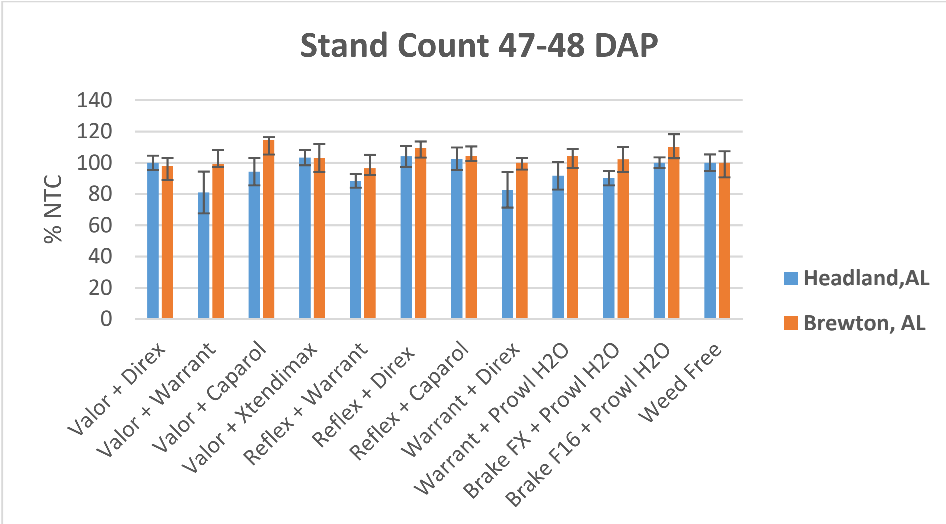
Procedures:

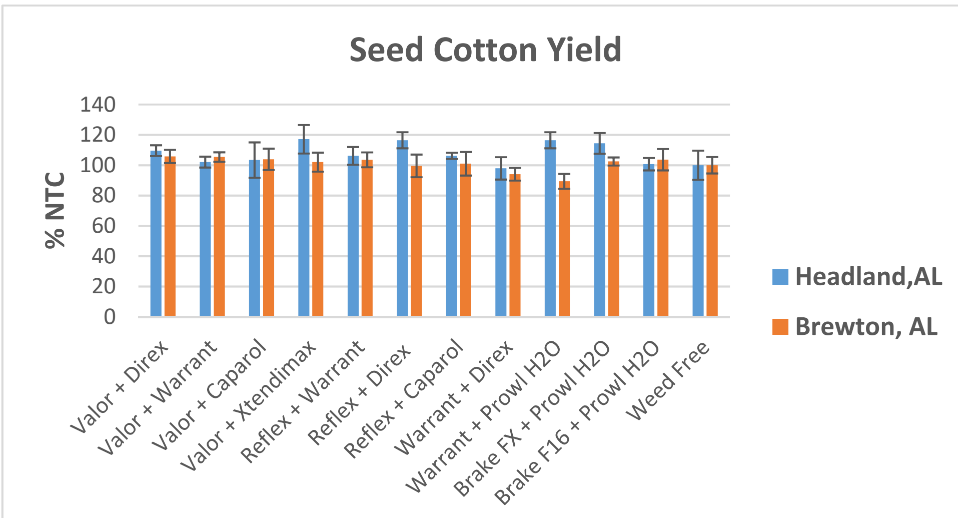
Field studies were conducted at Wiregrass REC at Headland and Brewton REC at Brewton AL in 2017. Herbicide treatments (Table 1) were applied with spray ATV and Teejet TT110025 nozzles at 20 GPA output. Then, herbicide residues were incorporated with a rototiller to 3 inches deep. These treatments were applied either 3 or 1 week before planting (WBP). Cotton variety used was DP1646 and was planted in early May. Gramoxone 32 oz/A + NIS 0.25% v/v was used in all treatments except for NTC. All plots remained weed free with multiple applications of Roundup + Dual Magnum. Data collection included stand count and seedling height at 3 and 7 weeks after planting, and final yield.

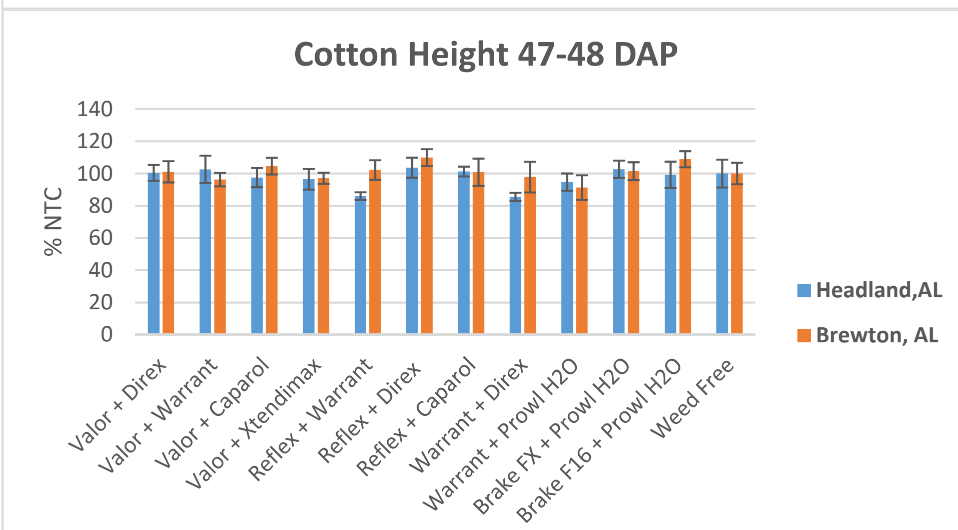
Table 1. Herbicide treatments

#	Preplant treatments	Rate	Timing
1	Valor + Direx 4L	2 oz + 3.2 pt/A	3 WBP
2	Valor + Warrant	2 oz + 3.2 pt/A	3 WBP
3	Valor + Caparol	2 oz + 4.5 pt/A	3 WBP
4	Valor + Xtendimax	2 oz + 44 oz /A	3 WBP
5	Reflex + Warrant	1 + 3.2 pt/A	1 WBP
6	Reflex + Direx 4L	1 + 1.6 pt/A	1 WBP
7	Reflex + Caparol	1 + 4.5 pt/A	1 WBP
8	Direx + Warrant	1.6 + 3.2 pt/A	1 WBP
9	Warrant + Prowl H2O	3.2 + 2 pt/A	1 WBP
10	Brake FX + Prowl H2O	2 + 2 pt/A	1 WBP
11	Brake F16 + Prowl H2O	1 + 2 pt/A	1 WBP
12	Weed-Free	-	1 WBP

Results and Findings:


Stand Count 47-48 DAP
% NTC
140
120
100
80
60
40
20
0
Valor + Direx
Valor + Warrant
Valor + Caparol
Valor + Xtendimax
Reflex + Warrant
Reflex + Direx
Reflex + Caparol
Warrant + Direx
Warrant + Prowl H2O
Brake FX + Prowl H2O
Brake F16 + Prowl H2O
Weed Free
Headland,AL
Brewton, AL


Seed Cotton Yield
% NTC
140
120
100
80
60
40
20
0
Valor + Direx
Valor + Warrant
Valor + Caparol
Valor + Xtendimax
Reflex + Warrant
Reflex + Direx
Reflex + Caparol
Warrant + Direx
Warrant + Prowl H2O
Brake FX + Prowl H2O
Brake F16 + Prowl H2O
Weed Free
Headland,AL
Brewton, AL


Cotton Height 47-48 DAP
% NTC
140
120
100
80
60
40
20
0
Valor + Direx
Valor + Warrant
Valor + Caparol
Valor + Xtendimax
Reflex + Warrant
Reflex + Direx
Reflex + Caparol
Warrant + Direx
Warrant + Prowl H2O
Brake FX + Prowl H2O
Brake F16 + Prowl H2O
Weed Free
Headland,AL
Brewton, AL

None of the treatments significantly reduced cotton stand and seedling height during the course of this study, although some of the means may be numerically lower than NTC but not statistically different. Cotton yield was not affected by any of the herbicide treatment at both locations. Results suggested these soil herbicide treatments applied at high label rates close to planting with Gramoxone did not cause negative impact on seedling establishment. Dual Magnum applied at 3 weeks after planting on small seedlings did not cause unacceptable seeding stunting and injury. Applying soil herbicide treatments prior to planting has shown potential to avoid crop injury, increase management flexibility and reduced dependence on rainfall for herbicide activation.

Cotton Variety Tolerance and Yield Response to Soil Herbicides Applied PRE Behind Planter

S. Li

Objectives:

1. Evaluate tolerance and yield responses of common cotton varieties to high rates of soil herbicide combinations.
2. Identify potential risk for Alabama cotton growers in term of cotton injury caused by nozzle overlapping, inaccurate application and miscalculation when spraying soil herbicides.

Procedures:

Three field studies were conducted at Plant Breeding Unit (PBU) at Tallassee, Wiregrass REC at Headland and Brewton REC at Brewton AL in 2017. Cotton varieties tested DP 1538 B2XF, DP 1646 B2XF, PHY 444 WRF, and PHY 490 W3FE. Planting dates were May 10, May 11 and May 30 for Wiregrass, Brewton and EV Smith REC. Field studies utilized randomized complete block design with 4 replications. Each plot was 2 row (6ft) by 25ft long. Herbicide treatments evaluated included:

#	Trade Name	Active Ingredient	RATE	FIELD RATE (PT/A)
1	Reflex + Warrant	Fomesafen + Acetochlor	1X	1 + 3.2
2	Reflex + Warrant	-	2X	2 + 6.4
3	Reflex + Direx	Fomesafen + Diuron	1X	1 +1.6
4	Reflex + Direx	-	2X	2 + 3.2
5	Reflex + Caparol	Fomesafen + Prometryn	1X	1 + 4
6	Reflex + Caparol	-	2X	2 + 8
7	Brake F16	Fomesafen + Fluridone	1X	1
8	Brake F16	-	2X	2
9	NTC			

Herbicide treatments were applied the same day of planting with a backpack sprayer equipped with Teejet TT110025 nozzles on a 4-nozzle boom calibrated at 20 GPA output. Conventional tillage was used at all locations. Plots remained weed free by using Roundup or Liberty + Dual Magnum POST. Data collected include stand counts, seedlings heights at 3 and 7 weeks after planting (WAP), seedling biomass at 3 WAP and yield at harvest. Data was analyzed using PROC GLIMMIX procedure in SAS 9.4 and means were separated with Fisher's protected LSD at p=0.05 level.

Results and Findings:

Stand reductions of 13-16% were observed in cotton treated with 2x rate of fomesafen + diuron and 1x rate of fomesafen + prometryn at Brewton and Tallassee at 3 WAP; however, those treated cotton recovered by 7 WAP. Height reductions of 24% were only observed in cotton treated with 2x rate of fomesafen + prometryn at 3 WAP at Tallassee; however, those cotton plants recovered by 7 WAP. No stand or height reduction was observed at Headland. Cotton seedling biomass (figure 1) and final yield (figure 2) was not affected by herbicide treatments at any location tested. No variety tested exhibited more sensitivity to these herbicide treatments than the others and data were combined across varieties. The results of this study indicated that incorporation of fomesafen based treatments into weed management programs may not significantly interfere with cotton development and yield.

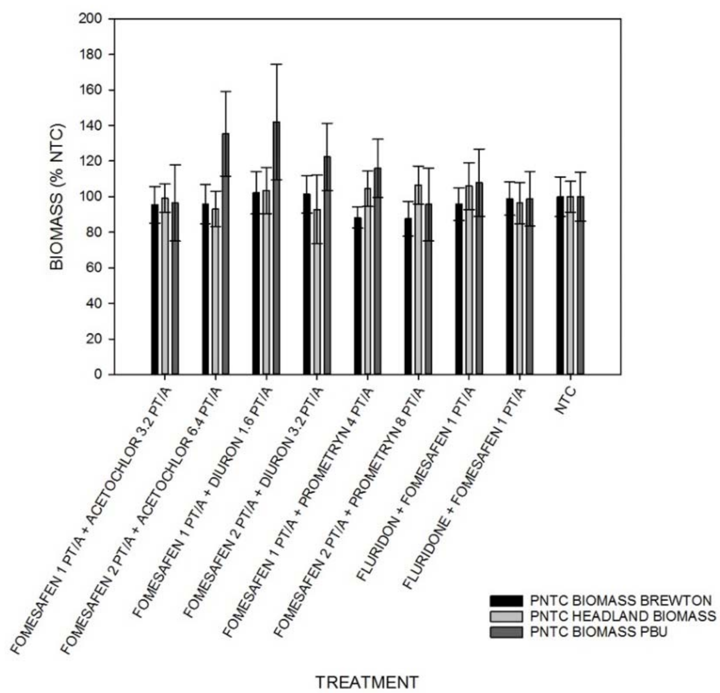


Figure 1: Cotton seedling biomass at 3 WAP. Data has been converted to % of NTC

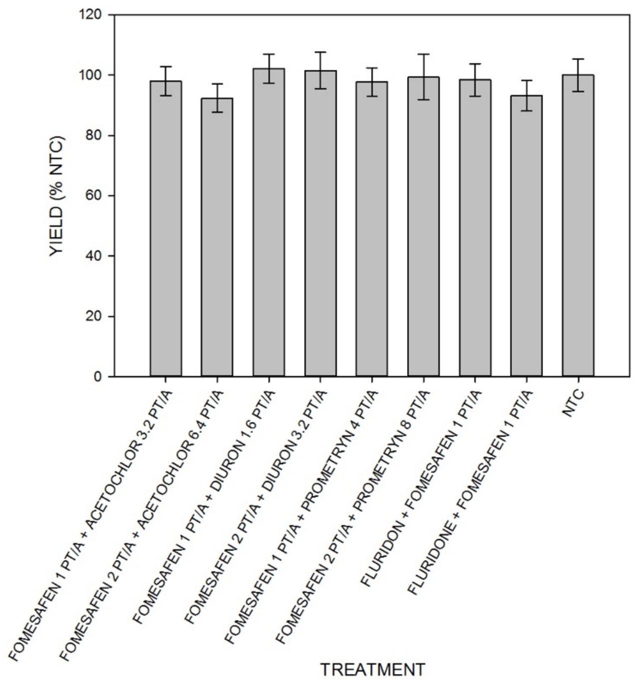


Figure 2: Cotton yield at harvest. Data was combined from 3 locations and converted to % of NTC

Incorporate Xtendimax and Enlist Duo into Current Weed Control Program in Alabama Cotton

S. Li

Objectives:

Evaluate if Xtendimax or Enlist Duo can be incorporate into current weed control system in cotton as standalone treatments.

Procedures:

This study was conducted at Wiregrass REC at Headland in June and July of 2017. No crop was planted and weeds in this study include natural populations of morningglory, FL beggarweed, sicklepod and grasses. The study area was thoroughly disked and weeds are allowed to germinate and establish. At the meantime, glyphosate and ALS-resistant pigweeds (Palmer amaranth), morningglory, sicklepod and coffeewed were planted into each plot in 5 rows in mid-late May. When average pigweed height reached 12-18 inch, herbicide treatments was applied as followed:

#	Initial treatment	Timing	Follow up treatment	Timing
1	Xtendimax 22 oz/A + Roundup PM 32 oz/A	June 15	Liberty 29 oz/A + Dual Magnum 22 oz/A	1 day after
2	Xtendimax 22 oz/A + Roundup PM 32 oz/A	June 15	Liberty 29 oz/A + Dual Magnum 22 oz/A	3 day after
3	Xtendimax 22 oz/A + Roundup PM 32 oz/A + Liberty 29 oz/A + Dual Magnum 22 oz/A	June 15	None	-
4	Xtendimax 22 oz/A + Roundup PM 32 oz/A	June 15	None	-
5	Enlist Duo 4.75 pt/A	June 15	Liberty 29 oz/A + Dual Magnum 22 oz/A	1 day after
6	Enlist Duo 4.75 pt/A	June 15	Liberty 29 oz/A + Dual Magnum 22 oz/A	1 day after
7	Enlist Duo 4.75 pt/A + Liberty 29 oz/A + Dual Magnum 22 oz/A	June 15	None	-
8	Enlist Duo 4.75 pt/A	June 15	None	-
9	Liberty 29 oz/A + Dual Magnum 22 oz/A	June 15	Xtendimax 22 oz/A + Roundup PM 32 oz/A	3 day after
10	Liberty 29 oz/A + Dual Magnum 22 oz/A	June 15	Enlist Duo 4.75 pt/A	3 day after
11	Liberty 29 oz/A + Dual Magnum 22 oz/A	June 15	None	-
12	2,4-DB 16 oz/A	June 15	Cobra 12.5 oz/A + Dual Magnum 22 oz/A	1 day after
13	2,4-DB 16 oz/A	June 15	Cobra 12.5 oz/A + Dual Magnum 22 oz/A	3 day after
14	2,4-DB 16 oz/A + Cobra 12.5 oz/A + Dual Magnum 22 oz/A	June 15	None	-
15	Cobra 12.5 oz/A + Dual Magnum 22 oz/A	June 15	None	-
16	NTC	-	-	-

Class act ridion 1% v/v and Intact 0.5% v/v were used as surfactant and drift reducing agent per label requirements. Treatments were applied with backpack sprayers at 20 GPA with Teejet TT110025 or TTI100025. Visual injury rating and pigweed height data were taken 2 and 4 weeks after initial treatment, and pigweed biomass were collected at 5 weeks after initial treatment. Data was analyzed in Proc Glimmix procedure in SAS 9.4 and means were separated by Fisher's protected LSD in SAS.

Results and Findings:

PALMER AMARANTH HEIGHT 2 AND 4 WAIT

TRT NO.	TRT NAME	HEIGHT AVERAGE 2 WAIT (%NTC)	HEIGHT AVERAGE 4 WAIT (%NTC)
1	DIC + GLY FB GLU + S-MET 1 DAIT	32.27 DE	25.87 F
2	DIC + GLY FB GLU + S-MET 3 DAIT	33.44 CDE	23.86 F
3	DIC + GLY + GLU + S-MET	25.71 DE	25.75 F
4	DIC + GLY	54.25 E	24.23 F
5	24D + GLY FB GLU + S-MET 1 DAIT	31.50 DE	17.31 F
6	24D + GLY FB GLU + S-MET 3 DAIT	25.62 DE	18.43 F
7	24D + GLY + GLU + S-MET	38.03 CDE	32.41 DEF
8	24D + GLY	32.53 CDE	32.97 DEF
9	GLU + S-MET FB DIC + GLY 3 DAIT	41.87 CDE	30.91 EF
10	GLU + S-MET FB 24D + GLY 3 DAIT	43.87 CD	32.70 DEF
11	GLU + S-MET	68.63 B	52.20 C
12	24DB FB LAC + S-MET 1 DAIT	41.61 CDE	57.58 BC
13	24DB FB LAC + S-MET 3 DAIT	39.93 CDE	46.21 CDE
14	24DB + LAC + S-MET	50.62 BC	74.34 CD
15	LAC + S-MET	63.35 B	70.07 B
16	NTC	100.00 A	100.00 A

[A]APPLICATION DATES: 26 JUNE, 27 JUNE, AND 29 JUNE 2017.
[B]HEIGHTS WERE RECORDED 10 JULY AND 25 JULY 2017. MEANS FOLLOWED BY THE SAME LETTER IN A COLUMN DO NOT DIFFER SIGNIFICANTLY BASED ON A MIXED MODEL ANALYSIS OF VARIANCE (P=0.05).
[C] ALL POST EMERGENT TREATMENTS INCLUDED 1% V/V CLASS ACT RIDION.
[D] PALMER AMARANTH IN NTC WAS 86 CM TALL AT 2 WAIT AND 116 CM AT 4 WAIT.

VISUAL INJURY RATINGS 4 WAIT

TRT NO.	TRT NAME	PALMER AMARANTH < 30 CM (% INJURY)	PALMER AMARANTH > 30 CM (% INJURY)	SICKLEPOD (% INJURY)	COFFEE WEED (% INJURY)	MORNING GLORY (% INJURY)
1	DIC + GLY FB GLU + S-MET 1 DAIT	57.50 AB	48.75 ABC	93.50 A	100.00 A	75.00 AB
2	DIC + GLY FB GLU + S-MET 3 DAIT	75.00 AB	68.75 A	45.00 BCDEF	100.00 A	72.50 ABC
3	DIC + GLY + GLU + S-MET	35.00 BCDE	55.00 AB	95.00 A	72.50 A	42.50 ABC
4	DIC + GLY	55.00 ABC	42.50 ABCD	87.50 A	100.00 A	76.25 ABC
5	24D + GLY FB GLU + S-MET 1 DAIT	63.75 AB	61.25 A	67.50 ABCD	75.00 A	77.50 ABC
6	24D + GLY FB GLU + S-MET 3 DAIT	72.50 AB	51.25 ABC	62.50 ABCDE	100.00 A	93.75 AB
7	24D + GLY + GLU + S-MET	40.00 ABCDE	51.25 ABC	68.75 ABC	100.00 A	47.50 ABCDE
8	24D + GLY	65.00 AB	27.50 BCDE	27.50 DEFG	77.50 A	32.50 CDE
9	GLU + S-MET FB DIC + GLY 3 DAIT	80.00 A	47.50 ABC	71.25 ABC	92.50 A	100.00 A
10	GLU + S-MET FB 24D + GLY 3 DAIT	42.50 ABCD	53.75 ABC	75.00 AB	75.00 A	57.50 ABCD
11	GLU + S-MET	41.25 ABCD	22.50 CDE	25.00 EFG	100.00 A	75.00 ABC
12	24DB FB LAC + S-MET 1 DAIT	2.50 DE	7.50 E	40.00 BCDEFG	25.00 B	60.00 ABC
13	24DB FB LAC + S-MET 3 DAIT	2.50 CDE	15.00 DE	15.00 FG	2.50 B	77.50 ABC
14	24DB + LAC + S-MET	2.50 DE	22.50 CDE	32.50 CDEFG	17.50 B	50.00 BCDE
15	LAC + S-MET	0.00 E	1.25 E	2.50 G	0.00 B	0.25 ED
16	NTC	0.00 E	0.00 E	0.00 G	0.00 B	0.00 E

[A]APPLICATION DATES: 26 JUNE, 27 JUNE, AND 29 JUNE 2017.
[B] INJURY RATINGS WERE RECORDED 25 JULY 2017.
[C] MEANS FOLLOWED BY THE SAME LETTER IN A COLUMN DO NOT DIFFER SIGNIFICANTLY BASED ON A MIXED MODEL ANALYSIS OF VARIANCE (P=0.05).
[D] INJURY RATING SCALE: 0% =NO VISUAL INJURY, 100% = DEAD.

PALMER AMARANTH FIELD BIOMASS 5 WAIT

TREATMENT NO.	TREATMENT NAME	WET BIOMASS (% NTC)
1	DIC + GLY FB GLU + S-MET 1 DAIT	49.87 CDEFG
2	DIC + GLY FB GLU + S-MET 3 DAIT	37.34 EFG
3	DIC + GLY + GLU + S-MET	28.32 FG
4	DIC + GLY	65.91 BCDEFG
5	24D + GLY FB GLU + S-MET 1 DAIT	15.03 G
6	24D + GLY FB GLU + S-MET 3 DAIT	23.55 FG
7	24D + GLY + GLU + S-MET	89.97 ABC
8	24D + GLY	87.47 ABCD
9	GLU + S-MET FB DIC + GLY 3 DAIT	32.33 FG
10	GLU + S-MET FB 24D + GLY 3 DAIT	46.61 CDEFG
11	GLU + S-MET	120.30 A
12	24DB FB LAC + S-MET 1 DAIT	46.11 DEFG
13	24DB FB LAC + S-MET 3 DAIT	33.08 FG
14	24DB + LAC + S-MET	38.59 EFG
15	LAC + S-MET	80.45 ABCDE
16	NTC	100.00 AB

[A]APPLICATION DATES: 26 JUNE, 27 JUNE, AND 29 JUNE 2017.
[B]BIOMASS WAS COLLECTED AND RECORDED 1 AUGUST 2017.
[C] MEANS FOLLOWED BY THE SAME LETTER IN A COLUMN DO NOT DIFFER SIGNIFICANTLY BASED ON A MIXED MODEL ANALYSIS OF VARIANCE (P=0.05).
[D] PALMER AMARANTH NTC BIOMASS AVERAGE WAS 9.04 KG.

All treatments reduced Palmer amaranth height as compared to NTC. Sequential applications with dicamba or 2,4-D applied first worked equivalent well as compared to the illegal four way mixes in terms of height reduction and visual injury. 2,4-DB followed by Cobra and Dual Magnum did not reduce more Palmer height than the three way tank mix. 2,4-DB and lactofen based treatment resulted much less visual injury on Palmer amaranth, sicklepod, coffeeweed and morningglory than dicamba and 2,4-D based programs, which indicates weed control can be conducted easier in resistant cotton varieties even when weed size is larger than ideal. In regards to Palmer amaranth biomass, applying 2,4-DB prior to Cobra + Dual Magnum did not improve control. Enlist Duo + Liberty + Dual Magnum produced more than 3 times of biomass than Enlist Duo fb Liberty + Dual Magnum. Sequential applications of dicamba and 2,4-D followed by Liberty + Dual magnum worked significantly better than Xtendimax + Roundup or Enlist Duo alone without the followup treatment. Results of this study indicated that Xtendimax + Roundup or Enlist Duo followed by Liberty + Dual Magnum were more effective than Xtendimax + Roundup or Enlist Duo applied without the follow up applications, and these two sequential application programs performed equivalently well or better than the illegal four way tank mixes that deliver the same amount of product at the same time.

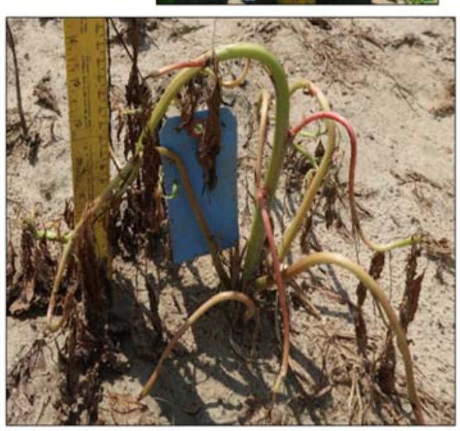
Enlist Duo (4.75 pt/a) followed by Liberty (29 oz/a) + Dual Magnum (22 oz/a) 3 days after initial application

Day of initial application (June 15 2017)

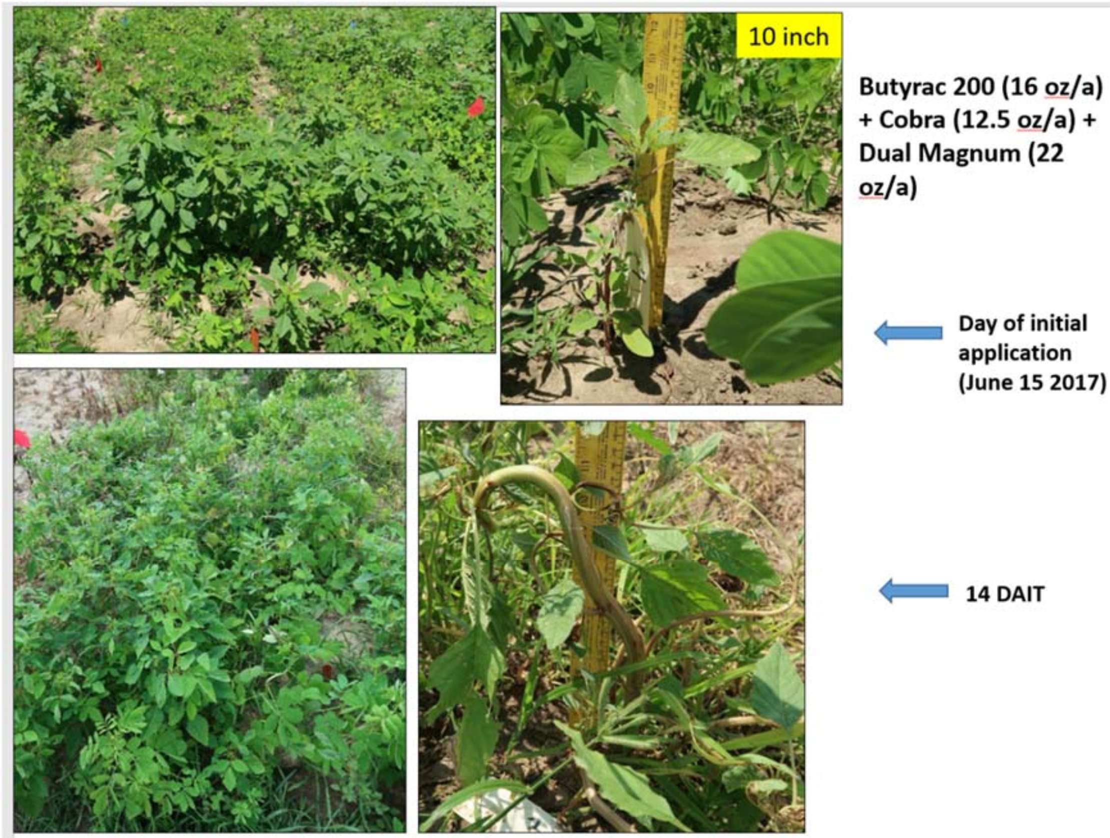
14 DAIT

Xtendimax (22oz/a) + Roundup Powermax (32 oz/a) followed by Liberty (29 oz/a) + Dual Magnum (22 oz/a) 3 days after initial treatment

Day of initial application (June 15 2017)



14 DAIT


10 inch
Butyrac 200 (16 oz/a) + Cobra (12.5 oz/a) + Dual Magnum (22 oz/a)
Day of initial application (June 15 2017)
14 DAIT

Evaluating High Residue Cover Crop Mixtures for Glyphosate Resistant Weed Suppression Compared to High Residue Monoculture Cover Crop and Winter Fallow Conservation - Tillage Cotton Systems

A. Price, K. Balkcom, T. Cutts, and S. Li

Location: E.V. Smith Research and Extension Center, Shorter, AL.

Objectives: To reduce weed competition, herbicide resistant selection pressure, and subsequent yield loss utilizing integrated weed management practices.

Justification: Control of troublesome weeds has been increasingly challenging, mostly due to glyphosate-resistant horseweed and Palmer amaranth found throughout Alabama. Palmer amaranth is highly competitive and can decrease cotton lint yield 50% with one Palmer amaranth plant per meter row, a density easily attained when control is lost. Heavy infestations of resistant weeds in conservation-tillage cotton have challenged current chemical weed control and producers have increasingly utilized tillage for weed control. Previous research has shown increased weed suppression can be achieved through the use of high residue cover crops managed for maximum biomass. We hypothesize that the utilization of cover crop mixtures, and placement of different cover crop species within the row and row middle, will provide effective weed control and protect conservation tillage as a viable option for cotton producers.

Report: Two studies evaluated high residue cover crop mixtures and placement in conservation agriculture cotton systems. Cereal rye, crimson clover, and radish placement was planted either between row (cereal rye) or within row (clover and radish), or broadcast as a mixture, or each planted as a monoculture, compared to winter fallow. In a separate study, the same cover crops was compared planted broadcast in mixture or monoculture and followed with different herbicide program components. Evaluations included weed biomass and population counts, weed control, % ground cover, and crop response reflected in stand establishment, crop height and yield. Only yield is reported in the following tables. Other factors are currently being analyzed to be presented at the Beltwide Cotton Conference annual meeting, and will be reported and summarized at the Alabama Cotton Commission at the reports meeting.

Table 1. Agronomic Effects from Cover Crop Mixtures and Herbicide Timing to Cotton – E.V. Smith 2017

	Agronomics	
Cover Crop Treatment	**Cotton Population (plants/Ha)**	**Seed Cotton Yield (kg/Ha)**
Winter Fallow[1]		2097[a]
Rye[2]		1559[a]
Mixture[3]		1821[a]
LSD (α = 0.10)		443.47
Herbicide Treatment		
Non-treated[4]		463[b]
A[5]		2148[a]
B[6]		2058[a]
A + B		2635[a]
LSD (α = 0.10)		512.07

[1]Plots were left fallow throughout the winter, no cover crop was planted.
[2]Rye (Wrens Abruzzi) was drilled in the fall of 2016 at 90 lbs/A.
[3]Rye (Wrens Abruzzi) – 15lbs/A; Wheat (Pioneer 26R61) – 15 lbs/A; Oats (Coker 227) – 15 lbs/A; Crimson Clover (Dixie) – 10 lbs/A; Radish (Daikon) – 4 lbs/A were drilled in the fall of 2016. Cereals were mixed at a 1:1:1 ratio (total = 45 lbs/A) and Legumes + Brassicas were mixed at a 2.5:1 ratio (total = 14 lbs/A).
[4]No herbicide was applied.
[5]Prowl H_2O (2 pt/A) + Reflex (1 pt/A) was applied pre-emergence (at planting).
[6]Engenia (12.8 fl oz/A) + Roundup Powermax (24 fl oz/A) was applied post-emergence at the 4-leaf growth stage of cotton.
[*]LS-Means with the same letter are not significantly different. [**]Proc glimmix was used in SAS for all statistical analysis.

Table 2. Agronomic Effects from Cover Crop Mixes and Drill Seed Placement in Cotton – E.V. Smith 2017

	Agronomics	
Cover Crop Treatment	Cotton Population (plants/Ha)	Seed Cotton Yield (kg/Ha)
Winter Fallow[1]		3205[a]
A[2]		3437[a]
B[3]		3527[a]
C[4]		3600[a]
D[5]		3437[a]
E[6]		3238[a]
F[7]		3405[a]
LSD (α = 0.10)		360.77

[1]Plots were left fallow throughout the winter, no cover crop planted.
[2]Rye (Wrens Abruzzi) – 90 lbs/A was drilled into the whole plot in the fall of 2016.
[3]Crimson Clover (Dixie) – 20 lbs/A + Radish (Daikon) – 8 lbs/A were drilled into the whole plot in the fall of 2016. Legumes and brassicas were mixed at a 2.5:1 ratio.
[4]Rye (Wrens Abruzzi) – 45 lbs/A + Crimson Clover (Dixie) – 10 lbs/A + Radish (Daikon) – 4 lbs/A were drilled into the whole plot in the fall of 2016. Legumes and brassicas were mixed at a 2.5:1 ratio.
[5]Rye (Wrens Abruzzi) – 90 lbs/A was drilled into the row middles only in the fall of 2016.
[6]Crimson Clover (Dixie) – 20 lbs/A + Radish (Daikon) – 8 lbs/A were drilled into the rows only in the fall of 2016. Legumes and brassicas were mixed at a 2.5:1 ratio.
[7]Rye (Wrens Abruzzi) – 45 lbs/A was drilled into the row middles; and Crimson Clover (Dixie) – 10 lbs/A + Radish (Daikon) – 4 lbs/A were drilled into the rows in the fall of 2016. Legumes and brassicas were mixed at a 2.5:1 ratio.
[*]LS-Means with the same letter are not significantly different. [**]Proc glimmix was used in SAS for all statistical analysis.

Table 3. Agronomic Effects from Cover Crop Mixtures and Herbicide Timing to Cotton – E.V. Smith 2017

	Agronomics					
	Winter Fallow[1]		**Rye[2]**		**Mixture[3]**	
Herbicide Treatment	Cotton Population (plants/Ha)	Seed Cotton Yield (kg/Ha)	Cotton Population (plants/Ha)	Seed cotton Yield (kg/Ha)	Cotton Population (plants/Ha)	Seed Cotton Yield (kg/Ha)
Non-treated[4]		656[bdc]		261[d]		473[dc]
A[5]		2277[ba]		2045[bac]		2122[bac]
B[6]		2317[ba]		1723[bdac]		2134[bac]
A + B		3140[a]		2207[ba]		2558[a]
LSD (α = 0.10)		886.95		886.95		886.95

[1]Plots were left fallow throughout the winter, no cover crop was planted.
[2]Rye (Wrens Abruzzi) was drilled in the fall of 2016 at 90 lbs/A.
[3]Rye (Wrens Abruzzi) – 15lbs/A; Wheat (Pioneer 26R61) – 15 lbs/A; Oats (Coker) – 15 lbs/A; Crimson Clover (Dixie) – 10 lbs/A; Radish (Daikon) – 4 lbs/A were drilled in the fall of 2016. Cereals were mixed at a 1:1:1 ratio (total = 45 lbs/A) and Legumes + Brassicas were mixed at a 2.5:1 ratio (total = 14 lbs/A).
[4]No herbicide was applied.
[5]Prowl H_2O (2 pt/A) + Reflex (1 pt/A) was applied pre-emergence (at planting).
[6]Engenia (12.8 fl oz/A) + Roundup Powermax (24 fl oz/A) was applied post-emergence at the 4-leaf growth stage of cotton.
[*]LS-Means with the same letter are not significantly different. [**]Proc glimmix was used in SAS for all statistical analysis.

Evaluation of Enlist Technology for Herbicide Resistant Pigweed

J. T. Ducar, A. Price, and S. Li

OBJECTIVES:

In a grower survey conducted last year, we determined that 65 out of 67 counties in Alabama had glyphosate resistant pigweed. In a separate grower survey in 2014, of the 29 growers surveyed, 45% have one glyphosate resistant weed, 14% have two resistant weeds, 10% have three resistant weeds, and 14% have four or more resistant weeds. Twenty-two percent of the crop acres in Alabama are infested with GR pigweed. Therefore, GR pigweed is a problem in Alabama that is only increasing in our state and is becoming an economically challenging problem. Enlist cotton is a new technology which will enable growers to spray the newly formulated, lower volatile 2,4-D choline over the top of cotton. It has been deregulated in our state. It will provide an alternative herbicide system using Enlist technology to control glyphosate-resistant pigweed.

PROCEDURES:

Field Study:

The study was conducted at the Tennessee Valley REC in Belle Mina, AL and the Field Crops Unit at E.V. Smith in Shorter, AL that have high populations of glyphosate resistant Palmer amaranth. A randomized complete block study with four replications will be used. A systems approach will be evaluated with the Enlist systems. The treatments are listed in the table below. Herbicides will be sprayed at 15 gallons per acre and plot size will be 13 by 25 feet. Weed control will be evaluated at 7, 14, 28 days after 8-leaf timing and at the end of the study to evaluate any pigweed regrowth that may occur. Yields will be taken.

1. Untreated
2. Cotoran – 32 fl. oz./A PRE
3. Cotoran – 32 fl. oz./A PRE
Roundup WeatherMax 28.4 fl. oz/A 2-4 inch weeds
Roundup WeatherMax 28.4 fl. oz/A 14-21 days after B application
4. Cotoran – 32 fl. oz./A PRE
Enlist Duo – 75 fl. oz./A 2-4 inch weeds
Liberty – 29 fl. oz/A 14-21 days after B application
2,4-D choline salt – 32 fl. oz./A 14 -21 days after B application
Dual Magnum – 16 fl. oz./A 14 – 21 days after B application
5. Cotoran – 32 fl. oz./A PRE
2,4-D choline salt – 32 fl. oz./A 2-4 inch weeds
Dual Magnum – 16 fl. oz./A 2-4 inch weeds
Liberty – 29 fl. oz/A 2-4 inch weeds

Enlist Duo – 75 fl. oz./A 14-21 days after B application

6. Cotoran – 32 fl. oz./A PRE
   Dual Magnum – 16 fl. oz./A 2-4 inch weeds
   Liberty – 29 fl. oz/A 2-4 inch weeds
   Liberty – 29 fl. oz/A 14-21 days after B application
   Roundup WeatherMax 28.4 fl. oz/A 14-21 days after B application
7. Cotoran – 32 fl. oz./A PRE
   Enlist Duo – 75 fl. oz./A 2-4 inch weeds
   Dual Magnum – 16 fl. oz./A 14-21 days after B application
   Liberty – 29 fl. oz/A 14-21 days after B application
8. Cotoran – 32 fl. oz./A PRE
   Dual Magnum – 16 fl. oz./A 2-4 inch weeds
   Liberty – 29 fl. oz/A 2-4 inch weeds
   Enlist Duo – 75 fl. oz./A 14-21 days after B application

Results:

Treatments receiving only a PRE of Cotoran or Cotoran plus Roundup WeatherMax did not control Palmer amaranth. By mid-season ratings, they were comparable to the untreated check. Treatments receiving Enlist Duo or 2,4-D Choline Salt controlled Palmer amaranth 90% or greater. Liberty containing treatments controlled Palmer amaranth throughout mid-season but by the end of the season, another flush of Palmer amaranth had broken through. Our research findings were that Enlist Duo or 2,4-D Choline Salt were effective when used with a residual herbicide for Palmer amaranth control.

Evaluation of Liberty + Dual Magnum in Liberty Link, Extend, and Wide Strike Cotton

J. T. Ducar and A. Price

OBJECTIVES:

All major cotton genetics have the ability to use Liberty on them including Dicamba tolerant cotton and Enlist varieties. However, varying degrees of crop response have been observed depending on rate, timing, environmental conditions, nozzle type, and tank-mix partners. Specifically, chloroacetamide's such as Dual Magnum, are used in conjunction with Liberty to provide grass and small-seeded broadleaf control. The objective of this test is to determine the degree of crop injury, how it affects maturity, and lint yield.

PROCEDURES:

Field Study:

The study was conducted at the Prattville Research Station in Prattville, AL. A randomized complete block study with a factorial treatment arrangement with four replications was utilized as the study design. The study had 12 treatments listed below. Three cotton cultivars were planted on May 9, 2016 and May 15, 2017 into a stale seedbed at a rate of 3-4 seed per ft row. Plot size was four 13 by 25 ft plots. Herbicide treatments were applied using a CO_2- pressurized backpack sprayer with 4 nozzles calibrated to deliver 15 gpa. Three varieties of cotton with varying herbicide resistance traits were planted in both years. Varieties planted were Stoneville 4848[1], a LibertyLink variety; Phytogen 333[2], a Widestrike variety; and Americot ng3406[3], a dicamba tolerant variety. Herbicide treatments consisted of either Liberty applied alone at 29 fl. oz./acre or Liberty applied at 29 fl. oz/acre in combination with Dual Magnum applied at 1 pt/acre. Two nozzles types were used for herbicide application, a 110015 Turbo TeeJet Induction nozzle and an 110015 XR TeeJet extended range flat spray tips. The same treatments were applied to cotton at 4-leaf and 8-leaf growth stages. The center two rows of each four-row plot were harvested using a spindle picker modified for small-plot harvesting. Visual assessments of cotton injury were taken at 7, 14, and 21 days after the first treatment timing and at 7, 14, 21 and 42 days after the second application timing. Cotton was mapped the first year with no differences detected so no mapping was conducted the second year. The study was kept weed-free by hand pulling and hoeing.

Treatments	Nozzle	Stage	Variety
1 Liberty 29 oz/A	Flat Fan	up to 4 lf (<4" weeds)	Liberty Link
1 Liberty 29 oz/A		8 lf cotton	
2 Liberty 29 oz/A	Flat Fan	up to 4 lf (<4" weeds)	Liberty Link
2 Dual 1.33 pt/A			
2 Liberty 29 oz/A		8 lf cotton	
2 Dual 1.33 pt/A			
3 Liberty 29 oz/A	TTI	up to 4 lf (<4" weeds)	Liberty Link
3 Liberty 29 oz/A		8 lf cotton	
4 Liberty 29 oz/A	TTI	up to 4 lf (<4" weeds)	Liberty Link
4 Dual 1.33 pt/A			
4 Liberty 29 oz/A		8 lf cotton	
4 Dual 1.33 pt/A			
5 Liberty 29 oz/A	Flat Fan	up to 4 lf (<4" weeds)	Wide Strike
5 Liberty 29 oz/A		8 lf cotton	
6 Liberty 29 oz/A	Flat Fan	up to 4 lf (<4" weeds)	Wide Strike
6 Dual 1.33 pt/A			
6 Liberty 29 oz/A		8 lf cotton	
6 Dual 1.33 pt/A			
7 Liberty 29 oz/A	TTI	up to 4 lf (<4" weeds)	Wide Strike
7 Liberty 29 oz/A		8 lf cotton	
8 Liberty 29 oz/A	TTI	up to 4 lf (<4" weeds)	Wide Strike
8 Dual 1.33 pt/A			
8 Liberty 29 oz/A		8 lf cotton	
8 Dual 1.33 pt/A			
9 Liberty 29 oz/A	Flat Fan	up to 4 lf (<4" weeds)	DT Cotton
9 Liberty 36 oz/A		8 lf cotton	
10 Liberty 29 oz/A	Flat Fan	up to 4 lf (<4" weeds)	DT Cotton
10 Dual 1.33 pt/A			
10 Liberty 29 oz/A		8 lf cotton	
10 Dual 1.33 pt/A			
11 Liberty 29 oz/A	TTI	up to 4 lf (<4" weeds)	DT Cotton
11 Liberty 29 oz/A		8 lf cotton	
12 Liberty 29 oz/A	TTI	up to 4 lf (<4" weeds)	DT Cotton
12 Dual 1.33 pt/A			
12 Liberty 29 oz/A		8 lf cotton	
12 Dual 1.33 pt/A			

Results:

Herbicide injury was higher, on average, for all treatments on WideStrike cotton varieties regardless of the herbicide treatment. However, injury had decreased to less than 5% by 21 days after treatment. Injury ratings were also higher, on average, for treatments applied with TTI nozzles regardless of cotton variety. Injury ratings tended to be higher for the combination treatment of Dual Magnum plus Liberty however, there were no differences in cotton yield and no correlation between herbicide induced injury and cotton yield. This research is important as dicamba cotton becomes more widely utilized and as nozzles such as TTI with coarser droplet sizes become standard for applications with dicamba and 2,4-D based technology.

V. Insect Management

State Pheromone Trapping Program for Cotton Bollworm, Tobacco Budworm, Fall Armyworm, and *Heliothis armigera* (The Old World Bollworm)

T. Reed, A. Jacobson, and R. Smith

Study Protocol: A statewide pheromone trapping program was conducted in 2017 to assess the moth activity level for 4 species of lepidoptera which can be pests of cotton. Species monitored were cotton bollworm (CBW), tobacco budworm (TBW), fall armyworm (FAW) and the potentially invasive species *Heliothis armigera (HA)*. All moths collected in HA traps were tested using a DNA based technique to confirm the species present. The trapping program was conducted from the 2ndrd week of June through the 2nd week of September for all species except HA which was trapped through October. CBW traps were monitored in Henry, Escambia, Baldwin, Elmore, Autauga and Limestone counties. TBW traps were monitored in Henry, Elmore, Autauga and Limestone counties. FAW traps were monitored in Baldwin, Lawrence and Limestone counties. HA pheromone was placed in traps in Baldwin, Escambia and Henry counties. **Results**: **Cotton bollworm**--Numbers of cotton bollworm (CBW) moths remained below 10 per week at the Henry county site and never exceeded 40 per week at the Escambia county site. (Figures 1 and 2 below). CBW moth trap catches were highest at the Elmore and Baldwin county sites. CBW moth trap catch numbers first exceeded 200 /week during the 2nd week of July in Elmore county and peaked at 403 moths during the 1st week of August. The CBW moth trap catch at the Baldwin county site jumped the 4th week of July to 198 and peaked at 549 during the 2nd week of August. The Autauga and Limestone county CBW trap catch numbers jumped the 1st week of August . CBW larvae numbers in cotton at the Prattville and Belle Mina stations were very low. CBW larvae were first treated in cotton within a 25 mile radius of the Limestone county trap at Belle Mina during the 2nd week in July and treatments continued into August as both Bollgard 2 and Widestrike cotton varieties failed to deliver acceptable control.. During the 4th week of June the CBW trap catch increased to 42 at the Limestone county site compared to 27 the previous week.

Tobacco budworm (TBW): Numbers of tobacco budworm moths trapped were highest at the Henry county site.(Figures 3 and 4) Numbers of TBW moths jumped the 2nd week of July and remained above 150 moths / week through the rest of July. Numbers were much lower for the next two weeks and then peaked for the year at 380 the 3rd week of August. Numbers of trapped TBW moths peaked at the 3 other trapping sites as follows: Elmore county-- the 4th week in July at 78, Autauga county –the 4th week of June at 72 and Limestone county the 1st week of August at 133. No economic infestations of tobacco budworm larvae were confirmed in any row crop in 2017. TBW larvae numbers were very low also in an experimental trap crop planting of tobacco at the Henry county trapping site at the Wiregrass station.

Fall armyworm: Numbers of FAW moths trapped at the Baldwin, Lawrence and Limestone county sites never exceeded 10 per week and were frequently 0.

Heliothis armigera: A total of 1908 moths were trapped at the 3 Heliothis armigera trapping sites in south Alabama. None of the moths tested were found to be H. armigera. Cotton bollworm moths are attracted by the Heliothis armigera pheromone and all the moths that were tested were CBW moths.

(See Pheromone Trap Catch Numbers for CBW and TBW in Figures 1- 4 Below0

Figure 1. Cotton Bollworm Moths per Trap by Location, 2017

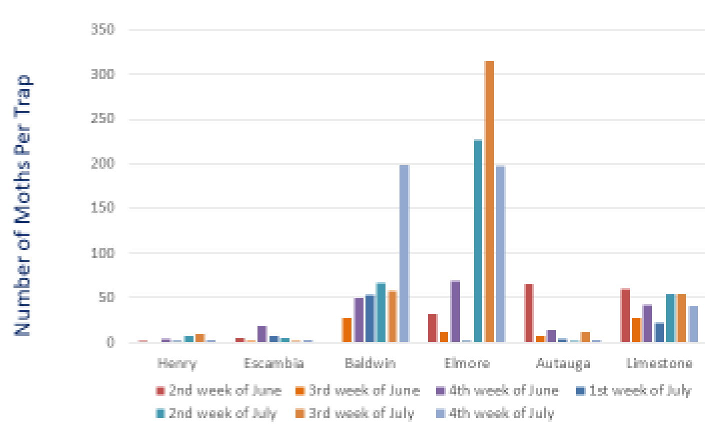


Figure 2 .Cotton Bollworm Moths per Trap by Location, 2017

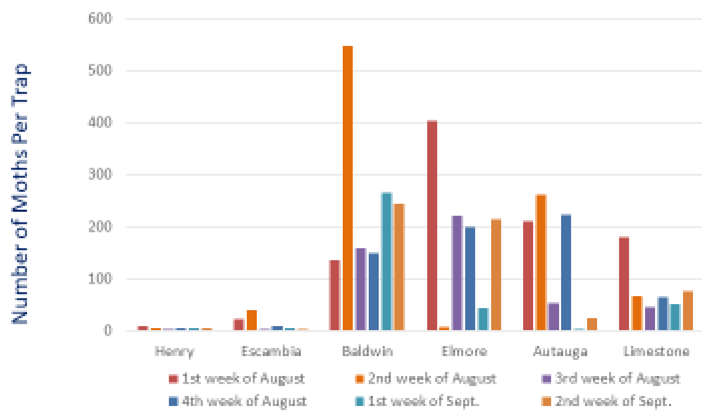


Figure 3. Tobacco Budworm Moths per Trap by Location, 2017

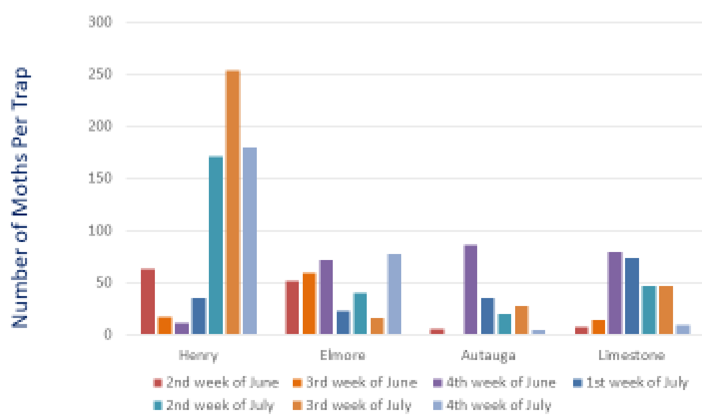
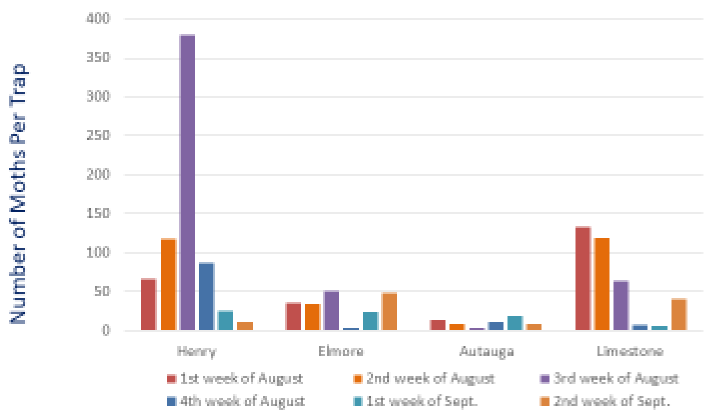


Figure 4. Tobacco Budworm Moths per Trap by Location, 2017



Determining Which Insecticide Provides the Most Cost – Effective Control of Plant Bugs Infesting Cotton

T. Reed and R. Smith

This study was conducted at the Tennessee Valley Research and Extension Center at Belle Mina and the E.V. Smith Research and Extension Center at Shorter.. Plots at Belle Mina were planted May 15 using the variety ST 4747 GLB2. Plots were 8 rows wide and 25 feet long with a 38 inch row spacing. Treatments were arranged in a RCB design with 4 replications of each treatment at both locations.. Insecticide treatments and rates for the two studies are shown in Tables 1 and 2. Treatments at Belle Mina were applied August 4 using TX6 conejet nozzles that delivered a spray volume of 10 gallons per acre. Tarnished plant bugs (TPB's) at Belle Mina were sampled at 4 and 13 days after application by placing a 3 foot long drop cloth between two rows and shaking both rows vigorously. Two drop cloth samples were taken in each plot (total of 12 row feet)..Plots at Shorter were planted April 18 using the variety DPL 1646. Plots at Shorter were sprayed using Greenleaf TDXL 1102 nozzlest hat delivered 14.7 gallons of spray per acre using 40 psi. Plots were sampled on 5 different dates using the same sampling method used at Belle Mina. Square retention rates were also determined at Shorter

Results: Belle Mina-Total numbers of TPB's per 12 row feet and seed cotton yields at Belle Mina are presented in Table 1. There was a significant treatment effect with respect to the total number of plant bugs sampled at 4DAA and 13 DAA. The untreated plots had significantly more TPB's than all the insecticide treatments at 4 DAA. The Orthene , Orthene +Brigade, Transform and Bidrin treatments had significantly fewer TPB's at 4 DAA than the Diamond and Brigade treatments. The TPB's sampled in all plots at 4 DAA consisted of 3.6% adults, 55.1% large immatures and 41.3% small immatures. The total number of plant bugs sampled at 13 DAA was significantly greater in the Brigade-treated and untreated plots than in the other insecticide-treated plots. The total number of TPB's in the Centric-treated plots was significantly less than in the Brigade –treated and untreated plots but significantly greater than in all the other treatments. The TPB's sampled in all plots at 13 DAA consisted of 6.3% adults, 22.4% large immatures and 71.3% small immatures. There was not a significant treatment effect with respect to seed cotton yields at the 90% level of confidence (P>F=0.1174). Costs of the treatments applied ranged from \$3.20 to \$11.25/acre.

Table 1. Number of plant bugs recovered per 12 row feet and yields following one application of different insecticides. Belle Mina, AL, 2017

Trt #	Treatment Insecticide	Rate of Product Per Acre	Plant bugs/ 12 row feet 4DAA	13DAA	Pounds seed cotton/acre	Price/Acre For Trt
1	Orthene 97	0.55 lb	2.3	15.3	4567	$3.30
2	Orthene 97 + Brigade 2 EC	0.55 lb 6.4 oz	4.8	13.0	4843	$7.05
3	Bidrin 8 EC	3.2 oz	6.0	15.3	4817	$3.20
4	Diamond 0.83 EC	6.0 oz	13.5	11.0	4867	$9.00
5	Transform 50 WG	1.5 oz	6.0	7.8	4829	$11.25
6	Centric 40 WG	2.0 oz	11.0	23.0	4581	$6.50
7	Brigade 2 EC	6.4 oz	14.5	34.5	4694	$3.75
8	Untreated	---	26.8	31.5	4356	-----------

P>F = 0.0000 0.0000 0.1174

LSD 0.1 = 5.5 6.8

Results: Shorter- Plant bug counts and square retention rates at Shorter are presented in Tables 2 and 3. Numbers of adult plant bugs recovered in samples at Shorter were extremely low and only numbers of immature plant bugs are presented. Numbers of plant bug immatures were significantly greater in untreated plots than in insecticide-treated plots on all 5 sampling dates. Numbers of plant bug immatures in the2 insecticide treatments were not significantly different. Square retention rates did not drop below 91% in the untreated plots. Square retention rates were significantly greater in the two insecticide treatments than in untreated plots at 10 and 16 days after application. Yields were not taken due to significant variability in plant height across plots due in part to soil variability.

Table 2. Number of plant bugs recovered per 12 row feet following one application of two insecticide treatments to cotton. Shorter, AL, 2017

Treatment	Rate of Product Per Acre	Number of plant bug nymphs per 12 row feet 3 DAA	7 DAA	10 DAA	16 DAA	23 DAA
1. Untreated	---	6.9	9.9	8.4	8.1	6.6
2. Orthene 97 + Brigade 2 EC	0.75 oz 6.4 oz	1.5	0.0	1.8	2.1	1.8
3. Transform 50 WG	2 oz	0.6	1.8	1.8	1.8	1.5
	P>F	0.0065	0.0025	0.0004	0.0206	0.036
	LSD 0.1	2.6	3.31	1.92	3.46	3.19

Table 3. Percent square retention following one application of two plant bug insecticide treatments to cotton. Shorter, AL, 2017

Treatment	Rate of Product Per Acre	Percent Square Retention				
		3 *DAA	7 DAA	10 DAA	16 DAA	23 DAA
1. Untreated	---	92.5	93.8	91.3	91.3	93.8
2. Orthene 97 + Brigade 2 EC	0.75 oz 6.4 oz	95.0	96.3	97.5	100.0	98.8
3. Transform 50 WG	2 oz	96.3	97.5	100.0	96.5	95.0
	P>F	0.42	0.477	0.078	0.024	0.481
	LSD 0.1	-	-	0.16	4.43	-

*DAA= Days after application

Validation of a Thrips Infestation and Injury Model for Seedling Cotton in South Alabama

R. Smith and T. Reed

The objective of this study was to assess the accuracy of the NCSU cotton thrips damage risk model in south Alabama and confirm the value of the model to south Alabama growers in helping them make optimum thrips management input decisions prior to and after planting. The study was conducted at the Brewton and Fairhope Agricultural Research Units. Cotton was planted on 6 and 4 dates at the Brewton and Fairhope Stations, respectively. Planting dates for both locations are presented in Tables 1 and 2. At each planting date, 4 replicates of 2 row plots were planted using Avicta + Gaucho treated seed vs. untreated seed at Brewton and Avicta treated seed vs. untreated seed at Fairhope. Thrips damage ratings (0-5) scale were made on multiple dates. **Results:** Thrips damage ratings for different planting dates at the Brewton and Fairhope stations are presented in Tables 1 and 2. Damage ratings at both locations were lower for the plots planted with insecticide-treated seed than with untreated seed for each sampling date. There was a trend toward reduced levels of thrips damage as planting dates became later and this was in agreement with the predictive model for both locations.

Table 1. Thrips damage ratings to seedling cotton leaves for cotton planted over a six-week period with and without an insecticide seed treatment, Brewton, AL 2017

			Evaluation Date/Damage Rating				
	Planting Date	**Treatment**	**May 8**	**May 17**	**May 24**	**May 30**	**June 6**
1	4/20	Untreated	3.1	3.6	1.4		
		Avic + Gaucho	2.0	2.0	1.0		
2	4/27	Untreated		2.5	3.0	1.4	
		Avic + Gaucho		1.0	1.0	1.0	
3	5/3	Untreated			2.5	2.8	
		Avic + Gaucho			1.1	1.0	
4	5/10	Untreated			1.4	3.0	1.8
		Avic + Gaucho			1.1	1.4	0.8
5	5/17	Untreated				2.3	2.3
		Avic + Gaucho				1.4	0.9
6	5/24	Untreated				1.4	1.4
		Avic + Gaucho				1.0	1.1

Table 2. Thrips damage ratings to seedling cotton leaves for cotton planted over a 4 week period at Fairhope AL in 2017

	Date	Trt.	Evaluation Date/Damage Rating			
			5/10/2017	5/17/2017	5/25/2017	6/1/2017
1	4/20/2017	UT	4.5	4.0	*	*
		Avicta	1.5	1.5	*	*
2	4/26/2017	UT	3.5	4.0	*	*
		Avicta	2.0	1.5	*	*
3	5/3/2017	UT	2.0	2.0	3.0	3.0
		Avicta	1.0	1.0	1.0	1.0
4	5/11/2017	UT	not up	not up	3.0	2.0
		Avicta	not up	not up	2.0	1.0

Managing Seedling Thrips in the Era of Resistance to At-Planted Seed Treatments

T. Reed, R. Smith, and C. Hicks

Study Protocol: This study was conducted at the Belle Mina Research station and the Prattville Research Unit . Plots were planted at Belle Mina on May 15 and were arranged in a RCB design with 4 reps/treatment. (Exception: The untreated plots planted into a wheat residue were replicated 8 times). The variety used was ST 4946 GLB2. Plots were 4 rows wide (38 inch row spacing) and 25 feet long. Treatments are provided in Table 1. All treatments except 9, 10 and 12 were planted into a wheat cover-crop residue. Treatments 9, 10 and 12 were tilled prior to planting. Velum Total and Admire Pro were applied in-furrow on top of the seed using 6502 flat fan nozzles that applied 12 gallons of water per acre. Nozzles were turned to line up parallel with the furrow and all the water went into the furrow. Thrips damage ratings for the first and second true leaves were made on June 2. Thrips damage ratings for the third and fourth true leaves were made on June 12. Damage ratings were made on a scale of 0 to 5 with 0 being no damage and 5 being severe damage. A foliar overspray of Orthene 97 at a rate of 6 oz/acre was applied June 2 when the 3rd true leaf was very small using 8002 flat fan nozzles, 40 psi and 15 gallons water/acre. The middle two rows of each plot were harvested November 1.

Plots were planted at Prattville on May 2. The variety planted was ST 6182 GLT. Experimental design was similar to that at Belle Mina with 4 reps of all treatments. Plots were 4 rows wide and 30 feet long with a 36 inch row spacing. In-furrow sprays applied in treatments 3 and 9 were delivered in 8.7 gallons of water per acre using 25 psi and TX6 Conejet nozzles that had the insert removed and which sprayed a narrow band directly into the furrow middle. Treatments 6,7 ,8, and 11 had wheat straw spread over the plots to serve as the residue.. Foliar Orthene Treatments were applied to Treatments 8 and 12 on May 19 using a CO_2 back pack sprayer, 7.5 gallon water/acre, 60 psi and TX6 conejet nozzles. The middle 2 rows of each plot were harvested October 6.

Results: Thrips damage ratings , stand counts and yields at Belle Mina are presented in Table 1. There was a significant treatment effect with respect to thrips damage rating for each of the 4 true leaves rated (P>F=0.0000).The no insecticide with no crop residue treatment (Trt 12) had a significantly higher damage rating for each leaf rated than all the other treatments. Trt 12 was the only treatment to exceed the economic threshold damage level rating of 3 and this occurred at the 3rd and 4th true leaf stage . Thrips pressure was moderate in this study and under test conditions all the insecticide treatments provided satisfactory thrips control. There was no significant treatment effect with respect to stand count (P>F= 0.27) and seed cotton yield (P>F=0.72). Trt 12, which had the highest level of thrips damage in the study, had a seed cotton yield of 5240 lbs./acre, the 2nd highest numerical yield in the study.

Table 1. Thrips Damage Ratings, Stand Counts and Cotton Yields with Different Seed, In-Furrow and Seedling Foliar Sprays at Belle Mina, AL. 2017

	Mean Damage Rating					
Treatment	**[1]L1**	**[2]L2**	**[3]L3**	**[4]L4**	**Plants/ 6 row ft**	**Lbs Seed Cotton/Acre**
1. Avicta Elite	1.0	1.0	0.8	0.6	19.8	4995
2. Aeris	1.0	1.0	0.5	0.5	19.3	4960
3. Aeris + Foliar Orthene 97-6 oz	1.13	1.0	0.5	0.5	19.8	5071
4. Untreated Seed + Foliar Orthene-6 oz	2.0	1.4	2.4	2.0	17.1	4920
5. Avicta Elite + IFS[5] Admire Pro-7.4 oz	1.0	1.0	0.5	0.5	19.0	5205
6. Aeris + IFS Velum Total-14 oz	1.0	1.0	0.5	0.5	19.4	5097
7. Untreated Seed + IFS Velum Total-14 oz	1.0	1.0	0.6	0.5	19.3	4855
8. Aeris + IFS Orthene-8oz	1.0	1.0	0.6	0.5	18.0	5037
9. Avicta Elite with no crop residue	1.13	1.0	1.5	1.3	16.1	5110
10. Aeris with no crop residue	1.3	1.0	2.3	1.6	17.8	5123
11. Untreated seed with crop residue	1.9	1.5	2.8	2.4	18.2	4945
12. Untreated seed with no crop residue	2.5	2.1	3.6	3.1	18.1	5240
13. Untreated seed with IFS Admire Pro-7.4 oz	1.0	1.0	0.6	0.6	19.1	4979
14. AgLogic[6] IF-3.5 lbs	1.0	1.0	0.9	0.9	17.5	4931
15. AgLogic IF-5.0 lbs	1.0	1.0	0.6	0.6	20.8	5281
P>F	0.000[0]	0.000[0]	0.000[0]	0.000[0]	0.27	0.72
LSD 0.1	0.22	0.12	0.33	0.38	-	-

[1] L1 = Leaf 1; Rated June 2
[2] L2 = Leaf 2; Rated June 2
[3] L3 = Leaf 3; Rated June 12
[4] L4 = Leaf 4; Rated June 12
[5] IFS= In-Furrow Spray
[6]= In-Furrow Granule

Thrips damage ratings and yields at Prattville are presented in Table 2.

Table 2. Thrips Damage Ratings, Plant Height and Cotton Yields with Different Seed Treatments, In-Furrow and Seedling Foliar Insecticide Treatments at Prattville, AL, 2017

	Damage Rating					
Treatment	**5/26**	**5/30**	**6/6**	**6/13**	**Plants Ht (cm) 7/3**	**Lbs Seed Cotton/Acre**
1. AgLogic I5G-3.5 lbs	1.5	1.8	1.3	1.0	59.5	2956
2. AgLogic I5G-5.0 lbs	1.0	1.6	1.0	1.0	56.4	2638
3. Velum Total IFS[1]-14 oz	1.7	2.3	1.5	1.3	64.5	2875
4. Avicta	3.4	3.3	3.6	2.9	45.8	2356
5. Aeris	2.4	2.9	3.1	2.6	49.0	2400
6. Avicta + Residue	1.8	1.8	1.4	1.0	39.3	2131
7. Aeris + Residue	1.5	1.5	1.9	1.0	41.5	2063
8. Untreated Seed + Orthene-6oz FS[2] + Residue	1.8	1.6	1.5	1.0	37.0	2194
9. Admire Pro IFS-8 oz	1.8	2.2	2.0	1.0	63.8	2844
10. Untreated Seed	4.2	4.2	4.3	3.6	36.3	2300
11. Untreated Seed + Residue	1.6	2.3	2.0	2.0	37.8	1931
12. Untreated Seed + Orthene 6 oz / FS	3.8	3.6	3.0	1.5	51.0	2631
P>F	0.000	0.000	0.000	0.000	0.0000	0.0008
LSD 0.1	0.53	0.59	0.66	0.51	7.55	403

[1] IFS = In-Furrow Spray

[2] FS = Foliar Spray

There was a significant treatment effect with respect to thrips damage rating for each date ratings were made (P>F= 0.0000). The Untreated seed with no crop residue treatment (Trt 10) had the highest thrips damage rating each of the 4 rating dates. The economic threshold damage rating of 3 was also reached or exceeded by the Untreated seed + Orthene foliar spray treatment (Trt 12) and the Avicta seed treatment (Trt 4) on the first 3 sampling dates. The Aeris treatment (Trt 5) also exceeded the damage threshold on June 6. There was a significant treatment effect with respect to plant height at 62 days after planting (P>F = 0.0000). Treatments with mean plant heights greater than 50 cm were Velum Total IF (Trt 3), Admire Pro IF (Trt 9) Both Ag Logic treatments (Trts 1 and 2) and the Untreated seed without residue + Foliar Orthene spray (Trt 12).

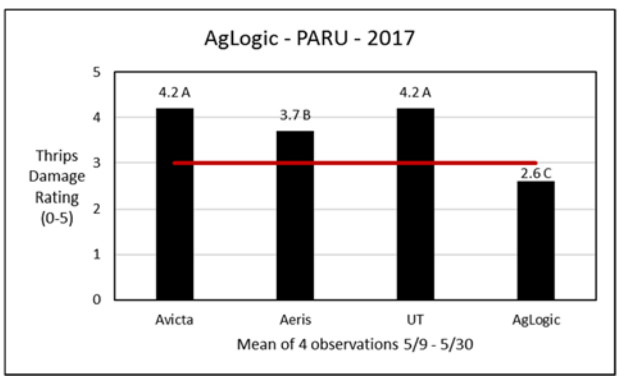
Thrips pressure was heavier in the study at Prattville than at Belle Mina and there was a significant treatment effect with respect to seed cotton yield at Prattville (P>F=0.0008). The top 5 yielding treatments that were not significantly different had seed cotton yields that ranged from 2956 to 2631 lbs./acre. These top 5 treatments were the two Ag Logic treatments (Trts 1 and 2), Velum Total IF (Trt 3), Admire Pro IF (Trt 9) and Untreated seed without residue + Orthene foliar spray (Trt 12) Although the 4 treatments that utilized a crop residue had low levels of thrips damage the residue created a nitrogen deficiency that resulted in pale green cotton plants that were shorter and yielded less than treatments without residue.

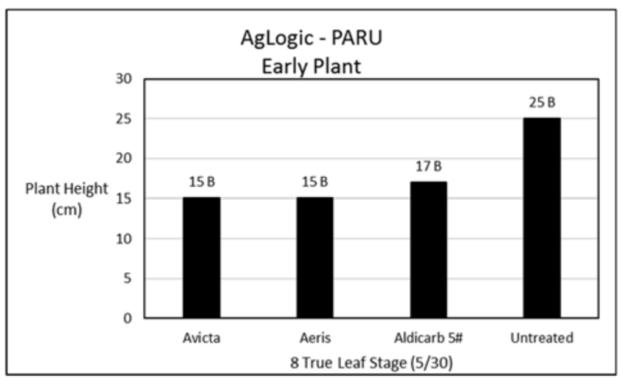
Evaluation of Aldicarb (Temik, AgLogic) for Suppression of Plant Bugs in Cotton

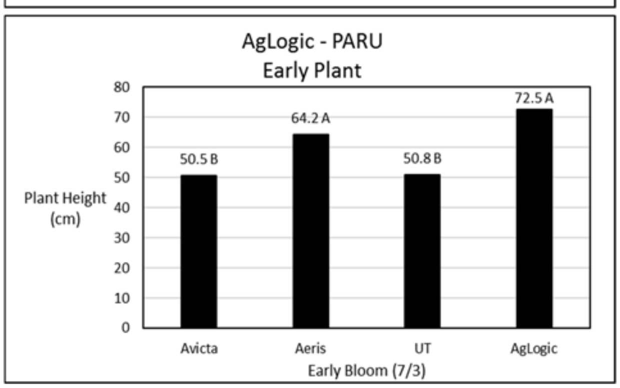
R. Smith

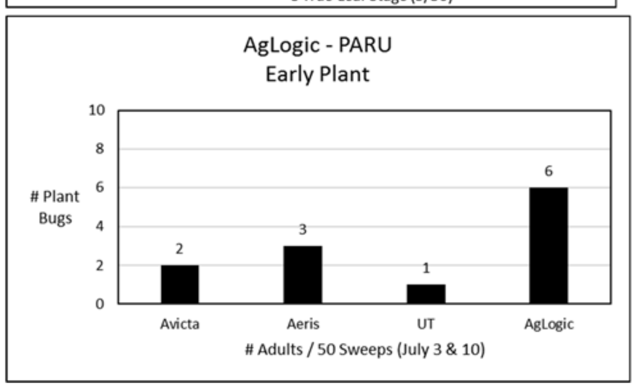
This trial was conducted at two locations to increase the odds that a natural economic level of plant bugs would be present. Both the Prattville research site (PARU) and the EV Smith research station were utilized. DP1646B2XF was planted early and late at both locations (April 18 and May 17). At the Prattville location, four at planting treatments were utilized: Avicta and Aeris seed treatments, aldicarb (AgLogic) @ 5 lbs/ac, and an untreated. At EVS, only two treatments were used: aldicarb (AgLogic 5 lbs/ac) and Aeris seed treatment. Both trials utilized plots 4 rows X 30 feet replicated 4 times in a randomized fashion. Plots were monitored for thrips from the first through the 6th true leaf stage. From pinhead square to first bloom, sweep net samples were taken from the two center rows of each plot for adult tarnished plant bugs. After first bloom, the sampling method was changed to a drop cloth in order to quantify immature plant bugs emerging from eggs deposited by the previous adult population. In early bloom, pinhead square retention counts were also made.

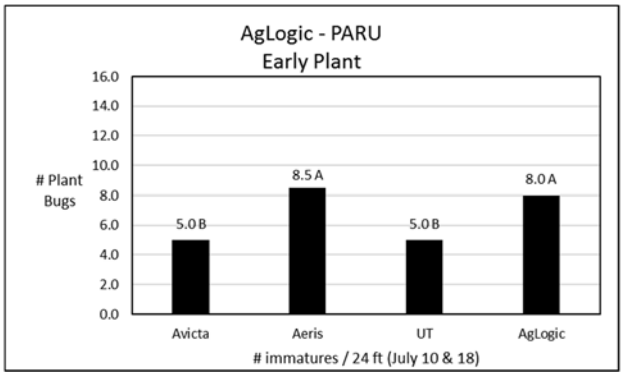
Results from this trial, conducted at two locations, are presented in the following bar graphs.

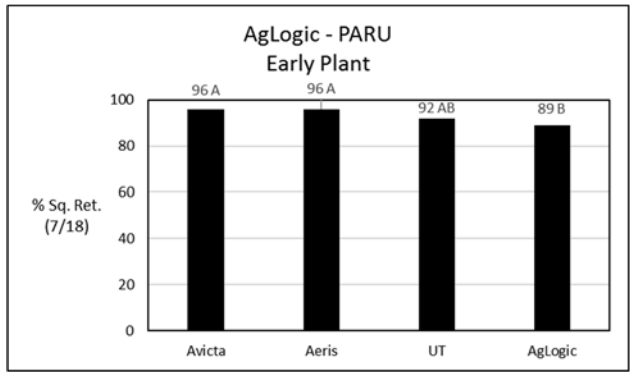


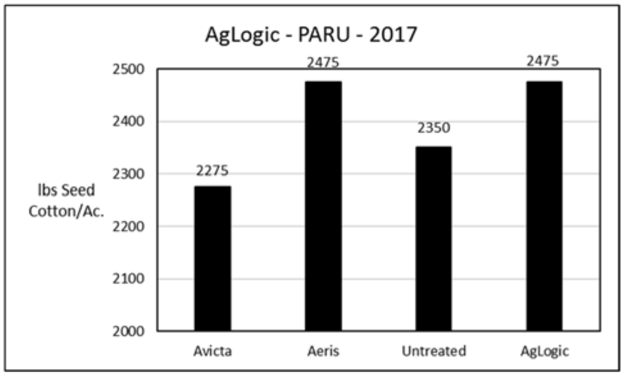


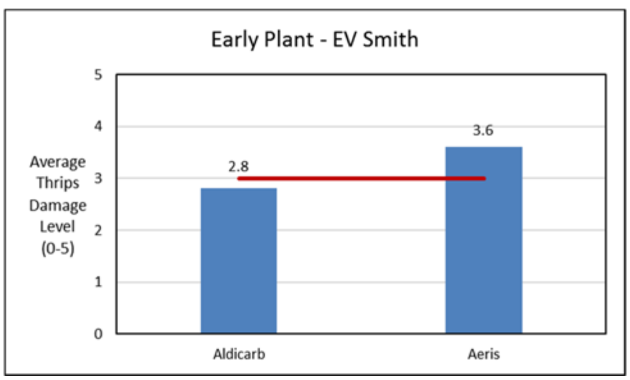


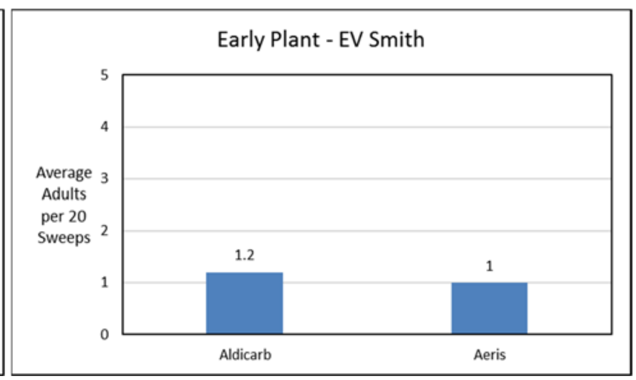


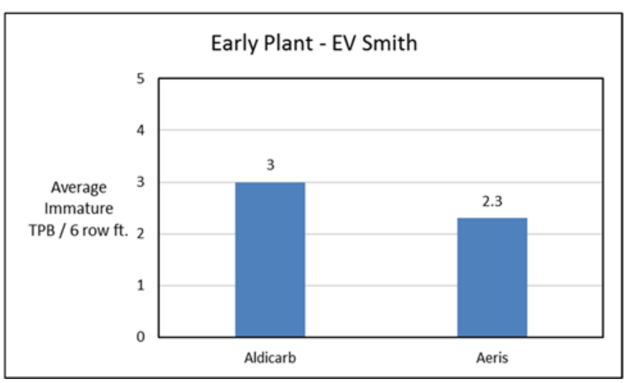

AgLogic - PARU
Early Plant
Plant Bugs
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
5.0 B
8.5 A
5.0 B
8.0 A
Avicta
Aeris
UT
AgLogic
immatures / 24 ft (July 10 & 18)

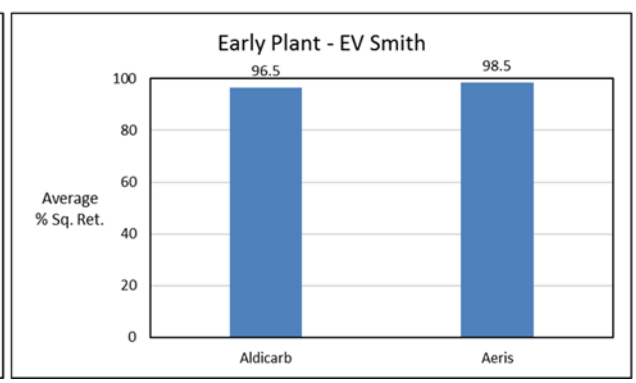

AgLogic - PARU
Early Plant
% Sq. Ret. (7/18)
100
80
60
40
20
0
96 A
96 A
92 AB
89 B
Avicta
Aeris
UT
AgLogic

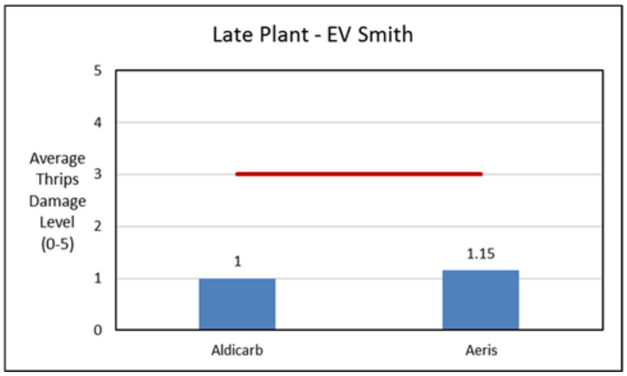

AgLogic - PARU - 2017
lbs Seed Cotton/Ac.
2500
2400
2300
2200
2100
2000
2275
2475
2350
2475
Avicta
Aeris
Untreated
AgLogic

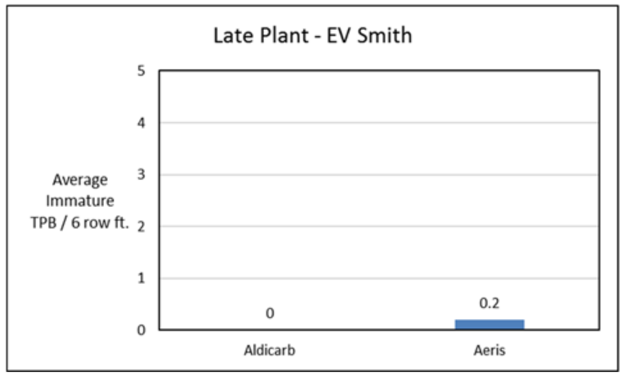

Early Plant - EV Smith
Average Thrips Damage Level (0-5)
5
4
3
2
1
0
2.8
3.6
Aldicarb
Aeris

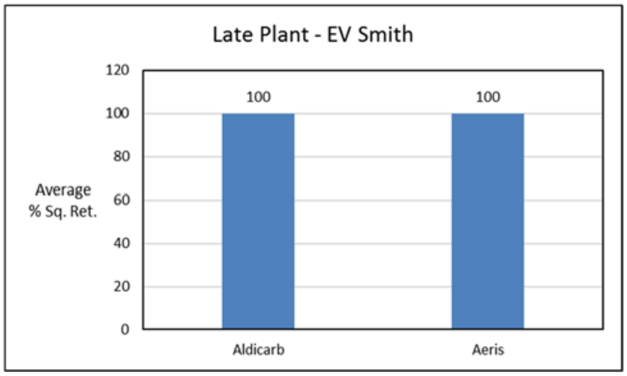

Early Plant - EV Smith
Average Adults per 20 Sweeps
5
4
3
2
1
0
1.2
1
Aldicarb
Aeris


Early Plant - EV Smith
Average Immature TPB / 6 row ft.
5
4
3
2
1
0
3
2.3
Aldicarb
Aeris


Early Plant - EV Smith
Average % Sq. Ret.
100
80
60
40
20
0
96.5
98.5
Aldicarb
Aeris







Results and Conclusions

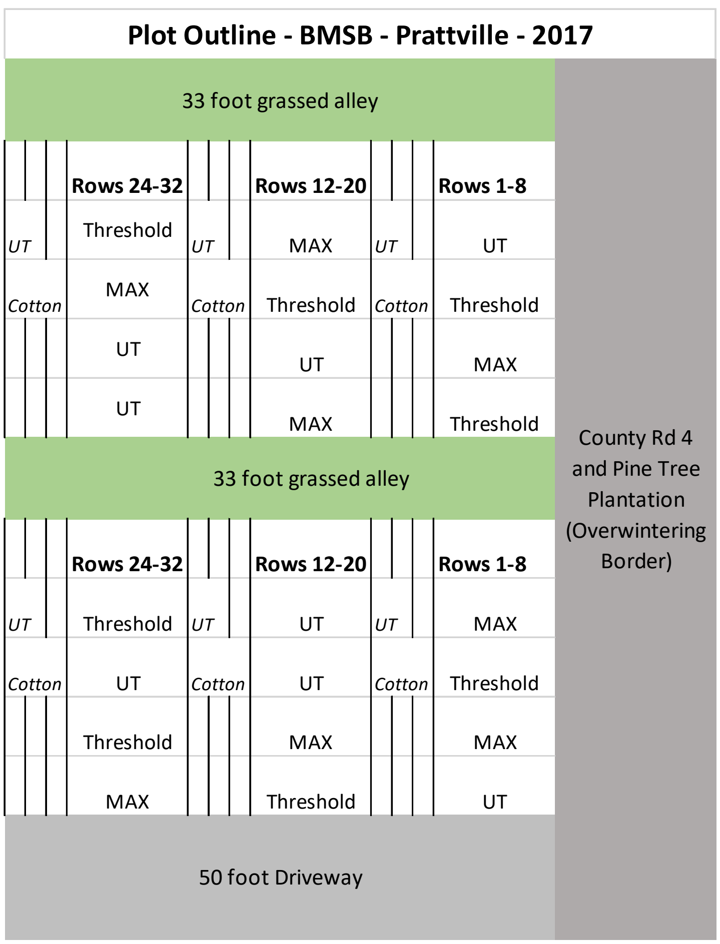
Aldicarb (AgLogic) @ 5 lbs/ac gave significantly better thrips control than the seed treatment(s) and was the only at-planting treatment that did not need a supplemental foliar thrips application. At Prattville, the aldicarb treated plots were numerically taller than the seed treatments by 8-10 cm (3-4 inches) at the 8 true leaf stage. Also at Prattville, the number of adult plant bugs on July 3 and 10 was highest in the aldicarb plots. This is likely the result of the taller cotton, which provided better shade and a more attractive host for egg deposition. On July 10 and 18, more immature plant bugs were found in the aldicarb and Aeris seed treatment plots which contained the tallest and healthiest plants. Square retention on July 18 was inversely related to the number of plant bugs present. The highest yielding treatments were aldicarb and Aeris, which correlated to the overall health of the plants in the seedling and early bloom period. There was no indication that aldicarb suppressed plant bugs in this trial. Instead, it provided the most attractive host for early season plant bugs. Two factors should be considered in the results of these trials. One the level of plant bugs was below threshold and second the excessive rainfall in May and June may have leached much of all at-plant treatments for both thrips and plant bugs.

No follow up work is planned with aldicarb due to the increased time and labor needed to apply at planting and the seeming lack of interest in aldicarb by Alabama growers.

Validating Treatment Thresholds and Determining Border Effect of Brown Marmorated Stink Bugs, A New Invasive Pest of Cotton

R. Smith and S. Duke

This project was conducted at the Prattville research site (PARU) using DP1555B2RF variety. Plots were 8 rows X 30 feet. Three thresholds for BMSB were utilized: Untreated, Threshold of 10% internal damage, and Maximum (weekly sprays). Plots were established at 3 distances from the field border adjacent to a stink bug overwintering site. Distance to the field border was 1-8 rows, 12-20 rows, and 24-32 rows. Four untreated border rows were maintained between all plots. Four applications were applied to the threshold plots while the maximum control received six applications. Ten quarter diameter, 10-12 day old bolls were collected weekly for 6 weeks and examined for internal stink bug injury. Results were recorded as % internal damage. On Aug. 1, 83% of the stink bugs captured by sweep net was the BMSB species (16% SGSB and 6% BSB). By Aug. 16, the population had shifted to approximately 50% BMSB and 50% SGSB with no BSB in the mix.



% Internal Boll Damage				
Pre Treat (8/10)				
Distance to Border				
	Row 24-32	Row 12-20	Row 1-8	Mean
UT	30	30	15	25
Threshold	13	15	43	27
Maximum	20	13	40	24
Mean	21	33	33	

% Damaged Bolls- Internal				
(Means of 6 observation Dates by Distance to Border)				
Distance to Border				
	Row 24-32	Row 12-20	Row 1-8	Mean
UT	58 (3)	59(3)	54(2)	57
Threshold	22(3)	19(2)	30(3)	24
Maximum	23(2)	16(3)	22(3)	20

% Internal Boll Damage by Location of Plot Over 6 Observation Dates		
	Interior	Perimeter
UT	44(4)	65(4)
Threshold	18(2)	26(6)
Maximum	13(2)	21(6)

Yields- BMSB-Prattville-2017			
(lbs seed cotton per ac)			
Rows from Border			
Treatment	24-32	12-20	1-8
UT	1851	2045	1658
Thresholds	2360	2710	2722
Max	2783	2468	2275

Conclusions

1. Populations containing a mix of both BMSB and SGSB can cause severe boll damage and yield reductions in cotton.
2. Internal boll damage by stink bugs may reach 80% or greater on field borders near BMSB overwintering sites.
3. When the BMSB is in the stink bug mix, weekly applications along field borders will be necessary to hold boll damage below the threshold level and prevent economic losses. (Weeks 3-8~9 of bloom).
4. The highest level of damage by the BMSB will be confined to the first 10-15 rows (30-45 ft) from all borders of fields where infestations occur.
5. As opposed to our native stink bug species (SGSB, GSB, and BSB, which prefer bolls 10-12 days old or quarter sized diameter) the BMSB appears to do damage to all sizes and ages of bolls, from thumb nail up to full grown (25 days or older). Little to no cotton will be harvested from field borders where the BMSB is in the stink bug mix.

Controlling Stink Bugs in Cotton without Phosphate Insecticides

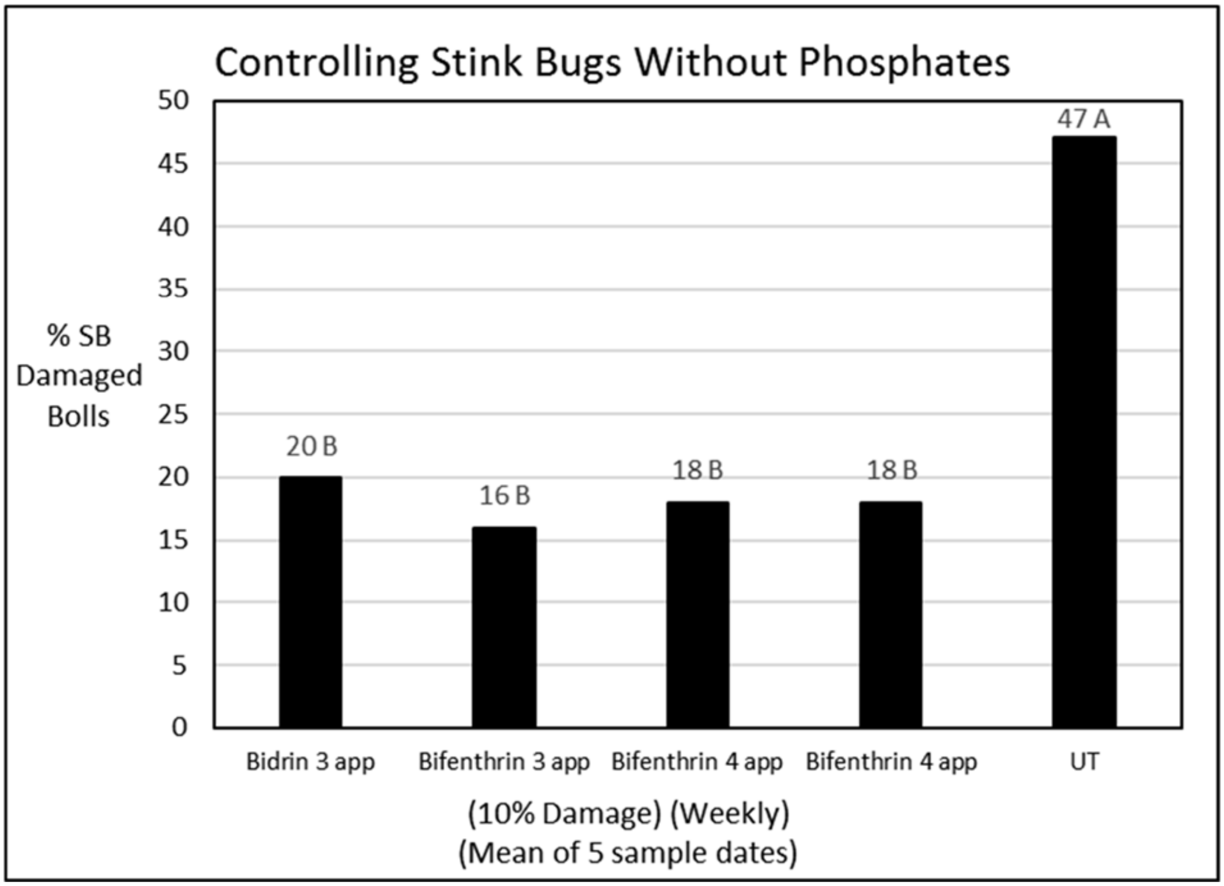
R. Smith

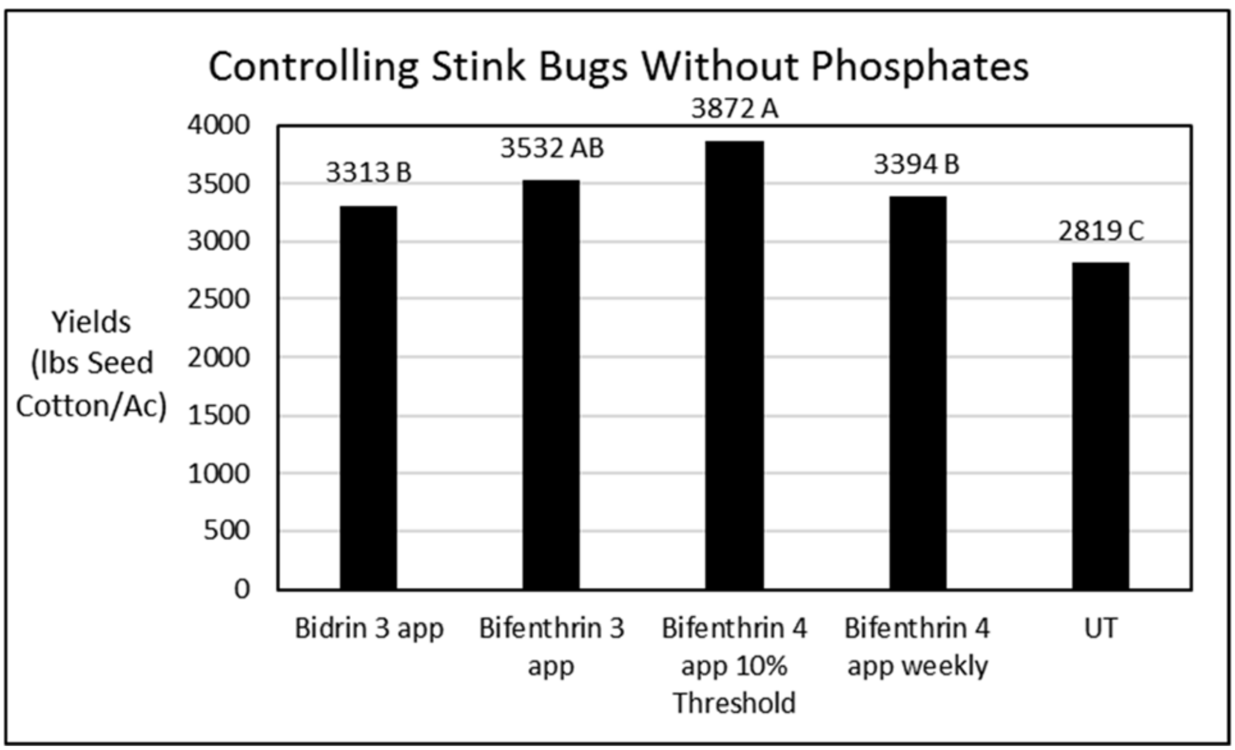
This project was conducted at the Prattville Research Station (PARU) using DP1646B2RF variety. Plots were 8 rows X 50 feet with five treatments and 4 replicates of each treatment. Chemicals or timing intervals were utilized for stink bug control as shown in table 1. Two of these treatments were Bidrin (phosphate) versus bifenthrin (pyrethroid) applied automatically on weeks 4, 6, and 9 of bloom. Evaluations were made weekly by selecting ten quarter diameter, 10-12 day old bolls from each plot. The bolls were then examined for internal stink bug injury and recorded as % internal damage. Yields were taken at harvest.

Trt#	**Material**	**Rate**	**Timing week of Bloom**	**Application Date & Plot #***			
				Week 4	**Week 5**	**Week 6**	**Week 7**
				7/26/2017	**8/2/2017**	**8/9/2017**	**9/1/2017**
1	Bidrin	6 oz	4th, 6th, 9th	104	201	303	401
2	Bifenthrin	6.4 oz	4th, 6th, 9th	103	203	301	405
3	Bifenthrin	6.4 oz	10% Damage	105	205	304	403
4	Bifenthrin	6.4 oz	Weekly	102	202	305	404
5	Untreated			101	204	302	402

* Treatments highlighted by plot and date

% Damage by Treatment Across Five Observation Dates							
Trt #	**Treatment**	**Timing (wk of Bloom)**	**Replicates**				**Mean**
			1	2	3	4	
1	Bidrin	4, 6, and 9	12	28	26	14	20 B
2	Bifenthrin	4, 6, and 9	16	12	14	24	16 B
3	Bifenthrin	10 % Damage (4,5,6, & 9)	6	12	22	32	18 B
4	Bifenthrin	Weekly (4,5,6, &9 wk of Bloom)	12	8	22	28	18 B
5	Untreated		54	40	56	38	47 A


Controlling Stink Bugs Without Phosphates
% SB Damaged Bolls
50
45
40
35
30
25
20
15
10
5
0
20 B
16 B
18 B
18 B
47 A
Bidrin 3 app
Bifenthrin 3 app
Bifenthrin 4 app
Bifenthrin 4 app
UT
(10% Damage) (Weekly)
(Mean of 5 sample dates)


Controlling Stink Bugs Without Phosphates
Yields (lbs Seed Cotton/Ac)
4000
3500
3000
2500
2000
1500
1000
500
0
3313 B
3532 AB
3872 A
3394 B
2819 C
Bidrin 3 app
Bifenthrin 3 app
Bifenthrin 4 app 10% Threshold
Bifenthrin 4 app weekly
UT

VI. Nematode Management

Cotton Variety Evaluation with and without Velum Total for Reniform Management in Alabama, 2017

D. Dyer, K. Lawrence, S. Till, W. Groover, N. Xiang, M. Rondon, and K. Gattoni

Ten cotton varieties were evaluated with and without the addition of Velum Total for the management of the reniform nematode at Auburn University's E. V. Smith Research Center, which is located near Shorter, AL. The field contains a Benndale fine sandy loam soil type (73% sand, 20% silt, and 7% clay). The field was arranged in a randomized complete block design with five replications. The plots were planted on 15 May, and seeds were planted at a depth of 2.5 centimeters. Test plots consisted of 4 rows (two treated with Velum Total and two untreated), that were 6 meters long with a 0.9-meter row spacing and a 1.8-meter alley between replications. Velum Total was applied as an in-furrow spray at a rate of 1 L/ha to the right two rows of each variety leaving the left two rows untreated. All plots were maintained throughout the season with standard insecticide, herbicide, and fertilizer practices as recommended by the Alabama Cooperative Extension System, and watered as needed with an overhead irrigation system. Monthly average maximum temperatures from planting in May through harvest in October were 82, 86, 91, 90, 84, 77°F with average minimum temperatures of 57, 66, 70, 68, 63, 54°F, respectively. Rainfall accumulation for each month was 7.76, 7.17, 5.12, 0.16, 0.0, and 2.27 inches with a total of 22.48 inches over the entire season. Nematode population density (eggs per gram of root), plant height, and biomass (root fresh weight + shoot fresh weight) were determined at 39 days after planting (DAP) by digging four plants at random from each plot. Extraction of nematode eggs from roots was accomplished by shaking the roots in 6% NaOCl for 4 minutes and collecting the eggs on a 25-µm sieve. Seed cotton yield was collected on 4 Oct. Data were analyzed with SAS 9.4 using PROC GLIMMIX, and LS-means were compared using Tukey-Kramer's method ($P \leq 0.1$).

Applying Velum Total significantly affected plant biomass, reniform eggs/g of root, and yield. Plant biomass was increased by 4.87 grams when Velum Total was applied. Application of Velum Total reniform eggs/g of root were reduced by 82% compared to plots not treated with Velum Total. The yield was increased by 361 kg/ha of seed cotton as a result of these lower nematode populations in Velum Total treated plots. Cotton variety selection had a significant impact on all measurements taken with the exception of plant biomass. The tallest variety was Deltapine 1522, which was significantly increased over PhytoGen 490. The highest reniform eggs/g of root were observed on PhytoGen 444. Stoneville 6182 supported 87.6% fewer reniform eggs/g of root compared to PhytoGen 444. The highest yielding varieties were Deltapine 1522 and Croplan Genetics 3885 that produced 623 and 621 kg/ha more seed cotton when compared to PhytoGen 490 respectively.

Source of Variation (F-value)	Plant Height (cm)	Biomass[z] (g)	Reniform eggs/g of root	Seed Cotton Yield (kg/ha)
Cotton Variety	1.97*[y]	1.42	2.44**	2.39**
Nematicide	2.51	5.46**	94.29****	18.75****
Variety x nematicide	0.66	0.66	1.26	0.38
Nematicide LS-means				
Untreated control	17.90 a[w]	35.71 b	1575 a	2126 b
Velum Total[x]	17.23 a	40.58 a	283 b	2487 a
Cotton Variety LS-means				
Deltapine 1646 B2XF	17.15 ab	30.65 a	479 ab	2142 ab
Deltapine 1522 B2XF	19.08 a	36.46 a	1001 ab	2584 a
Deltapine 1614 B2XF	18.43 ab	39.69 a	595 ab	2517 ab
PhytoGen 487 WRF	17.40 ab	43.26 a	634 ab	2246 ab
PhytoGen 444 WRF	18.43 ab	42.55 a	2419 a	2337 ab
PhytoGen 333 WRF	16.65 ab	37.12 a	1146 ab	2337 ab
PhytoGen 490 W3FE	16.08 b	33.79 a	750 ab	1961 b
Stoneville 6182 GLT	16.75 ab	37.76 a	299 b	2311 ab
Stoneville 4848 GLT	17.78 ab	38.71 a	1004 ab	2185 ab
Croplan Genetics 3885 B2XF	17.90 ab	41.48 a	963 ab	2582 a

[z] Biomass is the sum of shoot fresh weight and root fresh weights.
[y] Significance at the 0.1, 0.05, 0.01, and 0.001 level is indicated by *, **, ***, and **** respectively
[x] Velum Total was applied at the time of planting as an in-furrow spray at a rate of 1 l/ha
[w] values present are LS-means separated using the Tukey-Kramer method at $P \leq 0.1$. Values in the same column followed by the same letter do not differ significantly.

Cotton Variety Evaluation with and without Velum Total for Reniform Management in North Alabama, 2017

D. Dyer, K. Lawrence, S. Till, W. Groover, N. Xiang, M. Rondon, K. Gattoni, and C. Norris

Ten cotton varieties were evaluated with and without the addition of Velum Total for management of the reniform nematode at Auburn University's Tennessee Valley Research and Extension Center (TVREC), which is located near Belle Mina, AL. A control field that was not infested with the reniform nematode had the same ten varieties planted with and without the addition of Velum Total. The fields contain a Decatur silt loam soil type (23% sand, 49% silt, and 28% clay). The fields were arranged in a randomized complete block design with five replications. The plots were planted on 9 May, and seeds were planted at a depth of 2.5 centimeters. Test plots consisted of 4 rows (two treated with Velum Total and two untreated), that were 7.6 meters long with a 0.9-meter row spacing and a 1.8-meter alley between replications. Velum Total was applied as an in-furrow spray at a rate of 1 L/ha to the right two rows of each variety leaving the left two rows untreated. All plots were maintained throughout the season with standard insecticide, herbicide, and fertilizer practices as recommended by the Alabama Cooperative Extension System, and watered as needed with an overhead irrigation system. Monthly average maximum temperatures from planting in May through harvest in November were 82, 86, 91, 88, 82, 75, and 64°F with average minimum temperatures of 59, 66, 70, 68, 61, 52, and 41°F, respectively. Rainfall accumulation for each month was 6.01, 6.27, 6.04, 2.38, 3.82, 3.43, and 0.67 inches with a total of 28.62 inches over the entire season. Nematode population density (eggs per gram of root) was taken 44 days after planting by digging four plants at random from each plot. Extraction of nematode eggs from roots was accomplished by shaking the roots in 6% NaOCl for 4 minutes and collecting the eggs on a 25-µm sieve. The test was harvested and yield data were collected on 10 Nov. Data were analyzed with SAS 9.4 using PROC GLIMMIX, and LS-means were compared using Tukey-Kramer's method ($P \leq 0.1$).

The application of Velum Total only increased the yield in the reniform infested field. Plots treated with Velum Total increased yield by 1,498 kg/ha of seed cotton in this field. The control field that did not contain reniform nematodes produced 1,644 kg/ha of seed cotton more than the nematode infested field. The highest yielding variety was Deltapine 1522, which produced more seed cotton than Deltapine1664, Stoneville 4848, and PhytoGen 490 by 556, 549, and 525 kg/ha respectively.

Reniform eggs/g of root were reduced by 92.6% when Velum Total was applied to the nematode infested field. All the varieties had similar populations of reniform nematode egg/g of root.

Source of Variation (F-value)	Seed Cotton Yield (kg/ha)		Reniform eggs/g of root[z]
Cotton Variety	1.47[y]		0.73
Nematicide	54.24****		130.46****
Nematode	85.82****		-
Variety x Nematicide	0.48		0.69
Variety x Nematode	1.54		-
Nematicide x Nematode	41.53****		-
Variety x Nematicide x Nematode	0.21		-
Nematicide LS-means	Nematode	No Nematodes	
Untreated control	1620 b[x]	3963 a	4510 a
Velum Total[x]	3118 a	4063 a	333 b
Nematode LS-means			
Nematode infested field	2369 b		- -
Non-infested field	4013 a		- -
Cotton Variety LS-means			
Deltapine 1646 B2XF	2945 c		3443 a
Deltapine 1522 B2XF	3501 a		1760 a
Deltapine 1614 B2XF	3284 abc		1869 a
PhytoGen 487 WRF	3299 abc		1312 a
PhytoGen 444 WRF	3465 ab		2615 a
PhytoGen 333 WRF	3095 abc		2307 a
PhytoGen 490 W3FE	2976 bc		1806 a
Stoneville 6182 GLT	3242 abc		2875 a
Stoneville 4848 GLT	2952 bc		1408 a
Croplan Genetics 3885 B2XF	3190 abc		4823 a

[z] Data for reniform eggs/gram of root was only collected from the nematode infested field and not the control field.
[y] Significance at the 0.1, 0.05, 0.01, and 0.001 level is indicated by *, **, ***, and **** respectively
[x] Values present are LS-means separated using the Tukey-Kramer method at $P \leq 0.1$. Values in the same column followed by the same letter do not differ significantly.
[w] Velum Total was applied at the time of planting as an in-furrow spray at a rate of 1 l/ha

Cotton Variety Evaluation with and without Velum Total for Root-Knot Nematode Management in Alabama, 2017

D. Dyer, K. Lawrence, S. Till, W. Groover, N. Xiang, M. Rondon, and K. Gattoni

Ten cotton varieties were evaluated with and without the addition of Velum Total for the management of the root-knot nematode at the Plant Breeding Unit of Auburn University's E.V. Smith Research Center, which is located near Tallassee, AL. The field contains a kalmia loamy sand soil type (80% sand, 10% silt, and 10% clay). The field was arranged in a randomized complete block design with five replications. The plots were planted on 20 Apr., and seeds were planted at a depth of 2.5 centimeters. Test plots consisted of four rows (two treated with Velum Total and two untreated), that were 7.6 meters long with a 0.9-meter row spacing and a 1.8-meter alley between replications. Velum Total was applied as an in-furrow spray at a rate of 1 L/ha to the right two rows of each variety leaving the left two rows untreated. All plots were maintained throughout the season with standard insecticide, herbicide, and fertilizer practices as recommended by the Alabama Cooperative Extension System, and watered as needed with an overhead irrigation system. Monthly average maximum temperatures from planting in May through harvest in October were 79, 82, 86, 91, 90, 84°F with average minimum temperatures of 54, 57, 66, 70, 68, 63°F, respectively. Rainfall accumulation for each month was 3.27, 7.75, 7.17, 5.12, 0.16, and 0.00 inches with a total of 23.47 inches over the entire season. Nematode population density (eggs/g of root), plant height, and biomass (root fresh weight + shoot fresh weight) were taken 30 days after planting by digging four plants at random from each plot. Extraction of nematode eggs from roots was accomplished by shaking the roots in 6% NaOCl for 4 minutes and collecting the eggs on a 25-µm sieve. The test was harvested and yield data were collected on 17 Oct. Data were analyzed with SAS 9.4 using PROC GLIMMIX and LS-means were compared using Tukey-Kramer's method ($P \leq 0.1$).

The application of Velum Total had an effect on all test measurements. Plant height was increased by 2 centimeters when Velum Total was applied, no effect was observed between varieties. Biomass was increased by 7 grams when Velum Total was applied. An increase in biomass was observed for PhytoGen 444 and 333 when compared to Deltapine 1646 or PhytoGen 490. Velum Total reduced reniform eggs/g of root by 72.2% compared to untreated plots and yield was increased by 168 kg/ha of seed cotton when Velum Total was applied. The highest yielding variety was PhytoGen 490, which produced more seed cotton compared to Stoneville 6182 and 4848 by 321 and 317 kg/ha, respectively.

Source of Variation (F-value)	Plant Height (cm)	Biomass[z] (g)	Reniform eggs/g of root	Seed Cotton Yield (kg/ha)
Cotton Variety	0.76[y]	2.17**	0.86	1.68
Nematicide	38.36****	34.80****	25.99****	12.56***
Variety x nematicide	0.37	0.85	0.82	0.31
Nematicide LS-means				
Untreated control	14 b[w]	15 b	3493 a	797 b
Velum Total[x]	16 a	22 a	972 b	965 a
Cotton Variety LS-means				
Deltapine 1646 B2XF	14 a	13 b	2246 a	865 ab
Deltapine 1522 B2XF	15 a	18 ab	2196 a	854 ab
Deltapine 1614 B2XF	16 a	18 ab	2546 a	840 ab
PhytoGen 487 WRF	15 a	19 ab	2668 a	997 ab
PhytoGen 444 WRF	16 a	23 a	2198 a	877 ab
PhytoGen 333 WRF	15 a	22 a	1955 a	863 ab
PhytoGen 490 W3FE	15 a	17 ab	2303 a	1098 a
Stoneville 6182 GLT	14 a	16 b	2665 a	777 b
Stoneville 4848 GLT	15 a	20 ab	2005 a	781 b
Croplan Genetics 3885 B2XF	16 a	21 ab	1542 a	859 ab

[z] Biomass is the sum of shoot fresh weight and root fresh weights.
[y] Significance at the 0.1, 0.05, 0.01, and 0.001 level is indicated by *, **, ***, and **** respectively
[x] Velum total was applied at the time of planting as an in-furrow spray at a rate of 1 l/ha
[w] values present are LS-means separated using the Tukey-Kramer method at $P \leq 0.1$. Values in the same column followed by the same letter do not differ significantly.

Cotton Variety Evaluation with and without Velum Total for Root-Knot Nematode Management in South Alabama, 2017

D. Dyer, K. Lawrence, S. Till, W. Groover, N. Xiang, M. Rondon, K. Gattoni, and J. Jones

Ten cotton varieties were evaluated with and without the addition of Velum Total for the management of the root-knot nematode at Auburn University's Gulf Coast Research and Extension Center, located in Fairhope, AL. A control field that was not infested with root-knot nematode had the same ten varieties tested with and without the addition of Velum Total. The fields contain a Malbis sandy loam (59% sand, 31% silt, and 10% clay). The field was arranged in a randomized complete block design with five replications. The plots were planted on 16 May, and seeds were planted at a depth of 2.5 centimeters. Test plots consisted of 4 rows (two treated with Velum Total and two untreated), that were 6.1 meters long with a 0.9-meter row spacing and a 1.8-meter alley between replications. Velum Total was applied as an in-furrow spray at a rate of 1 L/ha to the right two rows of each variety leaving the left two rows untreated. All plots were maintained throughout the season with standard insecticide, herbicide, and fertilizer practices as recommended by the Alabama Cooperative Extension System, and watered as needed with an overhead irrigation system. Monthly average maximum temperatures from planting in April through harvest in October were 82, 84, 90, 88, 86, 81°F with average minimum temperatures of 63, 70, 75, 73, 68, and 61°F respectively. Rainfall accumulation for each month was 10.43, 9.65, 5.83, 11.46, 0.47, and 12.64 inches with a total of 50.48 inches over the entire season. Nematode population density (eggs per gram of root), plant height, and biomass (root fresh weight + shoot fresh weight) were determined at 44 days after planting by digging four plants at random from each plot. Extraction of nematode eggs from roots was accomplished by shaking the roots in 6% NaOCl for 4 minutes and collecting the eggs on a 25-µm sieve. Seed cotton yield was collected on 10 Oct. Data were analyzed with SAS 9.4 using PROC GLIMMIX, and LS-means were compared using Tukey-Kramer's method ($P \leq 0.1$).

The addition of Velum Total to plots increased ($P \leq 0.1$) plant height and biomass in both nematode infested and control fields. The yield was only affected by the application of Velum Total in the root-knot infested field, where it increased yield by 443 kg/ha. Plant height and biomass increases were observed in the control field when compared to the root-knot infested field, however, no yield effect was observed between the two fields. The tallest plants were recorded in plots containing Croplan Genetics 3585 cotton. Cotton variety had no significant effect on plant biomass. Stoneville

5115 and Deltapine 1646 produced the highest yield which was greater than Deltapint 1747, PhytoGen 444, 490, and Stoneville 5020. Root-knot nematode eggs/g of root were significantly reduced by 56% following the application of Velum Total. No differences in nematode eggs/g of root were observed for any of the varieties.

Source of Variation (F-value)	Plant Height (cm)	Biomass[z] (g)	Seed Cotton Yield (kg/ha)		Root-knot eggs/g of root[y]
Cotton Variety	3.12***[x]	1.07	4.74****		1.35
Nematicide	11.43***	1.27	8.03***		1.97
Nematode	13.55***	9.31**	0.47		-
Variety x Nematicide	0.20	0.53	0.83		0.75
Variety x Nematode	0.49	1.09	1.48		-
Nematicide x Nematode	2.37	1.11	10.04***		-
Variety x Nematicide x Nematode	0.36	0.42	1.03		-
Nematicide LS-means			Nematode	No Nematode	
Untreated control	20 b[w]	11 b	4168 b	4244 a	443 a
Velum Total[v]	21 a	12 a	4611 a	4219 a	212 b
Nematode LS-means					
Nematode infested field	18 b	9 b	4389 a		- -
Non-infested field	23 a	15 a	4231 a		- -
Cotton Variety LS-means					
Deltapine 1646 B2XF	21 abc	11 a	4616 a		521 a
Deltapine 1747 NR B2XF	20 bc	12 a	3810 d		167 a
Deltapine 1639 B2XF	19 c	11 a	4427 abc		218 a
PhytoGen 444 WRF	19 c	12 a	4181 c		355 a
PhytoGen 450 W3FE	20 c	11 a	4277 abc		590 a
PhytoGen 490 W3FE	20 c	11 a	4100 cd		345 a
Stoneville 5020 GLT	22 ab	13 a	4227 bc		606 a
Stoneville 6182 GLT	22 ab	13 a	4296 abc		104 a
Stoneville 5115 GLT	20 c	12 a	4620 a		271 a
Croplan Genetics 3885 B2XF	23 a	14 a	4551 ab		100 a

[z] Biomass is the sum of shoot fresh weight and root fresh weights.
[y] Data root-knot eggs/gram of root was only collected from the nematode infested field and not the control field.
[x] Significance at the 0.1, 0.05, 0.01, and 0.001 level is indicated by *, **, ***, and **** respectively
[w] values present are LS-means separated using the Tukey-Kramer method at $P \leq 0.1$. Values in the same column followed by the same letter do not differ significantly.
[v] Velum Total was applied at planting as an in-furrow spray at a rate of 1 L/ha

Effect of Starter Fertilizers, Plant Hormones, and Nematicides to Manage Reniform Nematode Damage in Alabama, 2017

D. Dyer, K. Lawrence, S. Till, W. Groover, N. Xiang, M. Rondon, and K. Gattoni

Cotton was treated with starter fertilizers, plant hormones, and nematicides to evaluate their management potential of reniform nematode damage at Auburn University's E. V. Smith Research Center, which is located near Shorter, AL. The field consists of Benndale fine sandy loam soil type (73% sand, 20% silt, and 7% clay). The trial was arranged in a randomized complete block design and contained four replications. The plots were planted on 15 May. Test plots consisted of 2 rows, that were 6 meters long with a 0.9-meter row spacing and a 1.8-meter alley between replications. Treatments of Velum Total were applied as an in-furrow spray at a rate of 1L/ha. Ascend plant growth regulator was applied as a seed treatment at a rate of 88.7 mL/cwt and a foliar spray applied 48 DAP at a rate of 0.2 L/ha. Micro-500 and Sure-k (pop-up fertilizers) were applied as an in-furrow spray at rates of 2.3 L/ha and 9.31 L/ha, respectively. Ammonium Polyphosphate (10-34-0) and 25-0-0 (starter fertilizers) were applied at planting 5 cm below and 5 cm beside the seed furrow using a G2 fertilizer disk at a rate of 37 L/ha. All plots were maintained throughout the season with standard insecticide, herbicide, and fertilizer practices as recommended by the Alabama Cooperative Extension System, and watered as needed with an overhead irrigation system. Monthly average maximum temperatures from planting in May through harvest in October were 82, 86, 91, 90, and 84.2, 77°F with average minimum temperatures of 57, 66, 70, 68, 63, and 54°F respectively. Rainfall accumulation for each month was 7.76, 7.17, 5.12, 0.16, 0.0, and 2.27 inches with a total of 22.48 inches over the entire season. Nematode population density (eggs per gram of root), plant height, and biomass (root fresh weight + shoot fresh weight) were taken 39 DAP by digging up four plants at random from each plot. Extraction of the nematode eggs from the roots was accomplished by shaking the roots in 6% NaOCl for 4 minutes and collecting the eggs on a 25-µm sieve. Seed cotton yield was collected on 4 Oct. Data were analyzed with SAS 9.4 using PROC GLIMMIX, and LS-means were compared using Tukey-Kramer's method ($P \leq 0.1$).

When samples were taken at 39 DAP application of Velum Total + pop-up fertilizers (Micro-500 and Sure-K) (7) supported the highest plant height and biomass measurements and were increased ($P \leq 0.1$) over the control (1). The highest reniform eggs/g of root were observed on the control (1). Application of Velum Total (2), Velum Total + Ascend (6), Velum Total + pop-up fertilizers (7), Velum Total + starter fertilizers (ammonium polyphosphate + 25-0-0) (8), Velum Total + Ascend + pop-up fertilizers

(11), Velum Total + Ascend + starter fertilizers (12) as well as Ascend + pop-up fertilizers (9) all reduced ($P \leq 0.1$) nematode population compared to the control (1). The highest yields were observed with the application of Velum Total + Ascend + starter fertilizers (12) and were followed closely by Velum Total + pop-up fertilizers (7), which both increased yield over the control (1) by 681 and 442 kg/ha respectively.

Treatments	Plant Height (cm)	Biomass[z] (g)	Reniform Eggs/g of Root	Yield (kg/ha)
1. Control	19.06 b[y]	11.38 d	2909 a	2655 de
2. Velum Total 1 L/ha	19.94 ab	14.68 abcd	350 cd	2701 de
3. Ascend 88.7 mL/cwt + 0.2 L/ha[x]	18.44 b	11.91 cd	2129 a	2590 e
4. Micro-500 2.3 L/ha Sure-K 9.31 L/ha	19.88 ab	12.36 cd	1032 abcd	2894 bcde
5. Ammonium Polyphosphate 37 L/ha 25-0-0 37 L/ha	20.94 ab	14.79 abc	1533 ab	3046 abc
6. Velum Total 1 L/ha Ascend 88.7 mL/cwt + 0.2 L/ha	21.13 ab	16.16 ab	485 cd	3062 abc
7. Velum Total 1 L/ha Micro-500 2.3 L/ha Sure-K 9.31 L/ha	22.56 a	16.60 a	332 cd	3097 ab
8. Velum Total 1 L/ha Ammonium Polyphosphate 37 L/ha 25-0-0 37 L/ha	20.19 ab	13.10 bcd	711 cd	2894 bcde
9. Ascend 88.7 mL/cwt + 0.2 L/ha Micro-500 2.3 L/ha Sure-K 9.31 L/ha	20.44 ab	13.38 abcd	747 bcd	2863 bcde
10. Ascend 88.7 mL/cwt + 0.2 L/ha Ammonium Polyphosphate 37 L/ha 25-0-0 37 L/ha	19.63 b	11.96 cd	935 abc	2929 bcd
11. Velum Total 1 L/ha Ascend 88.7 mL/cwt + 0.2 L/ha Micro-500 2.3 L/ha Sure-K 9.31 L/ha	18.81 b	12.32 cd	211 d	2746 cde
12. Velum Total 1 L/ha Ascend 88.7 mL/cwt + 0.2 L/ha Ammonium Polyphosphate 37 L/ha 25-0-0 37 L/ha	19.63 b	14.16 abcd	272 d	3336 a

[z] Biomass is the sum of shoot fresh weight and root fresh weights.
[y] Values present are LS-means separated using the Tukey-Kramer method at $P \leq 0.1$. Values in the same column followed by the same letter, or no letter, do not differ significantly.
[x] Treatments of Ascend were applied as a seed treatment at a rate of 88.7 mL/cwt and a foliar spray which was applied 48 DAP at a rate of 0.2 L/ha.

Effects of Starter Fertilizers, Plant Hormones, and Nematicides to Manage Reniform Nematode Damage in North Alabama, 2017

D. Dyer, K. Lawrence, S. Till, W. Groover, N. Xiang, M. Rondon, K. Gattoni, and C. Norris

Cotton was treated with starter fertilizers, plant hormones, and nematicides to evaluate their management potential of reniform nematode damage at Auburn University's Tennessee Valley Research and Extension Center (TVREC), which is located near Belle Mina, AL. The field consisted of Decatur silt loam soil type, (23% sand, 49% silt, and 28% clay). The trial was arranged in a randomized complete block design with five replications. The plots were planted on 9 May. Test plots consisted of 2 rows, 7.6 meters long with a 0.9-meter row spacing and a 1.8-meter alley between replications. Velum Total was applied as an in-furrow spray at a rate of 1 L/ha. Ascend plant growth regulator was applied as a seed treatment at a rate of 88.7 mL/cwt and as a foliar spray, which was applied 48 DAP at a rate of 0.2 L/ha. Micro-500 and Sure-K (pop-up fertilizers) were applied as an in-furrow spray at planting at rates of 2.3 L/ha and 9.31 L/ha, respectively. Ammonium Polyphosphate (10-34-0) and 25-0-0 (starter fertilizers) were applied at planting 5 cm below and 5 cm beside the seed furrow using a G2 fertilizer disk at a rate of 37 L/ha. Nematode population density (eggs per gram of root), plant height, and biomass (root fresh weight + shoot fresh weight) were determined at 44 DAP by digging up four plants at random from each plot. Extraction of the nematode eggs from the roots was accomplished by shaking the roots in 6% NaOCl for 4 minutes and collecting the eggs on a 25-µm sieve. Seed cotton yield was collected on 10 Nov. Data were analyzed with SAS 9.4 using PROC GLIMMIX and LS-means were compared using Tukey-Kramer's method ($P \leq 0.1$).

Velum Total + pop-up fertilizers (Micro-500 and Sure-K) (7) and Velum Total + starter fertilizers (Ammonium Polyphosphate and 25-0-0) (8) have a higher stand ($P \leq 0.1$) than Ascend + starter fertilizers (10), which did not contain Velum Total. In both plant height and biomass, plants were larger when treated with Ascend + the pop-up fertilizers (9) and Velum Total + Ascend + the pop-up fertilizers (11) as compared to Velum total + starter fertilizers (8) or Ascend + starter fertilizers (10). Ascend (3), pop-up fertilizers (4), and starter fertilizers (5) supported the higher ($P \leq 0.1$) reniform nematode populations compared to Velum Total (2). Velum total (2), alone, and in combination with Ascend (6) and Ascend + pop-up fertilizers (9) all reduced nematode population density by 99.3, 93.8, and 98.6%, respectively, when compared to starter fertilizers (5). Yields varied among all treatments by 1493 kg/ha with the greatest yields supported by Velum Total (2) alone and Ascend + pop-up fertilizers (9), which were increased over the control by 1,385 and 1,372 kg/ha, respectively.

Treatments	Stand[z]	Plant Height (cm)	Biomass[y] (g)	Reniform Eggs/g of Root	Yield (kg/ha)
1. Control	40 abc[x]	16.40 ab	6.52 abc	778 abcd	2758 cd
2. Velum Total 1 L/ha	41 abc	17.00 ab	8.08 ab	37 d	4143 a
3. Ascend 88.7 mL/cwt + 0.2 L/ha[w]	37 abc	17.00 ab	7.77 abc	4802 abc	3625 abc
4. Micro-500 2.3 L/ha Sure-K 9.31 L/ha	38 abc	16.75 ab	6.93 abc	4572 abc	3559 abc
5. Ammonium Polyphosphate 37 L/ha 25-0-0 37 L/ha	39 abc	15.90 ab	6.64 abc	5114 a	3319 abcd
6. Velum Total 1 L/ha Ascend 88.7 mL/cwt + 0.2 L/ha	40 abc	16.70 ab	7.53 abc	319 cd	3912 ab
7. Velum Total 1 L/ha Micro-500 2.3 L/ha Sure-K 9.31 L/ha	43 a	16.00 ab	6.77 abc	1259 abc	3092 bcd
8. Velum Total 1 L/ha Ammonium Polyphosphate 37 L/ha 25-0-0 37 L/ha	42 ab	14.60 b	5.64 c	2676 abc	3073 bcd
9. Ascend 88.7 mL/cwt + 0.2 L/ha Micro-500 2.3 L/ha Sure-K 9.31 L/ha	37 abc	17.45 a	8.85 a	71 d	4130 a
10. Ascend 88.7 mL/cwt + 0.2 L/ha Ammonium Polyphosphate 37 L/ha 25-0-0 37 L/ha	36 c	14.60 b	5.84 bc	2411 ab	2650 d
11. Velum Total 1 L/ha Ascend 88.7 mL/cwt + 0.2 L/ha Micro-500 2.3 L/ha Sure-K 9.31 L/ha	37 bc	17.15 a	8.20 a	462 abcd	3338 abcd
12. Velum Total 1 L/ha Ascend 88.7 mL/cwt + 0.2 L/ha Ammonium Polyphosphate 37 L/ha 25-0-0 37 L/ha	39 abc	15.95 ab	6.95 abc	3135 abc	3265 abcd

[z] Plant stands per 7.6-meter row.
[y] Biomass is the sum of shoot fresh weight and root fresh weights.
[x] Values present are LS-means separated using the Tukey-Kramer method at $P \leq 0.1$. Values in the same column followed by the same letter do not differ significantly.
[w] Treatments of Ascend were applied as a seed treatment at a rate of 88.7 mL/cwt and as a foliar spray at a rate of 0.2 L/ha 48 DAP

Reniform Nematode Control on Cotton Using Nematicide Combinations in North Alabama, 2017

H. Moye. Jr., K. Lawrence, N. Xiang, W. Groover, S. Till, D. Dyer, M. Foshee, K. Gattoni, M. Rondon, and C. Norris

Nematicide combinations were evaluated for reniform nematode management on Stoneville 4946 cotton. The field site is located on the Tennessee Valley Research and Education Center near Belle Mina, AL. This field has been cultivated in cotton for over 17 years and was infested with the reniform nematode in 1997. The soil is a Decatur silt loam (24% sand, 49% silt, 28% clay). The cotton seed were treated with nematicide seed treatments by Bayer CropScience. Plots were planted on 9 May with a soil temperature of 75.2°F at a 3.94 inches depth and adequate soil moisture. Plots consisted of 2 rows, 7.6 m long with 0.91 m row spacing and were arranged in a randomized complete block design with five replications. Blocks were separated by a 4.5 m wide alley. All plots were maintained throughout the season with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Plots were irrigated with a lateral irrigation system as needed. Seedling stand was determined 16 days after planting (DAP) on 25 May. Samples were collected for nematode analysis and cotton growth assessment by digging 4 random plants per plot on 13 Jun. Plant height and biomass was measured before nematode extraction. Nematodes were extracted from the root systems using 6% NaOCl and collecting the nematodes on a 25 µm sieve. Plots were harvested on 13 Nov. Data were analyzed with SAS 9.4 using PROC GLIMMIX and LS-means were compared using Tukey-Kramer's method ($P \leq 0.10$). Monthly average maximum temperatures from planting in April through harvest in Oct were 78.8, 86, 87.8, 87.8, 87.8, 82.4, and 75.2°F with average minimum temperatures of 57.2, 59, 64.4, 71.6, 69.8, 61, and 53.6°F, respectively. Rainfall accumulation for each month was 3.35, 6.02, 6.26, 6.02, 2.80, 3.82, and 3.43 inches with a total of 31.70 inches over the entire season.

Reniform nematode disease pressure was high for irrigated cotton in 2017. Plant stand ranged from 28 to 40 plants per 7.6 meter of row and all treatments had a numerical, but not statistical increase compared to Gaucho. The combination of Gaucho + CoPeO + Velum Total (6) increased plant height compared to solo Gaucho (1) numerically but not significantly. The combination of Gaucho + CoPeO + Velum Total (5) increased biomass (5) compared to solo Gaucho (1) numerically but not significantly. All treatments significantly reduced the reniform eggs compared to the Gaucho

(1). Yield was increased by the combination of Gaucho + Fluopyram + Trilex Advanced + Aeris + Velum Total (4) by 1296 kg/ha and Gaucho + Fluopyram + Velum Total (6) by 966 kg/ha over Gaucho (1) which may have been a result of the reduced nematode populations.

	Seed Treatment And Rate	Stand count[z] 16 DAP	Plant height (cm)	Total biomass (g)	*Rotylenchulus Reniformis* eggs per 4 plants 35 DAP	Seed Cotton (kg/ha)
1	Gaucho 600 (306 mL/100 kg)	28[y]	9.6	9.24	7802 a	1086 d
2	Gaucho 600 (306 mL/100 kg) + Fluopyram 600 FS (0.2 mg ai/seed)	31	10.2	10.89	2374 b	1874 abc
3	Gaucho 600 (306 mL/100 kg) + Fluopyram 600 FS (0.2 mg ai/seed) + Trilex Advanced FS300 (104.3 mL/100 kg) + Aeris (0.75 mg ai/seed)	38	9.5	9.58	3932 b	1386 cd
4	Gaucho 600 (306 mL/100 kg) + Fluopyram 600 FS (0.2 mg ai/seed) + Trilex Advanced FS300 (104.3 mL/100 kg) + Aeris (0.75 mg ai/seed) + Velum Total (321.5 g ai/ha)	33	10.7	13.47	541 c	2382 a
5	Gaucho 600 (306 mL/100 kg) + Fluopyram 600 FS (0.2 mg ai/seed) + Velum Total (578.7 g ai/ha)	33	10.7	13.99	2421 b	1901 abc
6	Gaucho 600 (306 mL/100 kg) + Fluopyram 600 FS (0.2 mg ai/seed) + Velum Total (450 g ai/ha)	33	11.3	13.71	407 c	2052 ab
7	Gaucho 600 (306 mL/100 kg) + Fluopyram 600 FS (0.2 mg ai/seed) + Velum Total (321.5 g ai/ha)	40	10.1	10.61	796 c	1647 bcd

[z] Stand count was the number of seedlings in 7.6 meters of row 16 days after planting (DAP).
[y] Values present are LS-means separated using the Tukey-Kramer method at $P \leq 0.10$. Values in the same column followed by the same letter, or no letter, do not differ significantly.

Cotton Nematicide Combinations for Reniform Nematode Management in North Alabama, 2017

H. Moye, Jr., K. Lawrence, N. Xiang, W. Groover, S. Till, D. Dyer, M. Foshee, K. Gattoni, M. Rondon, and C. Norris

Nematicide combinations were evaluated for reniform nematode management on Stoneville 4946 cotton. The field site is located on the Tennessee Valley Research and Education Center near Belle Mina, AL. This field has been cultivated in cotton for over 17 years and was infested with reniform nematode in 1997. The soil is a Decatur silt loam (24% sand, 49% silt, 28% clay). The cotton seed were treated with nematicide seed treatments by Bayer CropScience. Plots were planted on 9 May with a soil temperature of 75.2°F at a 3.94 inches depth and adequate soil moisture. Plots consisted of 2 rows and were, 7.6 m long with 0.91 m row spacing. Plots were arranged in a randomized complete block design with five replications. Blocks were separated by a 4.5 m wide alley. All plots were maintained throughout the season with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Plots were irrigated with a lateral line irrigation system as needed. Seedling stand was determined 16 days after planting (DAP) on 25 May. Samples were collected for nematode analysis and cotton growth measurements by digging up 4 random plants per plot on 13 Jun. Plant height and biomass was measured before nematode extraction. Nematodes were extracted from the root systems using 6% NaOCl and collecting the nematodes on a 25 µm sieve. Plots were harvested on 13 Nov. Data were analyzed with SAS 9.4 using PROC GLIMMIX and LS-means were compared using Tukey-Kramer's method ($P \leq 0.10$). Monthly average maximum temperatures from planting in April through harvest in Oct were 78.8, 86, 87.8, 87.8, 87.8, 82.4, and 75.2°F with average minimum temperatures of 57.2, 59, 64.4, 71.6, 69.8, 61, and 53.6°F, respectively. Rainfall accumulation for each month was 3.35, 6.02, 6.26, 6.02, 2.80, 3.82, and 3.43 inches with a total of 31.70 inches over the entire season.

Reniform nematode disease pressure was high for irrigated cotton in 2017. Plant stand ranged from 20 to 40 plants per 7.6 meter of row. The combination of Fluopyram seed treatment + Aeris + Velum Total increased plant height and biomass over all the treatments. Plant height was increased by 24.8% and biomass by 52.8% with the combination of Fluopyram + Aeris + Velum Total over the Gaucho + Cruiser + Avicta combination treatment. The combination of Fluopyram + Aeris + Velum Total reduced reniform eggs compared to the untreated control. Yield was increased by the combination of Fluopyram + Aeris + Velum Total by 639 kg/ha over the Gaucho + Cruiser + Avicta combination treatment which may have been a result of the reduced nematode populations.

	Seed Treatment and Rate	Stand count[z] 16 DAP	Plant height (cm)	Total biomass (g)	*Rotylenchulus reniformis* eggs per 4 plants 35 DAP	Seed Cotton (kg/ha)
1	Control	20 c[y]	10.86 b	6.64 b	6725 a	596 b
2	Fluopyram 600 FS (0.2 mg ai/seed)	24 bc	10.84 b	7.54 b	5410 b	890 ab
3	Aeris (0.75 mg ai/seed)	31 abc	11.82 ab	8.14 b	6935 a	1099 ab
4	Fluopyram 600 FS (0.2 mg ai/seed) + Aeris (0.75 mg ai/seed)	38 ab	11.88 ab	7.88 b	2421 b	919 ab
5	Gaucho 600 (0.375 mg ai/seed) + Cruiser 5FS (0.34 mg ai/seed) + Avicta 500FS (0.15 mg ai/seed)	29 abc	10.80 b	6.20 b	7538 a	778 b
6	Fluopyram 600 FS (0.2 mg ai/seed) + Aeris (0.75 mg ai/seed) + Velum Total (321.5 g ai/ha)	40 a	14.36 a	13.14 a	954 c	1417 a

[z] Stand count was the number of seedlings in 7.6 meters of row 16 days after planting (DAP).
[y] Means followed by same letter or symbol do not significantly differ ($P \leq .10$, Tukey-Kramer method).

Evaluation of a By-product Fertilizer to Increase Plant Growth and Decrease Reniform Population Density on Cotton in Alabama, 2017

D. Dyer, K. Lawrence, S. Till, W. Groover, N. Xiang, M. Rondon, K. Gattoni, and C. Norris

A by-product fertilizer was evaluated for its ability to increase plant growth and manage reniform nematode populations at Auburn University's Tennessee Valley Research and Extension Center (TVREC), which is located near Belle Mina, AL. The fields contain a Decatur silt loam soil type, which consists of 23% sand, 49% silt, and 28% clay. Treatments were arranged in a randomized complete block design with five replications. The plots were planted on 9 May. Test plots consisted of 2 rows, 7.6 meters long with a 0.9-meter row spacing and a 1.8-meter alley between replications. The by-product fertilizer was applied 14 days before planting as a soil drench at a rate of 1871 L/ha. Velum Total was applied as an in-furrow spray at a rate of 1 L/ha at the time of planting. Ammonium Polyphosphate starter fertilizer was applied at planting 5 cm below and 5 cm beside the seed furrow using a G2 fertilizer disk at a rate of 47 L/ha. All plots were maintained throughout the season with standard insecticide, herbicide, and fertilizer practices as recommended by the Alabama Cooperative Extension System, and watered as needed with a lateral irrigation system. Nematode population density (eggs per gram of root), plant height, and biomass (root fresh weight + shoot fresh weight) were determined at 44 DAP by digging four plants at random from each plot. Extraction of nematode eggs from roots was accomplished by shaking the roots in 6% NaOCl for 4 minutes and collecting the eggs on a 25-µm sieve. Seed cotton yield was collected on 10 November. Data were analyzed with SAS 9.4 using PROC GLIMMIX and LS-means were compared using Tukey-Kramer's method ($P \leq 0.1$). Monthly average maximum temperatures from planting in May through harvest in November were 82, 86, 91, 88, 82, 75, and 64°F with average minimum temperatures of 59, 66, 70, 68, 61, 52, and 41°F, respectively. Rainfall accumulation for each month was 6.01, 6.27, 6.04, 2.38, 3.82, 3.43, and 0.67 inches with a total of 28.62 inches over the entire season.

Plant stand ranged from 4.3 to 5.5 plants per meter of row. Plant stand was reduced when the by-product fertilizer was applied by itself compared to the plots treated with Velum Total. The combination of the by-product fertilizer + Velum Total increased ($P \leq 0.1$) plant height and biomass over all other treatments. Plant height was increased by 19% and biomass by 29% with this combination of the by-product fertilizer + Velum Total compared to Velum Total. The combination of the by-product fertilizer + Velum Total also supported the fewest reniform eggs/g of root. The by-product fertilizer, alone, also reduced reniform eggs/g of root compared to the untreated control and ammonium polyphosphate indicating that the product may be able to suppress nematode populations. Yield was significantly increased with the by-product fertilizer + Velum Total over Velum Total, alone, by 417 kg/ha of seed cotton, which may have been a result of the numerically reduced nematode populations.

Treatments	Stand[z]	Plant Height (cm)	Biomass[y] (g)	Reniform eggs/g of root	Yield (kg/ha)
Control	38 ab[x]	10.8 c	5.4 c	14122 a	659 c
By-product fertilizer 1871 L/ha	33 b	11.1 bc	7.0 c	3110 b	891 c
Ammonium Polyphosphate 47 L/ha	39 ab	11.7 bc	7.5 c	9189 a	647 c
Velum Total 1 L/ha	42 a	12.1 bc	9.9 b	1075 b	1733 b
By-product fertilizer 1871 L/ha Velum Total 1 L/ha	39 ab	14.4 a	12.8 a	587 b	2150 a
Ammonium Polyphosphate 47 L/ha Velum Total 1 L/ha	38 ab	12.7 b	10.4 b	1888 b	2017 ab

[z] Plant stands per 7.6-meter row.
[y] Biomass is the sum of shoot fresh weight and root fresh weights.
[x] Values present are LS-means separated using the Tukey-Kramer method at $P \leq 0.1$. Values in the same column followed by the same letter do not differ significantly.

Isolation of a Novel Fluorophore from Rotylenchulus reniformis (Reniform Nematode, RN)

S.W. Park and K.S. Lawrence

Objective: To identify the novel fluorophore(s) compound produced in RN.

Background: RN, parasitic soil pathogens, are of considerable economic importance. In the U.S. cotton industry, RN cause an estimated annual yield loss of >$ 100 million, needing thus an urgent breakthrough in the development of effective and sustainable disease management programs, including new resistance cultivars. It is however not necessarily forthcoming, due to a narrow genetic diversity in the cotton cultivars and germplasm, and little understanding on pathophysiology of cotton-nematode interactions.

Significance: To elucidate the molecular fingerprints in cotton-nematode interactions, our team has developed a novel imaging technique, capable of monitoring the 'real-time' responses of cotton root cells while nematode attacks. The efforts uncovered serendipitously that RN accumulate an intestinal auto fluorescent compound(s) (fluorophore, 425/525-nm) with enhanced stability (Fig. 1). The same fluorophore was also found in other plant pathogenic nematodes such as *Meloidogyne incognita* (root- knot) and *Hetoerodera glycines* (soybean cyst), and observed across their lifespan from egg to adult stages, indicating that the metabolite must be essential in the grow- th and development of nematodes. Hence, further identification and characterization of a novel fluorophore produced in nematodes will **a**) significantly enhance out know- ledge on the basic physiology and pathology of nematodes and **b**) potentially yield an original and commercially valuable fluorophore.

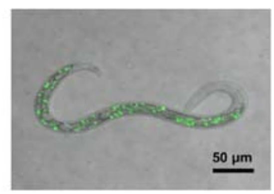


Fig 1. RN-derived autofluorophore. A live image merging the 2 different channels (DIC and FITC) of a confocal laser microscope.

Results: Currently we are in preparation of an article for the submission to Journal of Nematology which summarize the identity, biochemical and physiological properties, and uses of nematode autofluorophore.

A. High-performance liquid chromatography (HPLC) separation of RN metabolites. RN extracts were prepared by grounding them in 100% MeOH, and filtered with cheesecloths and Whatman papers. Total extracts were then separated upon their polarity by C4-column through a linear gradient of MeOH to H_2O (Fig. 2).

B. To determine HPLC fraction(s) that contain fluorophore(s), each fraction was subjected to a fluorometer (citation 3, Fig. 3), and monitored their emission spectrums; the fractions #44 and #45 displayed the highest level emission of fluorescence.

C. Liquid chromatography/mass spectrometer (LC/MS) determination of a RN - derived fluorophore. HPLC-faction #44 was further separated by a high – resolution LC column, and transferred into the MS ion source; the resulted masses suggested total 12 compounds in the fraction #44. We then further pinpointed and ion ,masses of a single fluorescence compound; the masses determined were finally assembled to draw a final structure (Fig. 4).

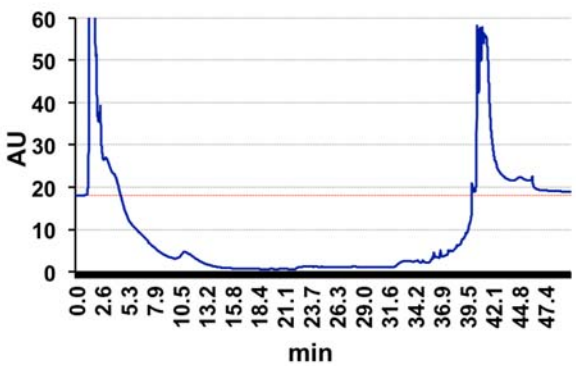


Fig 2. HPLC separation of total RN metabolites. Elutes were collected by every min.

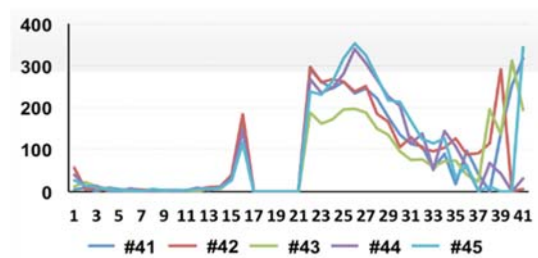


Fig 3. Average fluorescence intensity of HPLC fractions

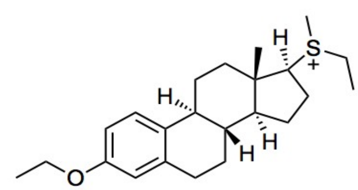


Fig 4. Structure of RN-derived fluorophore

Future direction: In developing the resistant cotton cultivars; to access in the molecular and cellular levels how do cottons **a**) respond and **b**) defend against nematode infec- tions, the properties and potential uses RN-derived fluorophore in cell labeling will be further characterized. In addition, we will continue utilizing the RN auto-fluorescence in co-imaging '**real-time**' interactions between cot- ton roots and nematodes. Note that we have already used a confocal laser scanning microscope (Nikon), and successfully attempted to feed '**live'** images in a single cell level of cotton roots, and their interactions to other organisms. This study will **i**) address the **innate immunity** of cotton plants toward RN, **ii**) deposit genetic reper- toires in cotton's own disease resistance capacity, and **iii**) substantiate if cotton roots (i.e., Lonren-1 line) are able to confer hypersensitive responses (**HR**) upon RN infections, which are the most eminent and effective defense machinery in plants.

Isolation of a Root Signal Attracting a Semi-Endoparasite Nematode, Rothlenchulus reniformis

S. W. Park and K. Lawrence

Objective: To determine whether the cotton plants produce underground signal chemicals in the short- distance communication with parasitic phytonematodes.

Background: Cotton is a major moneymaker throughout the southern regions of U.S., **a**) producing a yearly average of 17-milion bales (~$ 25B) and **b**) creating >200,000 jobs (Plant Dis 88:100). Its production and mar- ket sustainability are however significantly hindered by various environmental and pathogen challenges. For instance, parasitic nematodes cause more than $ 3B worth of crop losses annually, while reniform nematodes (RN) are the most destructive type In the U.S. accounting for $ 130M in annual losses (Bayer Global). However, a present pest management program lacks **i**) resistant cultivar, **ii**) effective rotation crop, and **iii**) low cost nematicide, therefore in urgent need of efficacious and sustainable IPM program(s) to control increasing nema- tode-associated diseases and damages, but it is not necessarily forthcoming.

Significance: It has long been proposed that chemotaxis is primary means by which nematodes locate host plants, as they are motile animals undulating in the dorsal ventral direction. Nematodes develop longitudinal muscles and a thick cuticle as a hydrostatic skeleton, used for their locomotion - commonly referred to move ~1 meter through the soil within their lifetime. However, it is still elusive if the movement of phytonematodes **a**) is autonomous or needs environmental matrices such as water, wind, insects and/or animals, or **b**) targets delib- erately towards specific host plants (chemical attractants) or reach ho Recently, our studies have hinted an activity of cotton root exudates to signal RN (Innovative Techniques in Agriculture 1.2:83). Hence, discovery of signal molecules will not only increase our basic understanding on plant-nematode interactions, but also assist in developing unique strategies and resources to control nematode disease, by e.g.) **i**) generating transgenic GM cottons impairing signal productions, or **ii**) screening chemical inactivators of the signal metabolites.

Results: In 2017, we published **an Alabama Cotton Commission** supported article, entitled "Underground mystery: the role of chemotactic attractant in plant roots and phytonematode interactions”, in the Innovative Techniques in Agriculture (1.2:83, see an acknowledgement at page #86 in the attached article), and are lately in preparation of another article for the submission to Journal of Nematology. This article will report the first- time evidence that prove a century old hypothesis; plant nematodes **a**) sense specific chemical attractants and host plants, and **b**) move autonomously in a short distance. For instance, RN (as well as root-knot nematode, *Meloidogyne incognita*) can recognize and sense root exudates prepared from cotton and soybean, but not peanut, roots (Fig. 1 and Table 1).

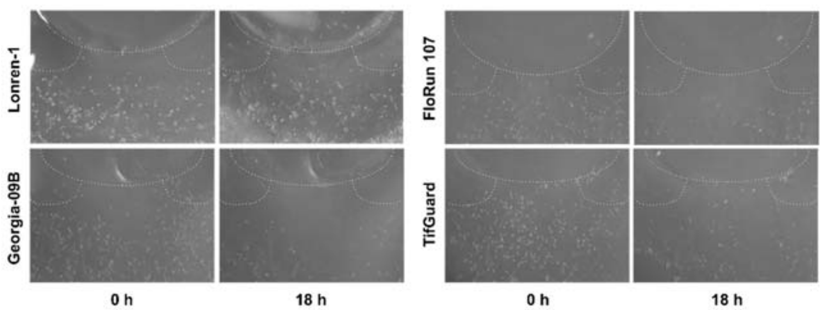


Figure 1. *R. reniformis* selectively respond to cotton but not peanut root exudates. The behavior and motility of RN upon the application of root exu-dates collected from 3- wk old com-mercial cotton (Lonren-1) and peanut varieties (Georgia-09B, FloRun 1078 and TifGuard). Representative photo-graphs were taken at 0 and 18 hr, and dotted lines draw the shape of volcano mountains.

Table 1. Chemotaxis analyses of *R. reniformis* and *M. incognita* towards roots exudates prepared from cotton, soybean and peanut roots. In each assay, nematodes displaced on the volcano decks were counted in 18 hr post application of 500 nematodes and 20 µL of root exudates

Nematode	name	# displaced on the deck			
		cotton exudates	soybean	peanut	water
R.reniformi	reniform	10 ± 3.2	8 ± 2.5	0	0
M.	root-knot	15 ± 4.6	17 ± 5.5	0	1 ± 1.4

Future direction: We will employ the high-performance liquid chromatography and the liquid chromato- graphy mass spectrometer, and identify an RN and root-knot-derived attractant(s) from cotton and soybean root exudates.

Underground Mystery: The Role of Chemotactic Attractant in Plant Roots and Phytonematode Interactions

H. N. Gosse, K. S. Lawrence, and S. W. Park

Phytonematodes are microscopic roundworms that develop an obligate parasitic relationship with plant hosts. Once they reached the root surface, they slowly insert a stylet, needle-like structure, and feed cytosolic nutrients from root hairs, which cause cell and tissue mo- tility (Mitchum., *et al.* 2013, Fous-Nyarko and Jones 2016). In the modern agriculture, the phytonematode diseases have become of great economic importance causing an estimated annual loss of 10 percent of world crop production (Nicol., *et al*. 2011), thus needing an urgent breakthrough in developing effective and sustainable disease management programs such as new resistance cultivars. It is however not necessarily forthcoming, largely due to our little knowledge of the pathophysiology of phytonematodes. Hence this editorial will briefly revisit current information gaps, and introduce our new studies in the mode of interactions between plant roots and phytonematodes, which help revamp unique and alternative prospective in future studies.

Recent increases in agronomic burden by Phytonematodes

Plant parasitic nematodes, belonging to the phylum Nematoda, are microscopic animals that have evolved to over 4,000 species and adapted to a broad range of environment from forests to oceans (Nicol., *et al.* 2011, Hodda 2011, Zhang 2013). Previously, many - if not most - of them were viewed as benign or non-damaging, but recent reports have recognized that selective species such as *Rotylenchulus* spp. *Meloidogyne* spp. and *Heterodera* spp., are agronomical important pests, attributing the annual losses of crop production at ~14 % in worldwide (Nicol 2002, Nicol., *et al.* 2011). For instance, R. *reniformis* (reniform nematodes) have become a major threat over the last decade towards cotton farming in the southern regions of the U.S., leading to an estimated yield loss of over $100 million annually. Cot- ton is the most important fiber producing crop of which its production in the U.S. accounts for about one quarter of the world supply (~ $25 billion values, Koenning., *et al*. 2004,), and creates over 200,000 jobs (NCCA 2015). However, the currently available integrated pest management method against phytonematodes (IPM-N) is limited to the casual application of toxic pesticides, which in turn has caused numerous unexpected ecological, economic and social drawbacks. Hence in order to develop more efficacious and sustainable IPM-N, a large number of efforts have made over the past 10 years to understand the pathophysiology of plant-nematode interactions, but our knowledge regarding i) the pathogenicity of phytonematodes and ii) the defense responses of host plants against phytonematodes are still rudimentary, compared to other plant-microbial pathogen interactions.

Current update on plant-nematode interactions

The current working model of plant - nematode interactions is built on the basis of two major hypotheses that i) phytonematodes use chemotaxis to sense and direct towards host plant roots, and ii) plant roots operate essentially similar - if not the same - defense mechanisms against phytonematodes as do plant leaves against other microbial and herbivore pathogens. Indeed, a single dominant gene (*Mi-1*) conferring resistance against the root-knot nematode *Meloidogyne* spp. was isolated over half a century ago from a tomato relative (*Lycopersicon peruvianum*, Bailey 1941). Since then, the major research goals of plant-nematode interactions have focused on espying phytonematode-derived avirulence (*avr*)-genes (also called effectors) that bind and trigger resistance (R)-gene (i.e. *Mi-1*)- mediated resistance (also called effector-triggered immunity, ETI). However, the identity of phytonematode-derived *avr-gene* is - if it is present - still elusive. Instead, several studies have proposed a pivotal role of phytonematode-derived cell wall degrading enzymes (CWDE, sugar hydrolases) in host plant defense responses, although their modes of action are not yet understood (Mitchum., *et al*. 2013, Fosu-Nyarko and Jones 2016). On the other hand, a recent study has underpinned that phytonematodes secrete conserved molecules, so called ascarosides that are capable of eliciting PAMP (pathogen-associated molecular pattern) responses (referred to PAMP- trig- gered immunity, PTI, or basal resistance) in various plants (Manosalva., *et al.* 2015). Although the cognate pattern recognition receptors (PRRs) of ascarosides are yet to be identified, this finding reveal the perception of PAMPs and other molecular patterns converges on triggering plant immunity. In addition, these results perhaps shed new light on an actual role of phytonematode-derived CWDE which could activate the production of damage-associated molecular patterns (DAMP, Gillet 2017), instead of targeting to nucleotide binding domain leucine rich repeat (NB-LRR) proteins leading to ETI. DAMP then target PRRs and induce several downstream signaling events during plant immune responses (Seong and Matzinger, 2004).

Underground talks between plant roots and phytonematodes

It has long been speculated that chemotaxis is primary means by which Phytonematodes locate host plants (Curtis 2008), as they are motile animals undulating in the dorsal ventral direction (snake-like motion, Backholm., *et al.* 2013). Phytonematodes develop lon- gitudinal muscles, and a thick cuticle that molts which serves as a hydrostatic skeleton used for locomotion, commonly referred to move ~1 meter through the soil within their lifetime (Davis and MacGuidwin 2000, Moore., *et al.* 2010). However, it is unclear if the movement of phytonematodes i) is autonomous or needs environmental matrices such as water, wind, insects and/or animals, or ii) targets towards specific chemical attractants (host plants) or reach host plants opportunistically via environmental matrices.

Thus far, at least 50 different nematode motility or chemotaxis assays have been carried out via employing agar gel, pluronic F-127 gel, natural sand and soil as migration matrices, which displayed that phytonematodes are responsive to CO_2, pH and electrical gradi- ents (Fosu-Nyarko and Jones 2016). However, considering that each phytonematode species only targets a selective group of host, but not non-host, plant species (Nicol., *et al.* 2011), it is quite feasible to hypothesize that phytonematodes are able to perceive and locate chemotactic compounds originated from root cap slime or cells sloughed from the roots. One well-studied example of an attractant is the volatile (E)-β-caryophyllene emitted by the maize roots in response to feeding by the larvae of the Western corn rootworm (WCR) (Rasmann., *et al.* 2005, Degenhardt., *et al.* 2009). This volatile is highly attractive to an entomopathogenic nematode, *H. megidis*, which parasitizes and kills WCR within a few days (Degen., *et al*. 2004, Rasmann., *et al*. 2005). These studies illustrate the signaling role of root- derived allelochemicals which are likely to be involved in plant-nematode interactions. Therefore, to further substantiate the hy- pothesis, we recently have developed a novel nematode chemotaxis assay using an agar assay plate of which surface a) is hydrophilic (0.02% agar, Figure 1A) enough to evade the surface tension of nematodes (adhesion, shown in e.g. 0.1% agar; Figure 1B), and b) forms the shape of a volcano in the middle [Figure 1C]. Phytonematodes (e.g. reniform nematodes) are then placed around the slope of vol- cano, and their motilities are monitored in response to plant-derived compounds introduced on the top of volcano [Figure 1D]. Note that nematodes and plant compounds are closely positioned, but yet not directly contact each other.

Exudates from cotton roots signal and attract reniform nematodes

As shown in Figure 1E as a control experiment, reniform nematodes were gradually slid away from the top once water is placed on there, because of gravity on the slope. In contrast, reniform nematodes stayed on the slope, and/or crawled up to the top upon the appli- cation of cotton root exudates (Figure 2B), underpinning that cotton roots secret underground chemotactic attractants seduce reniform nematodes. On the other hand, reniform nematodes exhibited little if any response to the extracts and exudates prepared from non-host plants such as peanut (data not shown), concurring with the conclusion that phytonematodes are able to i) recognize chemotactic at- tractants, ii) specific allelochemicals released from host plant roots to rhizosphere, and iii) travel autonomously towards the origins.

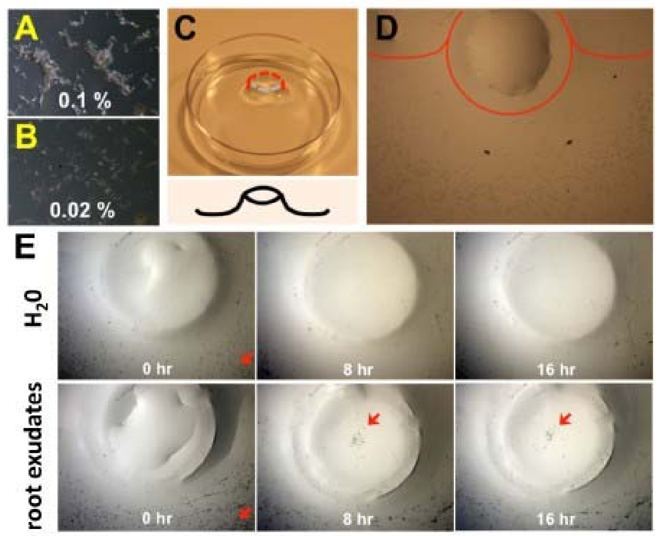


Figure 1: Exudates from cotton roots signal and attract reniform nematodes. (A to E) Establishment and optimization of novel nematode chemotaxis assay. Since nematodes formed a cluster on a normal agar concentra- tion plate (A), agar concentrations were lowered to 0.02 % (w/v) maintain a plate surface hydrophylic (B) with the shape of a volcano in the middle (C) where the chemical of interests were applied on the top, while nematodes were placed around the slope of a volcano mountain (D). Red line outlines the shape of a volcano. (E) Following the application of H_2O (upper panel) and root exudates prepared from 2 wk grown cottons (lower panel), the motility and movement of reniform nematodes were monitored every hr, and representa- tive photographs were taken at 8 and 16 hr via the high-definition color camera (Nikon DS-Fi1) attached to the Zoom Stereomicroscope system (Nikon SMZ1500). Red arrows indicate reniform nematodes.

Concluding Remarks

Given the considerable economic impact of phytonematodes on global crop yields, the development of unique and effective IMP for disease control requires particular attention (Gillet., *et al.* 2017). In line with this scenario, discovery of the chemotactic attractant(s) will not only increase our basic understanding on plant-nematode interactions, but also provide key resources in genetic engineering or molecular breeding approaches to upgrade the plants' own defense capacities, which in turn maximize the yield and survival for food, fiber or biofuel crops. Recent studies of ours [Figure 1] and other groups (Reynolds., *et al*. 2011 Hinda., *et al*. 2015) have finally started to corroborate a half-century old hypothesis that "phytonematodes recognize and infect target plants through hijacking root-released allelochemicals in perhaps rootrhizosphere interactions". In particular, the results obtained from the studies of cotton root reniform nematode interactions [Figure 1] will serve as an outset to finally reveal the chemical identity of chemotactic attractant(s) as e.g.) our following studies have employed the preparatory high-performance liquid chromatography analysis to profile the reniform nematode attractant activity of metabolic compounds separated from cotton root exudates. Information collected from these studies will develop a protocol to disrupt or neutralize plant root-phytonematode (e.g. cotton root-reniform nematode) interactions by i) further delineat- ing the biosynthetic pathways of chemotactic attractant(s), ii) which then allows us to generate transgenic GM plants knocking down the biosynthetic pathways, or alternatively iii) screening chemical antidotes to the attractant(s); together help improve the economic and environmental sustainability of agriculture.

Acknowledgement

We thank William Groover for the steady supply of *R. reniformis*. This work was supported in part by the Alabama Agricultural Ex- periment Station (S.W.P), the Hatch program of the National Institute of Food and Agriculture, USDA (S.W.P.), and the Alabama Cotton Commission (S.W.P.).

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Evaluation of BioST Nematicide for Root-Knot Nematode Management on Cotton in Central Alabama, 2017

N. Xiang, K. Lawrence, W. Groover, S. Till, D. Dyer, K. Gattoni, M. N. Rondon, and M. Foshee

The nematicide BioST was evaluated along with SAR, Orthene, and an Experimental for the management of root-knot nematode on cotton in a naturally infested field at Plant Breeding Unit of the E. V. Smith Research Center near Tallassee, AL. The soil is Kalmia loamy sand with 80% sand, 10% silt, and 10% clay. Seeds treated with basic fungicide and insecticide and Avicta + Vibrance & IMD were used as controls. The nematicides BioST, SAR, Orthene, and Experimental 203 were applied as seed treatments. Plots consisted of 2 rows, 7 m long with 0.9 m spacing and were arranged in a randomized complete block design with five replications. Blocks were separated by a 6 m wide alley. All plots were maintained with standard herbicide, insecticide, and fertility production practices throughout the season as recommended by the Alabama Cooperative Extension System. The trial was planted on 25 Apr. Plant growth parameters including seedling stand and plant survival at 21 days after planting (DAP), plant height, shoot fresh weight, and root fresh weight were measured at 35 DAP. Root-knot nematode egg counts were obtained from four whole root systems per plot at 35 DAP. Plots were harvested on 17 Oct. Data were analyzed by ANOVA using PROC GLIMMIX with SAS 9.4 (SAS Institute, Inc., Cary, NC) and means compared with the Tukey-Kramer method at the significant level of 0.1. Monthly average maximum temperatures from planting in April through harvest in October were 80.6, 82.4, 86, 91.4, 91.4, 84.2, and 77°F with average minimum temperatures of 53.6, 57.2, 66.2, 69.8, 69.8, 62.6, and 53.6°F, respectively. Rainfall accumulation for each month was 3.26, 7.74, 7.15, 5.12, 0.41, 0.00, and 2.27 inches with a total of 25.95 inches over the entire season. The rainfall was adequate in May, June, and July but became limited through the remainder of the season. Temperatures were normal over this season for heat units.

Plant stand ranged from 39 to 48 per 7 m of row and percent survival ranged from 52% to 64% which were similar among all the treatments. The BioST 8 oz/a, BioST 10 oz/a, BioST 8 oz/a + Exp, and Avicta + Vibrance & IMD increased plant height compared to BioST 8 oz/a + SAR ($P \leq 0.1$). Shoot and root fresh weights were similar among all the treatments. Root-knot nematode population density was high for the 2017 growing season. The BioST 8 oz/a, BioST 8 oz/a + Exp, and Avicta + Vibrance & IMD significantly reduced root-knot nematode eggs per gram of root (eggs/gr) ($P \leq 0.1$) compared to the BioST 8 oz/a + SAR. BioST 10 oz/a enhanced seed cotton yield by 167 kg/ha followed by Avicta + Vibrance & IMD enhanced by 96 kg/ha and BioST 8 oz/a + SAR EEFAL enhanced by 79 kg/ha over the basic fungicide and insecticide control.

		21 DAP	21 DAP	35 DAP	35 DAP	35 DAP	35 DAP	172 DAP
No.	Treatment[z]	Stand[y]	Survival[x]	Plant height (cm)	Shoot fresh weight (g)	Root fresh weight (g)	*Meloidogyne incognita* eggs/gr[w]	Seed cotton yield (kg/ha)[v]
1	Fungicide & Insecticide	41	55	10.5 ab	8.5	1.9	5636 ab[u]	675
2	BioST 8 oz/a	39	52	12.3 a	14.1	2.8	2222 b	706
3	BioST 10 oz/a	48	64	11.8 a	13.4	2.8	4997 ab	842
4	BioST 8 oz/a + SAR	40	53	8.2 b	10.0	2.5	8951 a	754
5	BioST 8 oz/a + Orthene	48	64	11.2 ab	13.3	3.0	5315 ab	627
6	BioST 8 oz/a + Exp	43	58	11.7 a	12.3	2.7	2016 b	676
7	Avicta +Vibrance & IMD	42	56	11.4 a	10.8	2.2	1839 b	771

[z]Treatments included a base fungicide & insecticide, Avicta + Vibrance & IMD as industry standards and the application rates were as labeled.
[y]Stand was the number of seedlings in 7 meter of row.
[x]Survival was the percentage of plant survival at 21DAP divided by total number of seeds planted multiply by 100.
[w]*Meloidogyne incognita* eggs/g root means root-knot nematode in 4 root systems.
[v]Data were analyzed by ANOVA using PROC GLIMMIX with SAS 9.4 (SAS Institute, Inc., Cary, NC) and means compared with Tukey-Kramer at $\alpha \leq 0.10$.
[u]Means followed by same letter do not significantly differ according to Tukey-Kramer method ($P \leq 0.10$).

Evaluation of BioST Nematicide for Reniform Nematode Management on Cotton in North Alabama, 2017

N. Xiang, K. Lawrence, W. Groover, S. Till, D. Dyer, K. Gattoni, M. N. Rondon, and M. Foshee

The nematicide BioST was evaluated along with SAR, Orthene, and an Experimental for the management of reniform nematode on cotton in a field at the Tennessee Valley Research and Education Center in Belle Mina, AL. The soil is a Decatur silt loam (24% sand, 28% clay, and 49% silt). Seeds treated with a basic fungicide and insecticide, Fluopyram, and Avicta + Vibrance & IMD were used as controls. The nematicide BioST, SAR and the Experimental were applied as seed treatments. Plots consisted of 2 rows, 7 m long with 0.9 m spacing and were arranged in a randomized complete block design with five replications. Blocks were separated by a 6 m wide alley. All plots were maintained with standard herbicide, insecticide, and fertility production practices throughout the season as recommended by the Alabama Cooperative Extension System. The trial was planted on 9 May. Plant growth parameters including seedling stand at 16 days after planting (DAP), plant height, shoot fresh weight, and root fresh weight at 35 DAP were evaluated. Reniform nematode egg counts were obtained from four whole root systems per plot at 35 DAP. Plots were harvested on 13 Nov. at 188 DAP. Data were analyzed by ANOVA using PROC GLIMMIX with SAS 9.4 (SAS Institute, Inc., Cary, NC) and means compared with Tukey-Kramer at the significant level of 0.1. Monthly average maximum temperatures from planting in April through harvest in October were 80.6, 82.4, 86, 91.4, 91.4, 84.2, and 77°F with average minimum temperatures of 53.6, 57.7, 66.2, 69.8, 69.8, 62.6, and 53.6 °F, respectively. Rainfall accumulation for each month was 3.26, 7.74, 7.15, 5.12, 0.41, 0.00, and 2.27 inches with a total of 25.95 inches over the entire season. The rainfall was adequate in May, June, and July but became limited through the remainder of the season. Temperatures were normal over this season for heat units.

Plant stand ranged from 28 to 35 plants per 7 m of row at 16 DAP. Fluopyram significantly increased plant height as compared to BioST 8 oz/a and 10 oz/a, and BioST 8 oz/a + Exp and plant shoot fresh weights as compared to BioST 8 oz/a and BioST 8 oz/a + Exp ($P \leq 0.1$) at 35 DAP. The reniform nematode population density was high during the 2017 growing season. Reniform nematode eggs per gram of root (eggs/gr) were statistically similar among all the treatments. Fluopyram significantly increased seed cotton yield by 709 kg/ha as compared to the basic fungicide & insecticide followed by Avicta + Vibrance & IMD which enhanced yield by 564 kg/ha and BioST 8 oz/a + SAR which enhanced yield by 423 kg/ha.

		16 DAP	35 DAP	35 DAP	35 DAP	35 DAP	188 DAP
No.	Seed Treatment[z]	Stand[y]	Plant height	Shoot fresh weight /g	Root fresh weight /g	*Rotylenchulus reniformis* eggs/gr[x]	Seed cotton yield (kg/ha)[w]
1	Fungicide & Insecticide	34	9.6 ab	6.2 ab	1.0	29,185	523 b[v]
2	BioST 8 oz/a	28	9.1 b	5.4 b	1.0	9,420	778 ab
3	BioST 10 oz/a	35	9.3 b	6.2 ab	1.0	13,982	675 ab
4	BioST 8 oz/a + SAR	34	10.1 ab	7.2 ab	1.2	25,606	946 ab
5	BioST 8 oz/a + Orthene	35	9.9 ab	6.7 ab	1.0	18,925	871 ab
6	BioST 8 oz/a + Exp	28	9.2 b	5.7 b	1.1	18,746	896 ab
7	Fluopyram	32	11.1 a	8.9 a	1.3	10,961	1,233 a
8	Avicta +Vibrance & IMD	29	10.3 ab	7.5 ab	1.3	20,139	1,087 ab

[z]Treatments included a base fungicide & insecticide, Fluopyram, Avicta + Vibrance & IMD as industry standards and the application rates were as labeled.
[y]Stand was the number of seedlings in 7 meter of row.
[x]*Rotylenchulus reniformis* eggs/gr means reniform nematode in 4 root systems.
[w]Data were analyzed by ANOVA using PROC GLIMMIX with SAS 9.4 (SAS Institute, Inc., Cary, NC) and means compared with Tukey-Kramer at $\alpha \leq 0.10$.
[v]Means followed by same letter do not significantly differ according to Tukey-Kramer method ($P \leq 0.10$).

Evaluation of Cotton Nematicide Combinations and Rates for Reniform Nematode Management in Northern Alabama, 2017

K. Gattoni, N. Xiang, K. S. Lawrence, W. Groover, S. Till, D. Dyer, M. N. Rondon, and M. Foshee

Vortex FL, Proline 480SC, Fluopryam 600S, Trilex Advanced FS300, Aeris Seed Applied System, and Velum Total were evaluated for reniform nematode management on cotton at the Tennessee Valley Research Center in Belle Mina, AL. The field was infested with the reniform nematode in 2007 and has been continuously cultivated in cotton. The soil is a Decatur silt loam soil consisting of 24% sand, 28% clay, and 49% silt. Seed treatments were supplied by Bayer Crop Science. Seeds were sown in plots that consisted of 2 rows, 7.3 m long with 1.0 m row spacing on 9 May. Velum Total was applied as an in furrow spray at 0.7 L/ ha, 1 L/ha and 1.3 L/ha depending on treetment. Plots were arranged in a random complete block design with five replications. Plots were maintained through the season with standard herbicide, insecticide and fertility production practices as recommended by the Alabama Cooperative Extension System, and a lateral overhead irrigation system was used for watering as needed. Plant height, biomass, and nematode population data were collected at 35 DAP.. Nematodes were measured by extracting eggs from 4 root systems using 6% NaOCl collected on a 25-um sieve, and recorded as total eggs per gram of root. Plots were harvested on 13 Nov. Data was analyzed in SAS 9.4 (SAS Institute Inc.) by using Glimmix procedure with $P \leq 0.1$. Monthly maximum temperatures from planting in April through November were 26, 80.6, 82.4, 86, 91.4, 91.4, 84.2, 77, and 66.4°F with average minimum temperatures 53.6, 57.2, 66.2, 69.8, 69.8, 62.6, 53.6, and 53.6 °F respectively. Rainfall accumulation for each month was 3.35, 6.02, 6.26, 6.02, 2.79, 3.82, 3.43, and 0.67 inches with a total of 32.37 inches, over the whole season.

Reniform nematode populations were relatively high in 2017 with adequate rainfall all season. The monthly temperatures were cooler than average with no monthly maximum reaching over 38°C. The largest biomass, numerically, was observed in Proline + Fluopyram + Velum Total 18 oz/A (No. 5) with the second largest being Proline + Fluopyram + Velum Total 14 g oz/A (No. 6). Reniform nematode eggs per gram of root was reduced ($P \leq 0.1$) in Proline + Fluopyram + Trilex Advanced + Aeris Seed Applied System + Velum Total 10 oz/A (No. 4) and Proline + Fluopyram + Velum Total 14 oz/A (No. 6) compared to Vortex FL (No. 1). Seed cotton yield was significantly higher ($P \leq 0.1$) in Proline + Fluopyram + Trilex Advanced + Aeris Seed Applied System + Velum

Total 14 oz/A (No. 4), Praline + Fluopyram + Velum Total 14 oz/A (No. 6), Proline + Fluopyram + Velum Total 18 oz/A (No. 5), and Proline + Fluopyram (No. 2) compared to Vortex FL (No. 1). The highest yield was obtained from Proline + Fluopyram + Trilex Advanced + Aeris Seed Applied System + Velum Total 10 oz/A (No. 4) with Proline + Fluopyram + Velum Total 14 oz/A (No. 6) having the second highest yield and Vortex FL (No. 1) having the lowest yield.

No.	Treatment[z]	35 DAP		35 DAP	
		Plant Height[y]	Biomass[x]	RR eggs/g root[w]	Yield[v]
1	Vortex FL 2.5 g ai/seed	9.62	13.39	3695 a[u]	1086 d
2	Proline 480SC 5 g ai/seed Fluopyram 600FS 0.2 mg ai/seed	10.16	12.96	1162 ab	1874 abc
3	Proline 480SC 5 g ai/seed Fluopyram 600FS 0.2 mg ai/seed Trilex Advanced FS300 104.3mL/100kg Aeris Seed Applied System 0.75 mg ai/seed	9.48	11.49	1944 ab	1386 cd
4	Proline 480SC 5 g ai/seed Fluopyram 600FS 0.2 mg ai/seed Trilex Advanced FS300 104.3mL/100kg Aeris Seed Applied System 0.75 mg ai/seed Velum Total 10 oz/A	10.72	15.66	239 b	2382 a
5	Proline 480SC 5 g ai/seed Fluopyram 600FS 0.2 mg ai/seed Velum Total 18oz/A	10.68	16.54	772 ab	1901 abc
6	Proline 480SC 5 g ai/seed Fluopyram 600FS 0.2 mg ai/seed Velum Total 14 oz/A	11.28	16.03	131 b	2052 ab
7	Proline 480SC 5 g ai/seed Fluopyram 600FS 0.2 mg ai/seed Velum Total 10 oz/A	10.12	12.52	342 ab	1647 bcd

[z]In all treatments seeds were treated with calcium carbonate 500 g/100kg, suspending agent 25 g/100kg, color coat white 130.4 mL/100kg, Spera 120.6 ml/100 kg, Pro-Ized blue colorant 62.5 m:/100kg, Secure Plus Seed Gloss 661 652mL/100kg Evergol Prime 5g ai/100 kg, Allegiance FL 28.9 mL/100kg, and Gaucho 306 mL/100kg
[y]Plant height was measured in millimeters
[x]Biomass is the shoot fresh weight plus the root fresh weight in grams.
[w]RR eggs/g root means reniform nematode eggs per gram of root from 4 root systems.
[v]Yield was measured in kg/ha
[u]Means followed by same letter do not significantly differ according to Tukey's method ($P \leq 0.10$).

Evaluation of Cotton Nematicide Combinations for Reniform Nematode Management in Northern Alabama, 2017

K. Gattoni, N. Xiang, K. S. Lawrence, W. Groover, S. Till, D. Dyer, M. N. Rondon, and M. Foshee

Fluopryam 600FS, Aeris Seed Applied System, Gaucho, Cruiser5 FS, and Avicta 500FS were evaluated for reniform nematode management on cotton at the Tennessee Valley Research Center in Belle Mina, AL. The soil is a Decatur silt loam soil consisting of 24% sand, 28% clay, and 49% silt. Seed treatments were supplied by Bayer Crop Science. Seeds were sown in plots that consisted of 2 rows, 7.3 m long with 1.0 m row spacing on May 9, 2017. Plots were arranged in a randomized complete block design with five replications. Plots were maintained through the season with standard herbicide, insecticide and fertility production practices as recommended by the Alabama Cooperative Extension System. Stand counts were observed and recorded 16 days after planting (DAP). Vigor ratings, plant height, shoot fresh weight, and root fresh weight were measured and recorded at 35 DAP. Nematodes were measured by extracting eggs from 4 root systems per plot at 35 DAP. Plots were harvested on November 13, 2017. Data was analyzed in SAS 9.4 (SAS Institute Inc.) by using Glimmix procedure with $P \leq 0.1$. Monthly maximum temperatures from planting in April through November were 26, 80.6, 82.4, 86, 91.4, 91.4, 84.2, 77, and 66.4°F with average minimum temperatures 53.6, 57.2, 66.2, 69.8, 69.8, 62.6, 53.6, and 53.6 °F respectively. Rainfall accumulation for each month was 3.35, 6.02, 6.26, 6.02, 2.79, 3.82, 3.43, and 0.67 inches with 32.37 inches, over the whole season.

The rainfall during May to November was substantial for the 2017 growing season. The monthly temperatures were cooler than average with no monthly maximum reaching over 38°C. Stand count at 16 DAP was higher ($P \leq 0.1$) for Fluopyram + Aeris + Velum Total than Fluopyram and the control Vigor at 35 DAP was lower ($P \leq 0.1$) in the Fluopyram + Aeris + Velum Total combination) than the control. Shoot and root fresh weigh were significantly higher in the Fluopyram + Aeris + Velum Total combination than the control. Reniform population densities were substantial at 35 DAP. The number of reniform nematode eggs per gram of root was significantly lower in the Gaucho + Cruiser + Avicta seed combination compared to the control, Fluopyram and Gaucho + Cruiser + Avicta combination. Yield was significantly higher in the Fluopyram + Aeris + Velum Total combination compared to the control with an increase in yield of 821 kg/ha.

Treatment[z]	16 DAP	35 DAP				*Rotylenchulus reniformis* (35 DAP)	Cotton yield
	Stand count[y]	Vigor[x]	Plant height[w]	Shoot fresh weight[v]	Root fresh weight[v]	RR eggs / g root[u]	kg/ha
Control	20 c[t]	3.4 a	10.9 b	6.6 b	0.8 b	8665 a	596 b
Fluopyram 600FS 0.2 mg ai/seed	24 bc	3.2 ab	10.8 b	7.5 b	0.8 ab	8250 a	890 ab
Aeris 0.75 mg ai/seed	31 abc	3.2 ab	11.8 ab	8.1 ab	0.9 ab	8575 ab	1099 ab
Aeris 0.75 mg ai/seed Fluopyram 600FS 0.2 mg ai/seed	38 ab	3.0 ab	11.9 ab	7.8 ab	1.1 ab	3336 ab	919 ab
Gaucho 0.375 mg ai/seed Cruiser 5FS 0.34 mg ai/seed Avicta 500FS 0.15mg ai/seed	29 abc	3.4 a	10.8 b	6.2 b	0.8 ab	9496 a	779 ab
Fluopyram 600FS 0.2 mg ai/seed Aeris 0.75 mg ai/seed Velum Total 10 oz/A	40 a	2.4 b	14.4 a	12.1 a	1.5 a	538 b	1417 a

[z]Nematicide treatments include calcium carbonate 500 g/100kg, suspending agent 25 g/100kg, color coat white 130.4 mL/100kg, Spera 120.6 ml/100 kg, Proline 480SC 5 g ai/100 kg, Secure Plus Seed Gloss 661 652mL/100kg, Evergol Prime 5g ai/100 kg, Allegiance FL 28.9 mL/100kg
[y]Stand was the number of seedlings in 5 feet of row
[x]Vigor was rated on a 1-5 scale with 5 being the best vigor rating.
[w]Plant height was measured in millimeters
[v]Shoot fresh weight and root fresh weight were measured in grams
[u]RR eggs / g root means reniform nematode eggs per gram of root from 4 root systems.
[t]Means followed by same letter do not significantly differ according to Tukey's method ($P \leq 0.10$).

VII. Extras

AAES, ACES, Animal Science, CSES, & Horticulture Leadership Team

D. Monks, L. Kriese-Anderson, G. Pate, S. Scott, J. Burkett, C. Smith, C. Hicks, and P. Mask

Amount granted. $6,000 each from Alabama Cotton Commission, AL Wheat & Feed Grains, & AL Soybean Producers

Objective.

Provide educational awareness of how traditional Alabama agriculture has changed through science, research, and advanced production technologies.

Activities & purpose

1. Educate urban and suburban Alabamians, 3 to 4 generations removed from Ag, about how their food and fiber are produced;
2. Showcase career opportunities in agriculture and how bright young minds have a future in developing food security and supply;
3. "Hands-on" demonstrations included:
    a. Pollination garden – importance of pollinators and other beneficial insects to flowering plants & crops;
    b. Aquaponics – vegetable production in a contained, balanced ecosystem where fish, water, and fish waste can be used;
    c. Cotton – demonstrate modern and historic cotton picking, cleaning, and ginning;
    d. Agricultural tour – wagon tour to explain Alabama agriculture, crops and animals, and agricultural research;
    e. Tractors and drones – showing how drone technology and modern horse power is beneficial in agriculture;
    f. Pumpkin painting – growing pumpkins in Alabama;
    g. Peanuts – raising and digging peanuts;
    h. Popcorn – raising popcorn and what makes it pop;
    i. Animal barn – barn with various farm animals and how they are used for pleasure, food, and/or fiber including poultry, equine, sheep, pigs, and beef and dairy cattle;

j. Fishing & casting – hands-on children's game to learn and appreciate sport fishing;
k. Water Wheels –demonstrating environmental stewardship and how to protect it;
l. Forestry – educating participants on tree identification, pine straw baling, and forestry's importance to the environment and economics of the state.

Attendance & participation.

3001 people attended (1413 children and 1588 adults) and 247 College of Ag students helped implement Ag Discovery Adventure along with 65 faculty and staff

Partners. Alabama Wheat and Feed Grains Comm.; Alabama Cotton Commission; Alabama Soybean Producers; Alabama Poultry and Egg Association; Alabama Agricultural Experiment Station; Alabama College of Ag; Alabama Cooperative Extension System; SunSouth; Southeast United Dairy Industry Association

Mission. Our overall mission was to bring together faculty and staff from the AU College of Ag, Alabama Agricultural Experiment Station, Alabama Cooperative Extension System, and College of Ag students with urban/suburban citizens for open discussion and experiences in the field about how food and fiber is raised in the US and to showcase agricultural-related careers to potential students.

ACC 2017 Report: Improving Soil Quality of Alabama

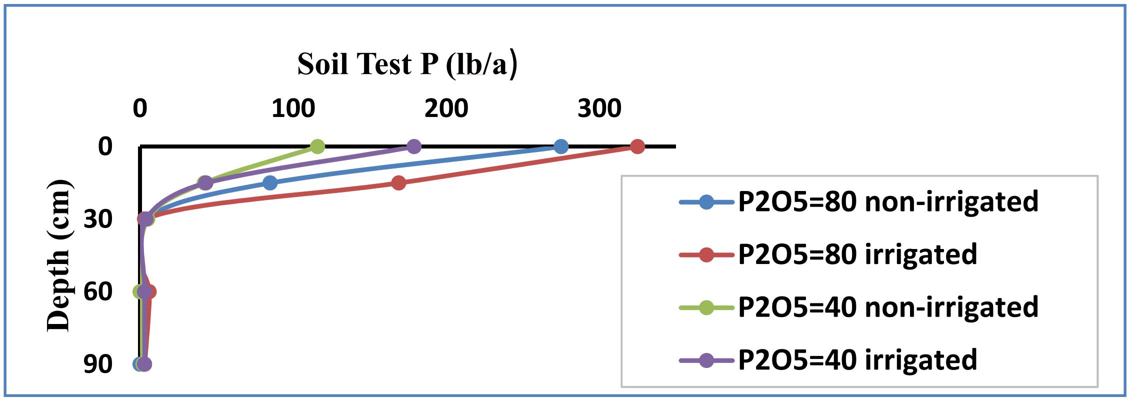
G. Huluka

Introduction: This proposal was funded by the Cotton Incorporated (CI) for 2018. Potential locations and farms that will be included in the study will be identified. The Old Rotation on campus and outlying Alabama Experiment Stations that practice conservation tillage will be included in this investigation. The AU lab Alabama Soil Quality Test and Soil Quality Index (SQI) will be utilized to quantify the ranking of a given soil. Field soil measurement surface and subsurface hardness (fragipans) will be measured using using penetrometer. Also, bulk density, texture, topography (slope) and others that will be good potential as soil health indicators will be measured.

The following laboratory Chemical, biological and physical tests will be conducted following standardprocedures.

Chemical Tests	Biological Tests	Physical Test
pH	Organic matter	Texture
Phosphorus	Active carbon	Surface hardness at 0-6 inch
Potassium	Microbial respiration rate	Subsurface hardness 0-18 inch
Calcium	Potential mineralizable nitrogen	Bulk density
Magnesium		Aggregate/Slake test
Iron		
Zinc		
Manganese		
Soil CEC		
Base Saturation		

Preliminary results for The Old Rotation 2017 for Irrigated/Non-irrigated:



Half of the Old Rotation plots have been receiving irrigation since 2003. Phosphorus in the soil significantly decreased below 30 cm irrespective of irrigation. In general, P in irrigated plots was greater than the non-irrigated plots that might have contributed to the high yield in the irrigated plots.

Continuing ACES &Exp. Station Information Transfer for Alabama Row Crop Producers

T. Cutts, D. Monks, D. Delaney, and C. Dillard

The www.alabamacrops.com website was developed to serve as a central site for research and extension information on Alabama field crops. The effort has been successful for delivering several types of information including IPM guides, research updates and reports, and extension information. The site has been especially useful for rapid delivery of crop variety and pest control information. Single-year variety yield data sets are often analyzed and posted 3 weeks before publication of the full Official Variety Report, providing current information to producers, county agents, crop advisors, and industry representatives on how well specific entries performed across the state. IPM Guides were also available on-line weeks before paper publication.

The Alabama Crops site also serves as the hub for crops-related sites in areas such as Soil Testing, Newsletters, on-farm research trial reports, and on-farm variety trials. Our Web Manager Mr. Jon Brasher develops and manages the www.alabamacrops.com site and assists in the development and maintenance of the Alabama Official Variety Testing web site. The web site includes links to information on, but not limited to: cotton, corn, soybeans, forages, wheat, small grains, stored grains, IPM guides, OVT research information, on-farm research and development, hay and pasture weed control, enterprise budgets, precision ag, soil fertility, plant diagnostics and soil testing. A Crops Calendar keeps users informed of training opportunities, conferences, and meetings. Twitter and Facebook feeds notify participants when new information is posted.

Jon's assistance to the Agronomic Crops team has been expanded to planting and harvesting on-farm tests, equipment maintenance and management, and a variety of other team activities. Jon has been trained to analyze, tabulate, and prepare research and demonstration results for posting to the web site.

Funding for this project was secured from the Alabama Cotton Commission, Alabama Soybean Producers, and Alabama Wheat and Feed Grains Committee for 2016 and will be requested for 2017. Common feedback has been that this website has been a major improvement in how we deliver our row crop information through the web.