2010 AU Crops

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Breeding Cotton for Yield and Quality in Alabama, 2010

D. B. Weaver

A cotton breeding project was initiated at Auburn University in 2001. Most of our work is centered on four primary objectives: (1) development of cotton germplasm or cultivars with improved yield and fiber properties, (2) evaluation and development of cotton germplasm for resistance to reniform nematode, (3) evaluation and development of cotton germplasm for resistance to abiotic stresses, particularly heat and drought, and (4) evaluation of effects of broadening the genetic base of upland cotton.

In 2010, we evaluated experimental lines for yield and fiber properties at two locations: Tallassee and Prattville. Complete yield and fiber quality data are now available from the 2009 Regional Breeders Testing Network at 11 yield locations and two disease evaluation locations across the Cotton Belt. Auburn experimental lines ranked first, eighteenth, and nineteenth in the 32-entry test (29 experimental lines plus three checks). New lines were submitted for evaluation in 2010, with the top-yielding line for 2009 being repeated in the test; results are unavailable as of the writing of this report. We are continuing to develop experimental lines using adapted cultivars and germplasm as parents and testing advanced lines

We have made significant progress in incorporating the LONREN source (RENlon gene) of resistance to reniform nematode into adapted germplasm and testing of advanced lines in both nematode-infested and nematode-free fields. We evaluated 100 F2:3 lines from the cross LONREN1 × Fibermax 966 in the greenhouse and identified 21 lines as having a high level of reniform resistance, at least equal to LONREN1. From this group we selected 20 highly resistant lines (Rf << 1; Rf is a reproduction factor and is the ratio between the final nematode count and the initial count) and 20 highly susceptible sister lines (Rf >> 1) and confirmed resistance/susceptibility phenotypes with SSR marker BNL 1066.

We planted these lines along with checks—LONREN-1, LONREN-2, FM 966, and DP 393—in two fields with reniform nematode infestation near Belle Mina, Alabama, at the Tennessee Valley Research and Extension Center. One field has been repeatedly inoculated in previous years with reniform nematodes, and populations were confirmed by sampling previous to planting. The other field was nematode-free, confirmed by sampling. Resistant lines were 11 cm shorter in the nematode-infested field than susceptible lines, but were not different in the reniform-free field. Thus, there were no inherent effects of the RENlon gene on plant height in the absence of nematodes. Any height reduction caused by the RENlon gene appeared to be a result of reaction to nematode feeding. The LONREN germplasm lines also tended to be shorter than both their resistant progenies and the susceptible checks.

Yield in the nematode-infested field was also significantly reduced in the resistant lines compared to the susceptible progenies. This result was somewhat surprising, as we expected the resistance in the lines carrying the RENlon gene to result in higher yield. Susceptible lines yielded slightly higher than resistant lines in the nematode-free field (1448 vs. 1372 pounds lint per acre) but the difference was not significant (P = 0.21). Fiber quality was largely unaffected by presence of the RENlon gene. There were no differences between lines carrying the RENlon gene and those that did not except for one fiber quality trait: fiber strength. Lines that carried the RENlon gene had significantly greater fiber strength than those that did not, regardless of nematode environment. In fact, average fiber strength of the resistant lines was more than 5 percent greater than susceptible lines in the nematode-infested field and equal to the checks in both fields, indicating that there may be some positive impact of the RENlon gene on fiber strength. All other group mean differences were not significant. Nematode populations were greatly reduced in the plots with lines carrying the RENlon gene, giving hope that this germplasm may yet play a significant role in the management of reniform nematodes.

With regard to this observed stunting problem, we conducted several greenhouse experiments to determine the effect of Cotoran®, reniform inoculation density, and secondary fungal organisms on LONREN and susceptible check lines in terms of root mass, shoot growth, and root/shoot ratios. Six genotypes were studied: LONREN-1, LONREN-2, and resistant line B104 of the cross LONREN-1 × FM 966 formed the group of resistant genotypes, whereas FM 966, Deltapine 555BR (DP555BGRR), and susceptible line B108 of the cross LONREN × FM966 constituted the group of susceptible genotypes. Inoculation levels were: 0, 500, 1,000, 5,000, 10,000 and 50,000 juvenile and vermiform life stages of *Rotylenchulus reniformis*. Shoot dry mass means from all genotypes decreased progressively with increase in nematode numbers. This was not the case with root dry mass means, where the group of resistant genotypes saw decreases with increased inoculation levels. All three susceptible entries recorded increases in root dry mass means with increased nematode population levels. The ratios in the resistant group showed limited variation in no particular direction. The ratios of the group of susceptible genotypes showed remarkable decreases, reaching up to 75 percent in the case of higher inoculation densities. The above-ground decrease in shoot mass of seedlings of resistant plants (stunting) appeared to be accompanied by decreases in root mass of near comparable magnitude. Shoots of susceptible genotypes also showed signs of stress at higher inoculation levels, either in reduced height or as a less vigorous stand.

Development of populations to examine the potential impact of introgression of exotic *Gossypium hirsutum* accessions as a means of broadening the genetic base of cotton on yield and fiber quality traits was begun in 2005 and continued through 2010. We have developed eight populations using a combination of four conventional adapted lines (Fibermax 966, Paymaster 1218, Delta Pearl, and Suregrow 747) and two exotic accessions (PI 165358, an accession from Mexico; and PI 530110, an accession from Brazil). Each population consists of a series of lines with 0, 25, 50, 75, and 100 percent exotic germplasm depending on how the cross was made. Six lines of each population per percent exotic were field-tested in 2009 and 2010 at two locations. Data for 2010 are incomplete at present, but results from 2009 are presented.

Across populations, except for days to first flowering and bolls per plant all other traits showed significantly decreased mean line performance with an increase in percent exotic germplasm. Days to first flowering did not show any significant difference up to 75 percent exotic whereas the 100 percent exotic parent significantly differed from adapted parent. Bolls per plant showed a nonsignificant difference between 0 and all other population per percent exotic combinations except in 50 percent exotic, which showed a significant decrease. All other agronomic traits such as boll mass, lint mass per seed, lint percent, seeds per boll, seed cotton yield, and lint yield significantly decreased with increase in exotic percentage.

Fiber properties were lowered with an increase in percent exotic germplasm except for uniformity index, fiber elongation and short fiber content. Fiber elongation increased significantly with increase in percent exotic germplasm. For short fiber content no significant difference was observed. Uniformity index decreased significantly with increase in percent exotic germplasm from 50 percent exotic onwards whereas no significant difference was observed between 0 percent and 25 percent exotic.

Another on-going related project is identifying germplasm accessions with tolerance to heat and drought. We have made some progress in this area during 2010. Our main focus is to identify techniques that can be used to evaluate genotypes in the growth chamber. We evaluated a select group of 44 accessions that had shown some promise of having heat tolerance from previous work and compared those to checks and a group of 44 randomly chosen accessions. As a group, the selected accessions performed better in terms of chlorophyll fluorescence compared to the random group when exposed to temperatures as high as 50 degrees C. We believe we have identified a core group of genotypes that can tolerate and recover more rapidly from exposure to high temperatures than non-tolerant genotypes. Our focus in 2011 will be to refine our technique and conduct experiments designed to measure plant growth parameters at high temperatures.

CROP PRODUCTION

The Old Rotation and Cullars Rotation, 2010

C. C. Mitchell, D. P. Delaney, and K. S. Balkcom

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. The complete history of this experiment was published in 2008 in the centennial issue of Agronomy Journal (C.C. Mitchell, D.P. Delaney and K.S. Balkcom. 2008. A historical summary of Alabama's Old Rotation (circa 1896): The world's oldest, continuous cotton experiment. Agron. J 100:1493-1498).

Non-irrigated crop yields in 2010 were below long-term averages for this experiment (Table 1). Dry matter yields of winter legumes (AU Robin crimson clover) have been disappointingly low for several years. Corn yields reflect N availability more than any other factor. Although we see a yield response to irrigation on corn, we cannot seem to break the 200 bushel-per-acre barrier. This may be due to the late planting of corn every year (mid to late April). Cotton yields, like corn, reflect N availability. Unlike 2009 yields, the late-season drought in 2010 resulted in a dramatic response to irrigation by all crops.

After eight years of irrigation versus no irrigation on the Old Rotation, we see a significant ($P<0.05$) yield increase due to irrigation on all summer crops (Table 2). With corn and soybeans, the response to irrigation has been rather consistent, with positive yield responses in five of seven years. With cotton, we have seen yield increases from irrigation in only three of the seven years, but when irrigation was needed, the yield resonse was dramatic. In three of the seven years, we actually saw a negative response to irrigation, i.e. the non-irrigated plots actually yielded more than the irrigated plots. This is no doubt a problem associated with our timing of irrigation and should be corrected so excess water is not applied in wet years as in 2009.

The Cullars Rotation (circa 1911) is the oldest, continuous soil fertility study in the Southern U.S. This study is not irrigated and yields reflect growing conditions during that season. Corn, cotton, and soybean yields were all dramatically reduced due to the late season drought in 2010 (Table 3). Wheat yields in 2010 were reasonable. Note the dramatic yield response to added K by cotton and the apparent lack of response to added micronutrients. No added P (Plot 2) dramatically reduced wheat and soybean yields more than cotton yields. The Cullars Rotation experiment is an excellent site to see dramatic nutrient deficiencies compared to healthy crops each year.

The Cullars Rotation will celebrate 100 years of continuous crop production research in 2011.

Table 1. Old Rotation Yields, 2010

Plot	Description	Clover dry matter Irrig.	Clover dry matter Non-irrig.	Wheat Irrig.	Corn Irrig.	Corn Non-irrig.	Cotton Irrig.	Cotton Non-irrig.	Soybean Irrig.	Soybean Non-irrig
		—lb/A—		–bu/A–	—bu/A—		—lb/A—		—bu/A—	
1	No N/no legume	0	0				488	207		
2	Winter legume	1812	2374				1076	795		
3	Winter legume	1352	2305				795	646		
4	Cotton-corn	3434	3193				811	902		
5	Cotton-corn + N	1479	2271				1506	869		
6	No N/no legume	0	0				447	422		
7	Cotton-corn	977	2444		33.9	25.3				
8	Winter legume	2354	1394				844	670		
9	Cotton-corn + N	896	1686		179.7	92.3				
10	3-year rotation	0	0	28.6					56.2	21.1
11	3-year rotation	0	0				1026	803		
12	3-year rotation	1991	4355		196.0	98.3				
13	Continuous cotton No legume + N	0	0				927	861		
	Mean				***136.5***	***72.0***	***880***	***686***		

Table 2. Effect of Irrigation on Mean Corn, Cotton, and Soybean Yields on The Old Rotation, 2003-2009

Plot	Treatment	Irrigated yield	Non-Irrigated yield
	CORN (bu/A)		
4,7	Legume N only	64.7 b	69.9 ab
5,9	Legume N + 120 lb N/A	167.4 a	98.9 a
10,11,12	3-yr rotation/legume N	131.1 a	52.6 b
	7-yr mean	121.1[1]	73.8
	COTTON (lb lint/A)		
1,6,	No N/no legume	514 d	390 d
2,3, 8	Legume N only	1020 c	990 b
13	120 lb N/A; no legume	1330 ab	930 b
4, 7	Corn rotation with legume	1270 b	1120 ab
5,9	Corn rotation with legume + 120 lb N/A	1500 a	1250 a
10, 11, 12	3-yr rotation/legume only	1190 bc	720 c
	7-yr mean	1040[1]	861
	SOYBEAN (bu/A)		
	3-yr rotation 7-yr mean	53.4[1]	39.4

[1] Significant at $P<0.05$

TABLE 3. CULLARS ROTATION YIELDS, 2010

Trt. no.	Description	Clover dry wt. *lb/A*	Wheat *bu/A*	Corn *bu/A*	Cotton *lb lint/A*	Soybean *bu/A*
A	no N/+legume	3000	17.8	36.6	588	18.2
B	no N/no legume	0	15.2	18.0	588	18.0
C	nothing	0	0.0	0.0	0	0.0
1	no legume	0	39.8	37.6	588	18.2
2	no P	1578	32.7	17.7	248	10.7
3	complete	2803	42.7	45.5	637	17.9
4	4/3 K	2825	40.2	24.4	488	15.1
5	rock P	3161	41.1	34.2	538	17.1
6	no K	891	40.8	4.3	0	10.1
7	2/3 K	3200	50.1	32.7	521	15.9
8	no lime (pH~4.9)	0	0.0	0.0	132	4.1
9	no S	2821	44.8	24.1	455	15.1
10	complete+ micros	4402	54.9	42.1	546	17.8
11	1/3 K	3243	46.9	33.0	414	13.8

IRRIGATION

Sprinkler Irrigation of Cotton for Biodiesel Production

D. Mullenix, J. P. Fulton, M. P. Dougherty, M. H. Hall, C. H. Burmester, B. Durham, and C. Brodbeck

Cottonseed response to a sprinkler irrigation study was initiated in 2008 at the Tennessee Valley Research and Extension Center (TVREC). The intent of this study was to understand seed oil-free fatty acid variations and how that might impact biodiesel production. The study consisted of a continuous rotation of cotton that was evaluated for yield, oil, and oil-free fatty acid (FFA) responses to six sprinkler irrigation treatments ranging from 0 percent (rainfed) to 125 percent of calculated pan evaporation adjusted for percent canopy cover. Cottonseed yield and characteristic responses to irrigation are important to assess the economic feasibility and environmental impacts of irrigation for biodiesel production and quality with high yield and oil content and low FFA desired. The study was conducted on 48 plots (39 feet x 39 feet) arranged in a randomized split plot design with four replications and two rotations. One rotation was a nontraditional energy crop rotation but the other, containing 24 plots of continuous cotton rotation, is the focus of this report. Total seasonal rainfall (June to August) at TVREC for 2008, 2009, and 2010 was 11.3 inches, 12.4 inches, and 5.3 inches, respectively, with the 82-year average being 11.4 inches.

In 2008, slight yield mean separation was determined with highest and lowest yields exhibited in 100 percent and rainfed treatments, respectively (Table 1). While insignificantly different, seed oil yields tended to increase with increasing irrigation, a finding documented in published literature by various researchers. Theoretical biodiesel yields correspond to seed cotton yield and all FFA levels remained within recommended tolerances (less than 2 percent), suggesting no oil pretreatment is necessary for biodiesel production.

Statistical differences in yield and seed oil content were not found in 2009, most likely due to above average seasonal rainfall (Table 2). Seed oil concentration, while not significantly different, was 2 percent to 3 percent higher in all treatments for 2009 and attributed to increased rainfall. FFA levels in 2008 were less than 1 percent for all treatments, but approximately 10 times higher in 2009 with significant differences observed. FFA levels from the 2009 cotton crop are not conducive to biodiesel production since the oil would require extensive pretreatment if biodiesel production is desired. Lower than expected yields in 2009 were due to boll shedding with the higher FFA levels a result of high moisture and cool weather at the end of the season, which prolonged harvest and allowed cottonseeds to be overly exposed to moisture. Excessive moisture is speculated to have activated key enzymes that began the germination process. The result was breakdown or oxidation of lipids inside the seed, leading to the extremely high FFA values (Table 2). Although oil content was consistently higher for 2009, average theoretical biodiesel production was down from the 41.6 gallons per acre estimated in 2008 due to overall lower seed cotton yields.

Seed cotton yield responses to irrigation treatments were notable in 2010 (Table 3).

Table 1. Irrigation Depth, Yield, Oil-Free Fatty Acid, and Theoretical Biodiesel Production, 2008

Irrigation treatment	Applied irrigation *in*	Seed cotton yield *lb/A*	Yield *bales/A*	Oil-free fatty acid *%*	Seed oil *% dry basis*	Biodiesel production *gal/A* [1]
Rainfed	0.0	2782 b	2.2 a	0.5 a	19.5 a	32.3
25%	3.2	3596 ab	2.9 a	0.7 a	20.6 a	44.5
50%	3.7	3044 ab	2.4 a	0.6 a	20.4 a	36.3
75%	5.9	2908 b	2.3 a	0.5 a	20.2 a	34.9
100%	7.9	3901 a	3.1 a	0.6 a	21.7 a	51.0
125%	17.3	3746 ab	3.0 a	0.4 a	22.2 a	50.6
Average	**—**	***3330***	***2.7***	***0.6***	***20.8***	***41.6***

[1] Assume a conversion ration of oil to biodiesel of 1:1 and 80 percent oil extraction efficiency.
Means followed by same letter do not significantly differ according to Fischer's least significant difference test ($P < 0.05$).

Table 2. Irrigation Depth, Yield, Oil-Free Fatty Acid, and Theoretical Biodiesel Production, 2009

Irrigation treatment	Applied irrigation *in*	Seed cotton yield *lb/A*	Yield *bales/A*	Oil-free fatty acid *%*	Seed oil *% dry basis*	Biodiesel production *gal/A* [1]
Rainfed	0.0	2691 a	2.1 a	8.1 ab	22.6 a	35.6
25%	3.1	2501 a	2.0 a	6.7 b	22.1 a	33.6
50%	6.5	2633 a	2.1 a	10.0 ab	22.0 a	35.1
75%	9.6	2350 a	1.9 a	7.8 ab	22.3 a	31.2
100%	12.8	2711 a	2.1 a	11.5 a	23.2 a	38.8
125%	16.6	2420 a	1.9 a	10.3 ab	22.2 a	32.6
Average	**—**	***2,551***	***2.0***	***9.1***	***22.4***	***34.5***

[1] Assume a conversion ratio of oil to biodiesel of 1:1 and 80 percent oil extraction efficiency.
Means followed by same letter do not significantly differ according to Fischer's least significant difference test ($P < 0.05$).

While the total seasonal rainfall for 2010 was only 5.3 inches, rainfed treatment yields were not unlike rainfed treatment yields observed in 2008 and 2009. However, treatments of 100 percent and 125 percent yielded favorably to irrigation and were the highest yields experienced for the duration of the experiment, producing 3.5 and 3.3 bales per acre, respectively. Seed oil FFA concentrations were well below 1 percent for all treatments and theoretical biodiesel production, like seed cotton yield, increased as irrigation increased with an experiment high average estimated yield of 54.1 gallons per acre.

TABLE 3. IRRIGATION DEPTH, YIELD, OIL-FREE FATTY ACID, AND THEORETICAL BIODIESEL PRODUCTION, 2010

Irrigation treatment	Applied irrigation *in*	Seed cotton yield *lb/A*	Yield *bales/A*	Oil-free fatty acid *%*	Seed oil *% dry basis*	Biodiesel production *gal/A* [1]
0%	0	2787 c	2.2 c	0.4 a	22.7 a	40.0
25%	4.0	2957 bc	2.4 bc	0.4 a	22.1 a	41.5
50%	8.4	3833 abc	3.0 abc	0.4 a	22.9 a	56.0
75%	12.0	3965 ab	3.2 ab	0.4 a	22.8 a	59.1
100%	16.2	4396 a	3.5 a	0.4 a	22.8 a	66.3
125%	21.0	4119 a	3.3 a	0.5 a	23.5 a	61.6
Average		***3676***	***2.9***	***0.4***	***22.8***	***54.1***

[1] Assume a conversion ration of oil to biodiesel of 1:1 and 80 percent oil extraction efficiency.

Means followed by same letter do not significantly differ according to Fischer's least significant difference test ($P < 0.05$).

Evaluation of Automatic Section Control Technology for Agriculture Sprayers

A. Sharda, J. P. Fulton, D. Mullenix, T. McDonald, A. Winstead, M. H. Hall, and B. V. Ortiz

Automatic section control (ASC) technology has been readily adopted by farmers over the past few years on agricultural sprayers. However, recent research at Auburn University has illustrated that off-rate application can occur more frequently than expected when utilizing this technology in conjunction with spray controllers. Therefore, a study was conducted to evaluate the application performance on sprayers when using ASC. A combination of laboratory and field experiments were conducted to quantify off-rate errors and nozzle flow stabilization. High frequency pressure sensors were installed near the boom-section control valves and at the nozzle bodies to document pressure variations during field operation and ASC actuation. A flow meter was also used to measure overall system flow to determine control system response and compute off-rate errors. For this study, off-rate represents the flow deviation from the desired target rate established by the operator and uploaded to the rate control system. The impact of different valve calibration numbers was investigated. While the term *valve calibration number* may have different names within manufacturer literature, this three-digit number is usually an operator-set parameter that controls how the primary control valve on the sprayer responds to required rate changes due to such things as ground speed changes. This value determines such things as valve response speed (quickness of change), brake point (when valve starts slowing down), and dead-band (acceptable tolerance to target point).

We found that ASC technology on sprayers can provide a savings between 2 percent and 12 percent per field with an approximate average of 4.3 percent across most farms in Alabama. Field shape and size affect savings. These savings are due to minimizing double-application areas within fields. These savings alone showed that the technology would pay for itself within two years (in several cases, less than one year) for most Alabama farm operations.

In terms of sprayer performance, results from this study determined that tip pressure variations can occur more frequently than realized by sprayer operators. These variations normally happen during quick ground speed changes and automatic section control actuation (sections turning on and off). Of interest, these pressure variations can impact droplet size and thereby application efficacy, which can be a concern when applying fungicides and similar products. Further, selection of the correct valve calibration number is important to minimize sprayer off-rate errors. These errors are due to delay times (over 10 seconds in some cases) when rate changes are required. These rate changes occurred during acceleration or deceleration of the sprayer and automatic section control actuation (on-off of boom sections). Additional results from this study indicated that off-rate errors and high pressure spikes happen most frequently at headlands or points rows where turning is required.

Based on these results, the following are suggestions to sprayer operators to minimize off-rate errors and large pressure fluctuations:

▪ Consulting manufacturer literature and company support is important to make sure of the following:

– The valve calibration number is proper for the sprayer and operating conditions.

– The flow meter is properly calibrated for the product bein sprayed.

– GPS offset and/or "look-ahead" values in the rate controller are correctly specified within the setup menus.

▪ Operator driving habits are important to consider. Quick speed changes greatly increase the risk of large pressure variations within hoses and tubing, causing off-rate errors for several seconds. Gentle sprayer acceleration and deceleration at field ends when turning helps provide time for the controller to properly respond to maintain the set target rate.

▪ A visible pressure gauge located in view of the sprayer operator is suggested so that the operator can observe any unnecessary pressure fluctuations. Based on this feedback, the operator can recognize when excessive pressure variations occur and can then respond accordingly to minimize this potential issue.

▪ The use of guidance systems on sprayers is recommended to help operators maintain parallel, adjacent passes. Guidance technology can help reduce overlap between adjacent passes down to around 1 percent to 2 percent from around 10 percent using traditional guidance methods (e.g. foam markers).

In summary, ASC technology can provide Alabama farmers substantial savings on inputs with an average savings of 4.3 percent determined in this study. For those adopting ASC, make sure to follow the manufacturer recommendations on setup and calibration for the rate controller but also recognize the operator can impact performance. You can learn more about ASC on sprayers from the Alabama Precision Ag Website, www.AlabamaPrecisionAgOnline.com under the topic Section Control Technology. An Extension publication "Automatic Section Control (ASC) Technology for Agricultural Sprayers" is also available.

Evaluating Pressure Compensating Subsurface Drip Irrigation for No-Till Row Crop Production on Rolling, Irregular Terrain, 2010

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This investigation was conducted on a 12-acre field located at the Tennessee Valley Research and Extension Center (TVREC), Belle Mina, Alabama. The objective was to evaluate cotton production on rolling terrain irrigated with subsurface drip irrigation (SDI) in conjunction with cover crops. The experimental design was a randomized block design with two irrigation treatments (irrigated and non-irrigated) and two cover crop treatments (cover and no-cover) with four replications. Plots measured 27 feet by 1,250 feet with SDI tape installed in 1,250-foot runs on 80-inch spacing (every other row of 40-inch row cotton) and buried at an average depth of 13 inches. Plots receiving a cover crop treatment were planted with rye at a rate of 90 pounds per acre. High moisture and cool weather during the fall of 2009 caused the rye to be planted late (November 29, 2009). The cover crop was desiccated on April 12, 2010. Cotton, variety ST 4554 B2RF, was planted on April 22, 2010. A quality analysis was conducted by harvesting 50 cotton bolls collected at six locations within each plot (96 total samples; six locations x 16 plots) prior to harvesting. Quality factors considered were micronaire, strength, uniformity, and lint length. Accumulated yield per treatment was determined using a weighing system. Yield data were analyzed to determine significant differences ($\alpha=0.10$).

The irrigated treatments produced the highest seed cotton yields in 2010 (Table 1), with yields of approximately 3,800 pounds per acre or 3.2 bales per acre for each treatment. The two non-irrigated treatments yields were not significantly different but yielded less (42 percent non-irrigated/cover and 46 percent non-irrigated/no-cover) when compared to the irrigated yields. When compared to yields in 2009, overall mean treatment yields were higher in 2010 except for the non-irrigated/no-cover treatment, which had equal yields each year. Cover crop treatments had a greater impact on yields in 2009 than irrigated versus non-irrigated treatments. In that year sufficient rainfall occurred during the growing season.

Due to wet conditions late in 2009, rye was planted late, resulting in limited biomass production prior to desiccation. The biomass samples collected in 2010 ranged from 51 percent to 62 percent less dry matter in the four treatments than in the measured biomass in 2009. Thus, 2010 yields were driven more by available water than by the cover crops. In general, this long-term study demonstrates that cover crops provide a yield benefit especially during growing seasons with limited rainfall.

Micronaire values for both irrigated treatments averaged 4.9,thereby not receiving a gin discount, while the 5.2 average value for the non-irrigated cotton did receive a discount (Table 2). Cotton fiber for all treatments was similar in strength and was within the premium range. The treatments with a cover crop produced stronger fibers than the treatments without a cover crop. Likewise, the irrigated treatments were on average stronger. The cotton did not receive any discounts for uniformity. Both irrigation treatments were graded as premium with the non-irrigated falling in the base level. The irrigated treatments were slightly higher in uniformity by around 1.5 percent. The lint length for the non-irrigated was the shortest at 1.07 inches, while the irrigated treatments were longer at 1.12 and 1.13 inches for no-cover and cover, respectively. In general, the cover crops provided little or no benefit on cotton quality.

In summary, the use of pressure compensated SDI has provided significant yield benefits over the 2006 to 2008 and 2010 years of this study. In 2010, the yield differences between irrigated and non-irrigated treatments were significant. While the 2010 results did not indicate a benefit from cover crops, this outcome was attributed to low biomass yields for the cover crop. However, previous years have confirmed a benefit to cover crops in terms of cotton yield such as the 0.5 bales per acre increase for 2009. The cotton quality analysis indicated that the irrigation treatments generally provide improvement in cotton quality. There was a slight benefit to the irrigated treatments in that the non-irrigated treatments were discounted for micronaire and had shorter lengths, but overall there was no significant difference in uniformity or strength.

Table 1. Yield Averages by Treatment, 2009 and 2010

Treatment	——2009——		——2010——	
	Seed cotton *lb/A*	Lint *bales/A*	Seed cotton *lb/A*	Lint *bales/A*
Irrigated/Cover	2921 a	2.4	3798 a	3.2
Irrigated/No-Cover	2311 b	1.9	3811 a	3.2
Non-Irrigated/Cover	2720 a	2.3	2208 b	1.8
Non-Irrigated/No-Cover	2064 b	1.7	2025 b	1.7

Mean yields with similar letters within columns indicate they are not statistically different ($\alpha=0.10$).

Table 2. Cotton Quality by Treatment, 2010

Treatment	Micronaire	Strength *g/tex*	Uniformity *%*	Length *in*
Irrigated/Cover	4.9	30.9	83.5	1.13
Irrigated/No-Cover	4.9	30.2	83.7	1.12
Non-Irrigated/Cover	5.2	30.4	82.0	1.07
Non-Irrigated/No-Cover	5.2	29.6	82.0	1.07

Subsurface Drip Irrigation-Fertigation for Site-Specific, Precision Management of Cotton

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A subsurface drip irrigation study was installed at the Tennessee Valley Research and Extension Center (TVREC) in 2005 to evaluate four precision fertigation management scenarios. Approximately 7,500 feet of subsurface drip irrigation (SDI) tape and four positive displacement liquid fertilizer injectors were installed on five nutrient timing treatments with four replications in a randomized complete block design. The twenty treatment plots were made up of eight, 345-foot rows of cotton on 40-inch row spacing, with drip tape between every other row of cotton. The four fertigation treatments and one non-fertigated control are described in Table 1.

Total seasonal rainfall at TVREC during June to August 2010 was 5.27 inches (Figure 1), which was drier than the 82-year average (11.44 inches).

Yield results for 2006 to 2010 are shown in Figure 2. Seed cotton yields for the 2010 season were high, above 2 tons per acre and similar to the 2008 yield. The 100 percent fertigated treatments (3 and 4) gave statistically ($\alpha = 0.1$) similar yields to the surface-applied control treatment in this season. Treatments 2 and 5, which contained 15 percent and 30 percent surface-applied fertilizer, produced significantly higher yield than the surface-applied control treatment. The highest statistical yield for this season was obtained from treatment 5 (30 percent surface application and 70 percent fertigation).

Cotton yield (bales per acre), lint quality parameters, and leaf nutrient analyses are presented in Table 2. Lint strength or uniformity was significantly affected by different fertilizer treatments. Treatment 4 (100 percent fertigated) gave significantly (α=0.1) higher lint length and lower micronaire than other fertigated treatments and surface-applied control.

Plant uptake for N was significantly (α=0.1) higher in the surface-applied control treatment (treatment 1) than the fertigated treatments without surface application. Uptake of K was relatively low at mid-bloom and not affected by any treatment, while Phosphorus, Ca, and Mg contents were significantly affected by different treatments.

Table 1. Treatment Description, Fertigation Management Trials, 2006-2009

Treatment[1]	Description
1. Control – drip irrigated, but all fertilizers are surface applied.	Preplant – 60 lb/A N and K Post-Plant – 75 lb/A N, sidedressed at early square
2. Timing 1 – with surface preplant	Preplant – 20 lb N and K, surface applied Drip – 40 lb N and K, square to bloom (25 days) Drip – 75 lb N and K, bloom to 25 days
3. Drip timing 1 – no preplant	Planting Drip – 20 lb N and K Drip – 40 lb N and K, square to bloom (25 days) Drip – 75 lb N and K, bloom to 25 days
4. Drip timing 2 – no preplant "spoon-fed"	Planting Drip – 20 lb N and K Drip – 40 lb N and K, square to bloom (25 days) Drip – 75 lb N and K, bloom to 40 days
5. Timing 2 – with surface preplant	Preplant – 40 lb of N and K, surface applied Drip – 95 lb N and K, square through bloom (50 days)

[1] All treatments received 135 pounds per acre of nitrogen and potassium (K_2O), 20 pounds per acre of sulfur, and l.0 pound per acre of boron. Phosphorus fertilizer was surface-applied to maintain P at high soil test levels. Drip fertilizer was 8-0-8-1.2S-0.06B applied using 32 percent liquid N, potassium thiosulfate, fertilizer grade KCL, solubor, and water.

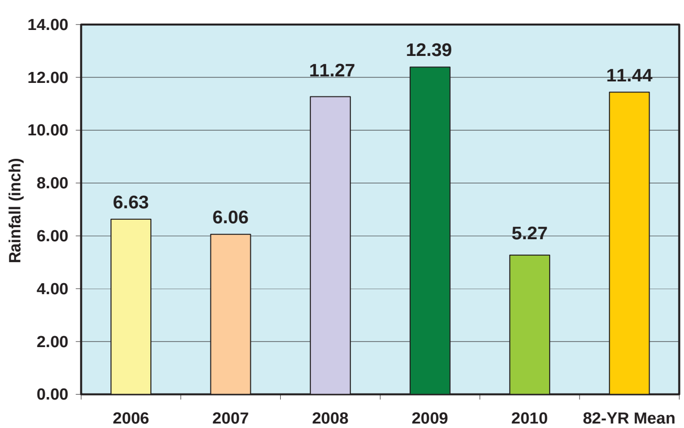

Figure 1. Total seasonal rainfall during June, July, and August vs. the 82-year average at Belle Mina, AL,

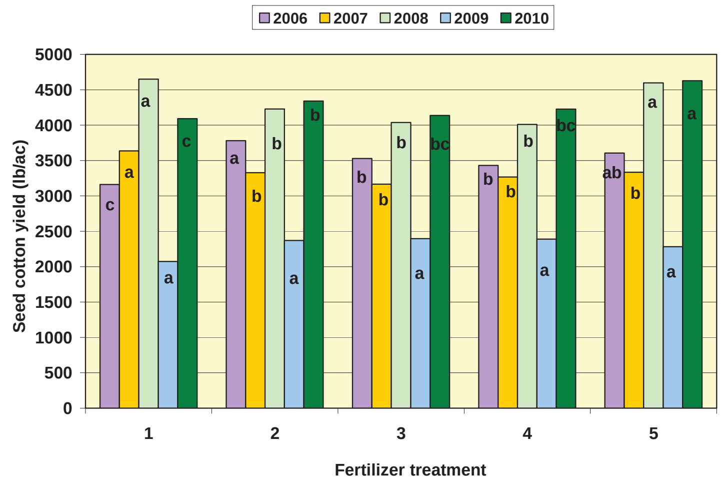

Figure 2. Seed cotton yield, lb/ac, drip tier fertigation management study, Belle Mina, AL, 2006-2010. N = 4. Turnout = 41.5 percent. Different letters within a year indicate significant difference (α = 0.1).

TABLE 2. COTTON LINT YIELD AND QUALITY ANALYSIS AND PLANT TISSUE ANALYSIS, COTTON FERTIGATION MANAGEMENT TRIALS, 2010

	Cotton yield and quality analysis					Plant tissue analysis				
Trt.[1]	Yield [2]	Micronaire	Length	Strength	Uniformity	N%	P%	K%	Ca%	Mg%
1	3.5 c	5.02 a	1.12 c	29.7 a	82.9 a	3.39 a	0.19 b	1.35 a	2.42 d	0.57 a
2	3.8 b	4.90 a	1.13 b	29.6 a	83.2 a	3.15 c	0.20 ab	1.32 a	2.79 a	0.55 bc
3	3.6 bc	5.10 a	1.14 ab	29.8 a	83.4 a	3.26 b	0.22 a	1.35 a	2.70 ab	0.54 c
4	3.7 bc	4.62 b	1.16 a	30.6 a	83.5 a	3.24 bc	0.22 a	1.38 a	2.59 c	0.52 d
5	4.0 a	5.10 a	1.14 ab	29.6 a	83.4 a	3.32 ab	0.19 b	1.32 a	2.65 bc	0.56 ab

[1] Treatments: 1. Surface applied N-P-K with drip irrigation (control). 2. Preplant 20# N-K surface with 2 N-K drip timings. 3. 20# N-K drip at planting with 2 N-K drip timings (to 25 days after bloom). 4. 20# N-K at planting with 2 N-K drip timings (to 40 days after bloom). 5. Preplant 40# N-K surface with 1 N-K drip timing (square through bloom). Different subscripts in a column denote statistical difference (α=0.1). N=4. Turnout = 41.5%.
[2] Yield in bales per acre.

Alternative Sources of N for Corn and Cotton in Alabama

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Rapidly increasing N fertilizer costs have left Alabama cotton and corn producers with few alternatives. Using legumes as winter cover crops and using poultry broiler litter as a source of nutrients are the only alternatives for many producers. Dry urea (46-0-0) is a less expensive alternative to ammonium nitrate (34-0-0) for surface application but the risks of volatilization losses can be high. This is especially true when applied during the hot, sometimes dry, summer months on residue in a well-limed soil.

Agrotain® (N-(n-butyl) thiophosphoric triamide), a urease inhibitor, is marketed to reduce volatilization losses from urea-containing fertilizers. Several new technology, controlled-release N sources are also available for row-crop farmers. Thus, our objectives were to compare alternative sources of N fertilization for non-irrigated cotton and corn in Central Alabama.

Treatments are designed to compare products. Ammonium nitrate is the standard of comparison and the two rates selected were chosen based upon recommendations for that site of 120 pounds total N per acre for non-irrigated corn and 90 pounds total N per acre for cotton. The two rates of ammonium nitrate are to verify the optimum N rate (Table 1).

Liquid Urea-ammonium nitrate (UAN) is the most widely used N source for cotton and corn in Alabama. In this study, a 28-0-0 UAN solution was used. It was applied by spraying a band about 8 inches wide on either side of the row.

Dry urea is usually the least expensive N material available. Widespread concerns about ammonia volatilization losses on hot, dry soils with a good residue cover often discourage its use as a sidedress N source on no-till/conservation-tilled corn and cotton in Alabama. However, in 2008, dry urea produced the highest cotton yield of any material studied.

Agrotain® has become the standard urease inhibitor product currently being used in the Southeastern U.S. Agrotain was mixed with dry urea at the highest recommended rate to give 14-day protection under adverse soil conditions. The rate was 5 quarts per ton. For 28 percent or 32 percent UAN solutions, the rate was 2.4 quarts per ton.

Nutrisphere N® is formulated to be used with both dry urea and UAN solutions. Both formulations were included at the manufacturers' recommended rates.

Nitamin Nfusion® is a 22 percent N product of which 94 percent is slowly available to be blended with UAN solutions. However, in this study it was used at the full rate as a sidedress N application.

Poultry litter is abundant in most areas of Alabama. An 11-year study showed rather conclusively that it could be used on conservation tillage corn and cotton based on the total N in the litter. Conservatively, most growers assume about two thirds available N. In this study, poultry broiler litter was applied at two rates of total N (120 and 180 pounds total N per acre for corn and 90 and 120 pounds total N per acre for cotton). All poultry litter was applied at planting. No additional N was applied to these treatments.

Calcium chloride. In 2007, 2008, and 2009, very similar studies were conducted that included rates of a liquid calcium chloride product. There were claims that calcium chloride could help reduce volatilization losses of urea-based N sources. We saw no evidence of this in these earlier tests, so calcium chloride was dropped as a treatment in 2010.

The site was on a Lucedale sandy clay loam (fine, loamy, siliceous, Thermic Rhodic Paleudults) testing "high" in P and K. No additional P and K was recommended and none was applied. Corn (Pioneer 31G97) was planted no-till into the previous crop's residue on April 7 and harvested by machine on August 23. Cotton (Phytogen 440W) was planted no-till into the previous crop's residue on April 26 and harvested by machine on September 22. Plot size was 12 feet wide (four, 36-

Table 1. Treatments and Yields for Corn, 2010

Trt. no.	Source	Total N	N rate at sidedressing	Corn grain yield
		lb/A		
1	None	0	0	1125 d [1]
2	Ammonium nitrate	120	100	4096 ab
3	Ammonium nitrate	180	160	3945 abc
4	UAN solution [2]	120	100	4592 a
5	UAN + Agrotain®	120	100	4616 a
6	Urea	120	100	4592 a
7	Urea + Agrotain®	120	100	4296 ab
8	Urea + Nutrisphere N®	120	100	4229 ab
9	UAN + Nutrisphere N®	120	100	4344 ab
10	Nitamin Nfusion 22-0-0®	120	100	3806 abc
11	Urea-am. sulfate blend	120	100	4386 ab
12	Poul. litter @ ~120# N/a	120	0	3213 c
13	Poul. ltter @ ~180# N/a	180	0	3739 bc

[1] DMRT P <0.05.
[2] 28-0-0-5S

Table 2. Treatments and Yields for Cotton, 2010

Trt. no.	Source	Total N	N rate at sidedressing	Cotton lint yield
		lb/A		
1	None	0	0	390 b [1]
2	Ammonium nitrate	90	70	460 ab
3	Ammonium nitrate	120	100	460 ab
4	UAN solution [2]	90	70	420 ab
5	UAN + Agrotain®	90	70	420 ab
6	Urea	90	70	420 ab
7	Urea + Agrotain®	90	70	470 ab
8	Urea + Nutrisphere N®	90	70	420 ab
9	UAN + Nutrisphere N®	90	70	400 b
10	Nitamin Nfusion 22-0-0®	90	70	460 ab
11	Urea-am. sulfate blend	90	70	560 a
12	Poul. litter @ ~90# N/a	90	0	460 ab
13	Poul. ltter @ ~120# N/a	120	0	510 a

[1] DMRT P <0.05.
[2] 28-0-0-5S

inch rows) and 35 feet long. Yields were harvested from the two center rows. Leaf samples were taken from the outside rows. In 2010, corn ear leaf samples were taken on June 24 at early tassel (R1 stage). On the same day, uppermost mature leaf blades were sampled from the cotton plots during early bloom. Samples were dried and ground and total N was determined on all leaf samples using a nitrogen analyzer (combustion).

Both corn (Table 1) and cotton (Table 2) yields were low in 2010 due to an extended drought and extreme heat during the critical growth stages for both crops. In spite of low yields, there were some significant differences in treatments. All the products produced similar yields when applied at the recommended rate of 120 pounds total N per acre. The most notable exception was poultry broiler litter. Poultry broiler litter applied at planting to corn at either 120 or 180 pounds total N per acre was not adequate for optimum grain yields compared to the other treatments. While it did not affect cotton yields as much as corn yields, leaf analyses from both crops (Table 3) indicated low N concentrations in the leaves compared to the other treatments. The new-technology sources such as Agrotain®, Nutrisphere®, and the controlled release, Nitamin® , did not increase yields or N concentration in the leaves compared to more conventional sources such as urea, ammonium nitrate, or UAN solution.

This is the fourth year of this study at the same location. Treatments have changed as new products became available to evaluate. The first year, 2007, was during a record drought and no yields were harvested. Low, but reasonable corn and cotton yields were harvested in 2008 and 2009. Additionally, in 2007, 2008, and 2009, ammonia volatilization was measured from selected treatments. While certain treatments, e.g., Agrotain®, did reduce estimated N losses from volatilization, volatilization of these treatments had minimal affect on corn and cotton yields as it did in 2010. The newer controlled release N products have not shown any yield advantage to more conventional N sources such as urea, ammonium nitrate, UAN solution, or the urea-ammonium sulfate blend, which is being sold as a substitute for ammonium nitrate. In 2008 and 2009, higher ammonia volatilization losses occurred if UAN solutions were broadcast when we had an unusually heavy surface residue cover. Agrotain® seemed to reduce these losses. However, we did not have a heavy residue in 2010 and apparently the risk of ammonia volatilization from UAN solutions was lower.

Table 3. Corn Ear Leaf and Cotton Leaf Nitrogen[1]

Trt. no.	Source	Corn ear leaf total N	Cotton leaf blade total N
		%	%
1	None	3.20 d [2]	1.36 c
2	Ammonium nitrate	4.25 a	2.09 ab
3	Ammonium nitrate	4.24 a	2.13 a
4	UAN solution [3]	3.96 abc	2.10 ab
5	UAN + Agrotain®	4.04 ab	2.17 a
6	Urea	4.19 a	2.06 ab
7	Urea + Agrotain®	4.07 ab	2.03 ab
8	Urea + Nutrisphere N®	3.91 abc	2.18 a
9	UAN + Nutrisphere N®	4.19 a	2.23 a
10	Nitamin Nfusion 22-0-0®	3.83 bc	1.90 b
11	Urea-am. sulfate blend	3.97 abc	2.08 ab
12	Poul. litter @ ~120# N/a	3.33 d	1.54 c
13	Poul. ltter @ ~180# N/a	3.66 c	1.56 c

[1]Ear leaf sampled June 24 at full tassel; cotton leaves taken from uppermost, mature leaf blade at early bloom on June 24.

[2] DMRT P <0.05.

[3] 28-0-0-5S

Fertilization of Cotton on Black Belt Soils

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This experiment was laid out in 2004 and was designed to complement the "Rates of NPK Experiment" (circa 1929) on other outlying units of the Alabama Agricultural Experiment Station. The purpose of this experiment is to identify optimum rates of N, P_2O_5, and K_2O for cotton on Black Belt soils and to calibrate soil test P and K for these soils. The site is on an acid, Vaiden clay (very fine, smetitic, thermic, Vertic Hapludalfs) and is the only soil fertility experiment in Alabama on Black Belt soils.

Initial soil tests from the site indicated a very uniform site typical of unfertilized Black Belt area cropland (Table 1). Phosphorus was rated "low" using the Mississippi/Lancaster extract, which is the preferred method for these soils and is used by both the Auburn University and Mississippi State University soil testing laboratories. Potassium was rated "very high." Soil samples have been taken from each plot every year of this experiment and are reported under a separate project.

The experiment consists of six N rates, four P rates, five K rates, and a no-lime treatment and an unfertilized treatment replicated four times in a randomized block design (Table 2). Plots consisted of five rows on 36-inch centers, 15 feet wide and 25 feet long. Each tier was separated by a 5-foot alley. Because of disappointing yields in 2005 when cotton was planted no-till into a rye cover crop and excessive rainfall occurred, the decision was made to switch to a ridge tillage system with no cover crop for 2006 through 2010. All the P and K and half of total N were applied within one week of planting in late April. The other half of N was applied in mid-June. Lint yields were estimated by hand-picking 20 feet from the two middle rows in each plot. Relative yields are yields compared to the mean yield of Treatment 5, the control treatment, which receives 90-100-100 pounds N-P_2O_5-K_2O per acre each year (see figure).

Excessive rainfall and anaerobic soil conditions dramatically reduced yields in 2005. Extreme drought plagued the test in 2006 through 2007. Yields in 2008 were the highest of the six-year study averaging 1154 pounds of lint per acre in spite of severe leaf spot diseases (*Alternaria, Cercospora,* and *Stemphylium*) which defoliated some plots, especially the low K treatments. This problem has become a serious limitation to cotton production on Black Belt soils in Alabama but it is also unpredictable. Leaf spot also occurred in 2009 but did not hurt yields as much as 2008 because it occurred later in the season. Cotton in 2009 was harvested late (November 13) due to an extremely wet fall season. If the 2006 through 2009 crops had been machine harvested, very little of the lint would have been saved because of hard locks and weak bolls. Extreme heat and a late-season drought may have reduced yields in 2010. Severe apparent 2,4-D damage was noted in mid-summer (June10 through early July) in 2010. Surprisingly, the cotton recovered and made a modest yield.

Selected treatments were tested each year for lint quality. No treatment differences were observed in 2007 but there were significant difference in 2008, 2009, and 2010 (Table 2). The "No K" treatment had significantly lower overall fiber quality (Table 3).

Because of the higher yields and significant differences in treatments on yield in 2007 through 2010, these data probably are more relevant to producers (Table 2).

N rates. Optimum total N rates over the five years of the experiment appear to be around 60 pounds N per acre. Although there was a more dramatic response to N rates in 2005, yields were low because excessive rainfall resulted in severe denitrification losses on these poorly drained soils. The current recom-

Table 1. Initial, Mean Plow-Layer Soil Test Value, 2004[1]

Extract used	Soil pH	P	K	Mg	Ca
		mg/kg and rating			
Mehlich-1	6.0	4 Very Low	88 High	35 High	2330 (not rated)
Miss/Lancaster	6.0	16 Low	180 V. High	60 High	10,000+

[1] N = 4.

Table 2. Fertilizer Treatments and Cotton Lint Yields on a Vaiden Clay in West Alabama, 2005-2010

		–Rates of nutrients applied–			–Cotton lint yields–					
Trt. no.	Description	N	P_2O_5	K_2O	2005	2006	2007	2008	2009	2010
		lb/A								
N variables										
1	No N	0	100	100	177	311	870	960	812	329
2	Low N	30	100	100	214	380	1040	1070	760	466
3	Moderate N	60	100	100	265	403	990	1220	855	934
5	Control	90	100	100	388	393	1076	1350	830	802
4	High N	120	100	100	237	400	1037	1340	858	848
6	No S/VH N	150	100	100	320	387	1040	1360	877	858
P variables										
7	No P	90	0	100	280	378	910	1310	995	793
8	Very low P	90	20	100	205	394	940	1350	974	676
9	Low soil P	90	40	100	274	375	1091	1260	892	829
10	Moderate P	90	60	100	233	388	1027	1470	951	867
5	Control	90	100	100	388	393	1076	1340	830	802
K variables										
11	No K	90	100	0	157	353	585	600	470	717
12	Very low K	90	100	20	170	324	784	770	444	637
13	Low K	90	100	40	253	295	803	1030	815	878
14	Moderate K	90	100	60	341	335	922	1030	747	809
15	High K	90	100	80	319	349	806	1150	1005	918
5	Control	90	100	100	388	393	1076	1340	830	802
Other variables										
16	No lime	90	100	100	196	413	1027	1350	852	864
17	Nothing	0	0	0	160	300	649	670	475	541
LSD P<0.1					***135***	***ns***	***220***	***210***	***179***	***153***
Mean yield					***261***	***366***	***934***	***1154***	***804***	***756***

mended N rate is 90 pounds N per acre for these soils.

P_2O_5 rates. One would have anticipated more dramatic responses to rates of P than we found in these tests because of the low soil test P rating. Except for the low-yielding, wet year of 2005, and the drought year of 2007, the "no P" treatment has produced relative yields between 96 and 120 percent of the control treatment which gets 100 pounds P_2O_5 per acre per year. There was never a significant yield response to added P. This calls into question the current "low" rating for this soil test value for cotton. The definition of a "low" soil test rating indicates that the soil will produce less than 75 percent of its potential without fertilization of that nutrient.

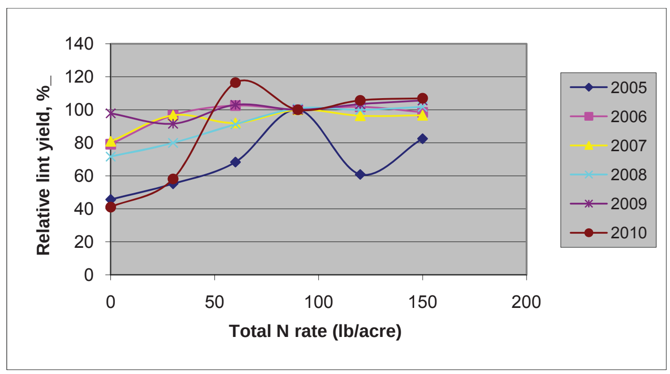
Table 3. Fiber Quality as Affected by Selected Treatments, 2007-2010

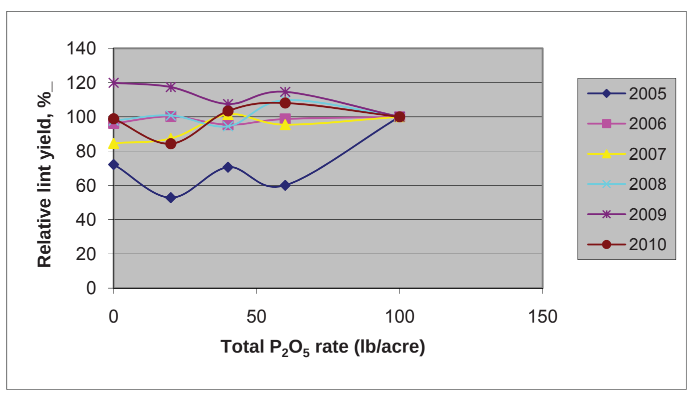
Trt. no.	Description	Lint %	Micronaire	Length	Strength	Uniformity
			2007			
1	No N	43	4.23	1.01	26.6	81.9
11	No K	43	3.60	1.02	25.9	81.6
15	High K (80 lb K_2O/A)	42	4.23	1.00	26.8	82.0
			2008			
1	No N	49.5 a	4.05 a	1.04	27.8 ab	81.9 ab
4	High N (120 lb N/A)	46.5 bc	4.22 a	1.07	28.8 a	83.0 a
7	No P	47.2 b	4.18 a	1.05	27.8 ab	81.0 b
11	No K	45.2 c	3.15 b	1.06	26.8 b	80.5 b
15	High K (80 lb K_2O/A)	46.0 bc	3.78 ab	1.06	28.8 a	82.0 ab
			2009			
1	No N	47 a	4.65 a	1.07 c	26.9 ab	82.0 a
4	High N (120 lb N/A)	43 c	4.05 b	1.14 a	28.5 ab	83.3 a
7	No P	45 b	4.50 a	1.10 bc	28.6 a	82.4 a
11	No K	43 c	3.47 c	1.10 bc	26.6 b	80.7 b
15	High K (80 lb K_2O/A,)	43 c	4.32 ab	1.12 ab	27.9 ab	82.7 a
			2010			
1	No N	0.47 a	4.58 a	1.01	25.0 b	80.4
4	High N (120 lb N/A)	0.46 b	4.88 a	1.04	27.6 a	81.8
7	No P	0.46 b	4.87 a	1.04	26.5 ab	81.4
11	No K	0.46 ab	4.90 a	1.04	27.2 a	81.4
15	High K (80 lb K_2O/A)	0.45 b	4.12 b	1.02	25.9 ab	81.3

Values followed by the same letter are not significantly different at $P<0.05$.

K_2O rates. In spite of this soil initially testing "very high" in K, there were significant increases in yield with higher rates of K_2O up to 100 pounds per acre each year except 2006. These results provide credibility to grower's claims that additional K seems to increase yields even when soils are rated "high" or "very high" for K and none is recommended from the Auburn University Soil Testing Laboratory. The most dramatic yield response to added K occurred in 2008 with the highest yields of the six-year study but also the most severe defoliation due to foliar diseases. There may be justification to change soil test K ratings for these soils and increase K recommendations for cotton. Additional studies are on-going.

In spite of extreme weather conditions at this site and some problems, e.g., phenoxy herbicide drift in 2010, we have observed some consistent trends in cotton response to N, P, and K after six years of fertilization and cropping. Only four of six years (2007, 2008, 2009, and 2010) have produced reasonably good lint yields (approximately 1.5 to 2 bales per acre). Surprisingly, yield responses to increasing N rates above 60 pounds per acre have not been evident. Significant differences in 2007 through 2010 suggest a need for modification of soil test ratings for both P and K on these soils. Phosphorus may be currently rated too low and potassium may be rated too high for cotton on these soils. Since these are the only established soil fertility variable plots on the Black Belt Research and Extension Center, we hope that they will be maintained indefinitely as are the "Rates of NPK" experiments at six other Alabama locations to provide more conclusive evidence for changes in soil test calibration for similar soils. Plans are to evaluate soybean response to residual fertility in 2011.





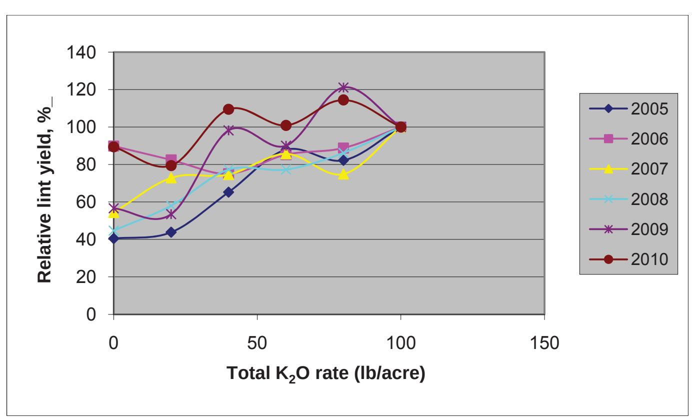


Figure (at right) Effect of rates of N, P_2O_5, and K_2O on relative cotton lint yields in five years on a Vaiden clay in West Alabama.

FGD Gypsum Research and Demonstrations in Alabama

C. C. Mitchell and D. Watts

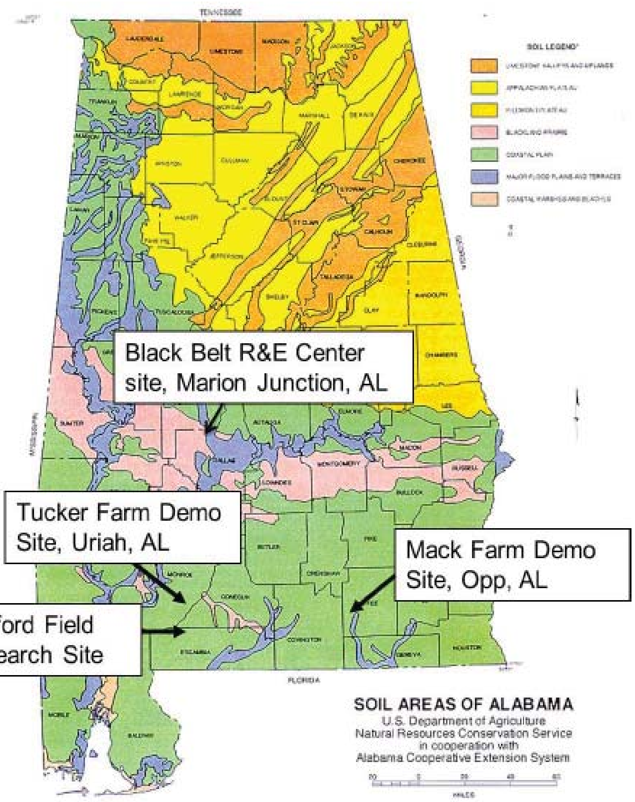
A by-product of flue gas desulfurization (FGD) in coal-fired electric generating plants is large quantities of FGD gypsum (calcium sulfate) which is produced when sulfur gases react with a slurry of ground limestone in the scrubbers. Agricultural gypsum has been used for decades as a source of calcium and sulfur for crop production. It is also widely used to reclaim sodic soils in arid regions. In Alabama, agricultural gypsum is routinely recommended at rates of 500 to 1000 pounds per acre as a source of calcium for pegging peanuts, especially the large-seeded types and peanuts grown for seed. Although gypsum is a neutral salt, it has been found to reduce the toxic effects of aluminum in acid subsoils and improve surface soil structure (aggregation) in some situations. Over 50 demonstrations in Alabama, Georgia, Mississippi, and Florida sponsored by the Southern Company showed positive crop responses on farmers fields to applications of 1 to 4.5 tons per acre of FGD gypsum. FGD gypsum is reported to reduce the shrinking and swelling of Vertisols in the Blackland Prairie region in northeastern Mississippi.

Agricultural gypsum is usually a mined product imported from Spain, South America, or the western U.S. By-product gypsum is produced from both the flue gas desulfurization process and from the manufacture of phosphate fertilizers. Phospho-gypsum has been known to contain radium which limits its widespread use on crops. It is also concentrated in phosphate mining areas such as Central Florida and is too expensive to transport long distances. Analyses of the FGD gypsum from Power South and of the agricultural gypsum used in this study do not indicate any properties that could potentially harm crops or the soil.

Objectives of the study were to
- Demonstrate to local farmers and landowners the use of FGD gypsum.
- Determine the benefits and potential problems associated with applying FGD gypsum to cotton on a South Alabama Coastal Plain soil and a Black Belt clay.

One research site and one on-farm test/demonstration were set up with cotton in the Coastal Plain of South Alabama in 2009. An additional on-farm test/demonstration was set up on a bermudagrass hayfield in South Alabama in 2009. In 2010, a test was added on a Vaiden clay on the Black Belt Research and Extension Center in Central Alabama.

Huxford research site. Soil at the research site near Huxford is a Bama fine sandy loam, 0 to 2 percent slope (Fine-loamy, siliceous, subactive, thermic Typic Paleudults). The field has had a history of cotton production although it has been fallow the past three years. Treatments (Table 1) were applied on June 10, 2009, after cotton had emerged. In 2010, cotton was planted in the same rows using no-till. Soil tests indicated the site is "low" in P and "medium" in K and would normally require ground limestone to reach a pH of approximately 6.5. Ground agricultural dolomitic limestone was applied to selected treatments. Lysimeters were installed in the row before spreading treatments. All treatments received 90-90-90 pounds N-P_2O_5-K_2O during the growing season. Treatments were arranged in a randomized block design in plots 18 feet (6 rows) wide x 25 feet long. Cotton yields were measured by machine harvesting the two center rows in each plot on October 29.



Sites for FGD gypsum research and demonstrations in Alabama.

Neither FGD gypsum nor agricultural gypsum had an effect on cotton lint yields at the Huxford site in 2009 or 2010.

Uriah demonstration site. FGD gypsum was applied by the producer in strips across an existing cotton field prior to planting. Rates applied were 0, 1, 2, and 4 tons per acre. Strips were replicated three times. Cotton was planted using conservation tillage. Fertilization and pest control was uniform across the entire field. Cotton was planted on May 20 and harvested by machine on November 13, 2009. There were no differences in lint yields (Table 2). The Uriah site was not harvested in 2010.

Table 1. Cotton Lint Yields, Huxford Research Site, 2009 and 2010

Treatment applied in 2009	Gypsum rate appl. in 09	Cotton lint yields 2009	2010
	—ton/A—	—lb/A—	
1. Check	0	620	713
2. FGD gypsum	1	560	570
3. FGD gypsum	2	604	650
4. FGD gypsum	4	610	650
5. Ag. gypsum	1	572	610
6. Ag. gypsum	2	534	600
7. Ag. gypsum	4	624	680
8. Lime(1 ton/A) + FGD gypsum	1	602	600
9. Lime only (1 ton/A)	0	574	620
		ns	ns

Opp demonstration site. An established, 11-acre Coastal bermudagrass hayfield on the farm of Brett Mack near Opp, Alabama, was used for another strip test. FGD gypsum was applied to strips across the field using a pull-type buggy spreader. Rates used were 0, 1, 2, and 4 tons per acre. Each treatment was replicated two times. Treatments were applied on May 22, 2009. Each strip was approximately 1 acre. Soil at the site is an Orangeburg sandy loam, 0-5 percent slope.

An initial, composite soil test indicated the following: pH = 6.0; P = very high (248 pounds extractable P per acre); K = medium (126 pounds per acre); Mg = high (137 pounds per acre); Ca = high (1268 pounds per acre).

Hay was harvested on July 24 and again in October 2009. Yields were measured only on the July 24 harvest. After the hay was cut, forage was measured in 3-foot by 3-foot square areas. Four squares were measured in each plot. A grab sample was used to estimate moisture and to convert forage yield to oven dry weight yields. In 2010, hay was harvested three times but yields and quality were measured only on the first harvest in late May.

Average dry matter forage yield was 2.3 tons per acre in 2009 and 3.0 tons per acre in 2010 (Table 3). There was no statistical difference in dry matter yield due to treatment because there was considerable yield variability across the field (see standard deviation). Forage quality analyses were not replicated.

Black Belt Research and Extension Center research site. In April 2010, a replicated test using FGD gypsum was established on a Vaiden clay (very fine, montmorillonitic, thermic Vertic Hapludalfs) at the Black Belt Research and Extension Center near Marion Junction, Alabama. Four rates of FGD gypsum were used, 0, 2, 4, and 8 tons per acre. All plots were fertilized with 90-100-100 pounds N-P_2O_5-K_2O with N rates applied in split applications.

High rates (4 to 8 tons per acre) of FGD gypsum significantly increased cotton lint yields on a Vaiden clay in 2010 (Table 4).

TABLE 2. COTTON LINT YIELDS, URIAH DEMONSTRATION SITE, 2009

Treatment and rate	Cotton lint yields
	—lb/A—
FDG gypsum, 4 tons/A	640
FDG gypsum, 2 tons/A	750
FDG gypsum, 1 tons/A	770
No gypsum	690

TABLE 3. BERMUDAGRASS HAY YIELDS AND FORAGE QUALITY, OPP DEMONSTRATION SITE, 2009 AND 2010

Treatment and rate	—Dry matter yield— lb/A	std. dev.	Field moisture	Crude protein	ADF[1]	NDF[2]	TDN[3]	Ca	K	Mg	P	S
			—%									—
2009 (second harvest)												
No gypsum	4680	2070	11.4	9.3	37	61	48	0.39	3.15	0.21	0.33	0.33
FDG gypsum, 1 ton/A	4470	1090	10.4	7.4	34	65	46	0.42	1.98	0.16	0.27	0.67
FDG gypsum, 2 tons/A	3830	940	11.6	7.5	34	60	57	0..44	2.65	0.22	0.32	0.51
FDG gypsum, 4 tons/A	5450	2150	9.8	7.0	36	66	46	0.53	1.81	0.14	0.22	0.54
2010 (first harvest)												
No gypsum	3290	1280	10.0	10.4	35.6	—	48.1	1.11	1.03	0.54	0.25	—
FDG gypsum, 1 ton/A	2370	490	10.0	10.9	33.9	—	49.5	1.21	1..59	0.56	0.25	—
FDG gypsum, 2 tons/A	2680	880	10.0	9.9	35.8	—	48.0	1.27	1.43	0.62	0.25	—
FDG gypsum, 4 tons/A	3650	1550	10.0	10.8	35.5	—	48.2	1.28	1.86	0.44	0.22	—

[1] ADF = Acid detergent fiber, which measures the cellulose and lignin content in the plant.
[2] NDF = Neutral detergent fiber, which measures all the fiber found in forage.
[3] TDN = Total digestable nutrients.

TABLE 4. COTTON LINT YIELDS, BBREC RESEARCH SITE, 2010

Proposed treatment and rate	Cotton lint yield
	—lb/A—
1 No gypsum	740 b
2 FGD gypsum, 2 tons/A	740 b
3 FGD gypsum, 4 tons/A	820 ab
4 FGD gypsum, 8 tons/A	920 a

Values followed by the same letter are not significantly different at $P<0.05$.

INSECT MANAGEMENT

Development and Validation of a Low Input Insect Control System for Conventional Cotton in Alabama, 2010

R. H. Smith

Large block (one acre or larger) non-replicated cotton trials with various levels of technology were conducted at four research stations in central and south Alabama: Prattville Agricultural Research Unit, E.V. Smith Research Center, Wiregrass Research and Extension Center, and Gulf Coast Research and Extension Center.

Weed and insect control on each technology at each site was treated as if it were a 1000 acre block managed by an Alabama grower. The technology at each site included the following: Bollgard II and Widestrike Roundup Flex (multiple varieties), Roundup Flex with no insect trait (DP 174RF), Widestrike with no herbicide trait (PHY 440W), and a conventional variety with no insect or herbicide traits (CT 210 or DP 491). Varieties with the highest yield potential were selected for each site.

Input costs for seed, technology, and weed and insect control were recorded for each variety at each site. Yields were taken and the costs for all of the above listed inputs were calculated as "cost per pound of seed cotton." All sites were impacted by drought, some more severely than others, just as the entire state. Therefore, potential yields were reduced by the lack of rainfall. Weed and insect control was not a limiting factor at any site. The 2010 insect season could be characterized as a lower-than-normal bollworm, tobacco budworm, fall armyworm, thrips, and plant bug year but higher than normal stink bug year. Harvested yields (pounds seed cotton per acre) ranged as follows: from 1896 to 2761 at Prattville, 1922 to 2280 at Fairhope, 1850 to 2067 at Shorter, and 2633 to 3329 at Headland. Input costs (per pound of seed cotton produced) ranged from $.036 to .067 at Prattville, $.04 to .07 at Fairhope, $.05 to .08 at Shorter, and $.023 to .054 at Headland.

It was estimated that weather related yield losses ranged from 20 to 45 percent at the four sites. This factor had a major impact on the cost per pound of seed cotton produced.

Based on the results of these trials, conclusions are that conventional cotton can be grown in Alabama. However, the economics would vary greatly depending on the weather, severity of the insect season and location. Furthermore, it would require much expertise in monitoring insect populations and selection of the appropriate chemistry for the target insect species present.

Cotton Systems Trials

Variety/ Technology	Seed cost	Technology cost	Weed control cost	Foliar insect control cost[1]	Seed cotton yield *lb/A*	Seed cotton cost/lb
Wiregrass Research and Extension Center, Headland, Alabama						
CT 210	$10.00	-	$37.50	$16.00	2,813	$0.023
PHY 440W	$21.97	$18.00	$37.50	$16.00	2,789	$0.034
DP 174RF	$23.89	$36.81	$31.00	$16.00	2,916	$0.037
DP 121RF	$23.89	$36.81	$31.00	$16.00	2,724	$0.040
DP 0912B2RF	$24.90	$70.00	$31.00	$16.00	3,230	$0.044
PHY 375 WRF	$23.50	$65.00	$31.00	$16.00	3,140	$0.043
ST 5288B2RF	$24.90	$70.00	$31.00	$16.00	3,329	$0.043
PHY 485 WRF	$23.50	$65.00	$31.00	$16.00	3,110	$0.044
DP 1034 B2RF	$24.90	$70.00	$31.00	$16.00	3,041	$0.047
DP 1048 B2RF	$24.90	$70.00	$31.00	$16.00	2,784	$0.051
PHY 565 WRF	$23.50	$65.00	$31.00	$16.00	2,990	$0.045
DP 0949 B2RF	$24.90	$70.00	$31.00	$16.00	2,940	$0.048
DP 1050B2RF	$24.90	$70.00	$31.00	$16.00	2,633	$0.054
E.V. Smith Research Center, Shorter, Alabama						
DP 1050B2RF	$24.90	$70.00	$43.50	$8.00	1,850	$0.08
DP 174RF	$23.89	$36.81	$43.50	$8.00	1,990	$0.06
PHY 440W	$28.22	$21.11	$43.50	$8.00	2,067	$0.05
DP 491	$10.00	—	$43.50	$8.00	1,854	$0.07
Gulf Coast Research and Extension Center, Fairhope, Alabama						
ST 5288B2RF	$24.90	$70.00	$12.00	$18.00	1,922	$0.06
DP 1050B2RF	$24.90	$70.00	$12.00	$18.00	2,122	$0.06
DP 0949B2RF	$24.90	$70.00	$12.00	$18.00	2,280	$0.05
PHY 565 WRF	$23.50	$65.00	$12.00	$18.00	2,167	$0.06
DP 174 RF	$23.89	$36.81	$12.00	$61.00	1,963	$0.07
PHY 440 W	$21.97	$17.99	$21.00	$61.00	2,018	$0.04
CT 210	$20.00	—	$21.00	$61.00	2,155	$0.05
Prattville Agricultural Research Unit, Prattville, Alabama						
DP 491 UT	$10.00	—	$43.60	$8.00	1,710	$0.036
DP 491 Sprayed	$10.00	—	$43.60	$16.00	1,896	$0.037
DP 174R UT	$23.89	$36.81	$32.50	$8.00	2,628	$0.038
DP 174R Sprayed	$23.89	$36.81	$32.50	$16.00	2,761	$0.040
PHY 440W UT	$21.97	$17.99	$43.60	$8.00	2,301	$0.040
PHY 440W Sprayed	$21.97	$17.99	$43.60	$16.00	2,339	$0.043
DP 1050B2RF UT	$24.90	$70.00	$32.50	$8.00	2,587	$0.052
DP 1050B2RF Sprayed	$24.90	$70.00	$32.50	$16.00	2,501	$0.057
ST 5288 B2RF UT	$24.90	$70.00	$32.50	$8.00	2,232	$0.061
ST 5288 B2RF Sprayed	$24.90	$70.00	$32.50	$16.00	2,150	$0.067
PHY 375 WRF UT	$23.50	$65.00	$32.50	$8.00	2,738	$0.047
PHY 375 WRF Sprayed	$23.50	$65.00	$32.50	$16.00	2,503	$0.055

[1]Includes application

Evaluation of the Varying Genetic Technologies for Control of Fall Armyworm and Bollworm in Alabama Cotton

R. H. Smith

A ten-acre field at the Wiregrass Research and Extension Center, Headland, Alabama, was planted to three different genetic technologies (conventional, WideStrike and Bollgard II) to evaluate their effectiveness against the fall armyworm, bollworm, and budworm species. Light pressure from all lepidopteran species occurred over an extended period during the 2010 season at this location. However, no species reached threshold level based on field scouting. Therefore, no treatments of the newer novel chemistry (Tracer, Steward, Belt, or Diamond) were applied over each of these technologies.

The varieties planted in this trial were DP174RF (conventional), PHY 565W RF, and DP 1050B2RF. Each varietal block was 76 rows wide by 222 feet long. This trial was planted on April 16 with Temik at 5 pounds per acre applied in-furrow. The entire trial area was oversprayed on June 29 (second week of bloom) with bifenthrin pyrethroid at the rate of 5 ounces per acre for control of stink bugs. The DP 174RF conventional variety was treated with Steward insecticide (11 ounces per acre) on July 15 for a mixture of bollworms and budworms. A subthreshold level of larvae three to seven days old were present from a moth flight that had occurred over the previous 10 days. All subsequent lepidopteran infestations were at subthreshold levels.

Field monitoring counts were made on August 4 and September 8 and are presented in the following table. Each count is an average of four replicate surveys made on the respective dates. Yields were taken by harvesting the entire plot of each variety. Weights were determined by utilizing a boll buggy.

DP 1050B2RF had less boll damage due to bollworm/budworm than did PHY 565WRF (0.3 versus 2.8 percent). Both the DP 1050B2RF and the PHY 565WRF had less boll damage than did the DP 174RF conventional (6 percent). This occurred even though one Steward application was made to the DP 174RF at an expense of $15 per acre plus application cost.

Fall armyworm infestations in this test field were much lighter than during the previous season, as in the remainder of the state. However, there was enough boll bract grazing (etching) to measure differences in the three technologies. Four percent of the bolls showed fall armyworm grazing in the DP 174RF conventional while the DP 1050B2RF had 0.5 percent and the PHY 565WRF had no boll etching. In conclusion, both varieties with lepidopteran technologies were superior to the conventional variety in reducing damage due to bollworms and budworms. The Bollgard II variety was slightly superior to the Widestrike variety in reducing bollworm damage while the Widestrike variety was superior to the Bollgard II in fall armyworm control.

Yields from the DP 1050B2RF and PHY 565WRF were nearly identical and both yielded slightly higher than the DP 174RF conventional variety.

Effectiveness of Three Genetic Technologies for Control of Lepidopteran Species in Cotton, 2010

Variety	Bollworm/Budworm damaged bolls Aug. 4	Fall armyworm boll bract grazing Aug. 4	Bollworm/Budworm damaged bolls Sept. 8	Yield seed cotton
	no/10 row ft	*%*	*%*	*lb/A*
DP 174RF (Conventional)	6 (3-10)[1]	4%	11%	2216
DP 1050B2RF (Bollgard II)	0.3	0.5%	0.5%	2480
PHY 565WRF (Widestrike)	2.8	0%	2%	2440

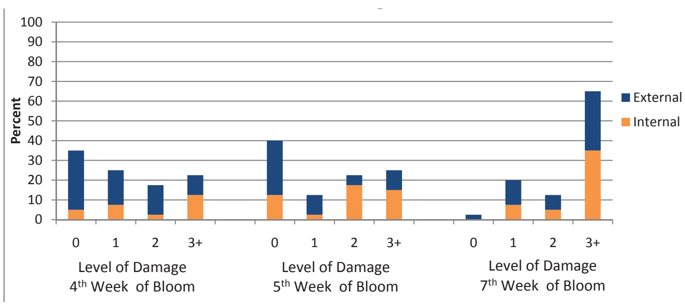
[1] All averages represent four replicate counts

Development of a More Rapid Survey Technique for monitoring Stink Bug Damage to Cotton

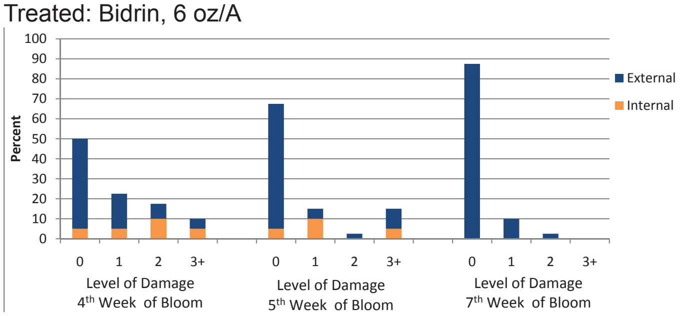
R. H. Smith

Preliminary work conducted during the 2008 and 2009 seasons indicates that external stink bug injury may possibly be correlated to internal injury. If this technique can be developed, it would greatly enhance more effective, efficient and economic decisions on controlling stink bugs. A larger sample size could be taken, which would reflect the level of stink bug damage throughout an entire field. Several factors affect this correlation of external to internal injury.

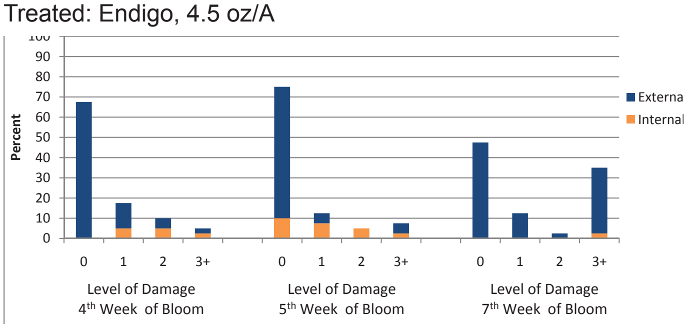
Untreated



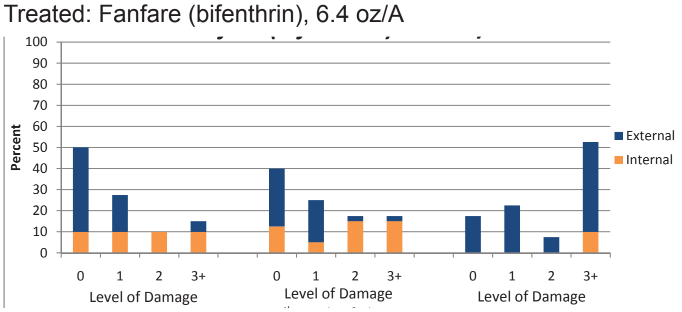
Treated: Bidrin, 6 oz/A



Treated: Endigo, 4.5 oz/A



Treated: Fanfare (bifenthrin), 6.4 oz/A



Percent of bolls with varying levels of external and internal damage.

Two eight-row strips of cotton approximately 1400 feet in length were planted and grown through the middle of a peanut field at the Wiregrass Research and Extension Center, Headland, Alabama. The peanuts served to insure abundant stink bug migration pressure throughout the cotton boll set period. Beginning the third week of bloom, when the earliest bolls were 10 to 12 days old (1 inch or 2.5 cm in diameter), stink bug controls were applied using two classes of insecticide chemistry. Each treatment covered eight rows by fifty feet and was replicated four times. Treatments were applied on weeks three and five of bloom (two-week interval). No further treatments were applied due to drought stress and the absence of developing bolls in this non-irrigated trial. Evaluations were made at day 8 and 15 following application number one. The final evaluation was made 14 days following evaluation number two. At each evaluation 40 bolls (10 per replicate) one inch in diameter were collected from rows two and three adjacent to the peanuts. Each 10-boll sample was bagged and transported to a lab for examination. Each boll was then examined for external stink bug feeding and placed in subgroups consisting of zero, one, two, or three or more external feeding lesions. Bolls from each subgroup were crushed and examined for internal damage (boll rot, stained lint, or carpal wall warts). Correlations were then made between external and internal injury based on the various treatments.

Based on the data collected in this trial, as the number of external lesions per boll increase, a corresponding increase in internal damage also occurs. As the season progressed, especially in the untreated checks and the less effective stink bug treatments, more bolls had higher numbers of external feeding sites and corresponding internal damage. Conversely, in the most effective treatments for stink bug control (Bidrin), less internal damage was recorded as the season progressed. Based on this trial, one could conclude that stink bugs produce varying amounts of boll feeding and corresponding internal damage based on the effectiveness of the insecticide used for their control. The majority of the stink bug population in this trial was the brown species, *Euschistus servus.*

In summary, several factors impact the correlation of external to internal stink bug boll injury to cotton.

- Time of season as expressed by week of bloom.
- Whether or not the field has been previously treated for stink bugs.
- The length of time since the previous treatment.
- The number of previous stink bug applications.
- The effectiveness of previous treatments.
- Species of stink bug that dominates the population (brown versus green)
- The number of external stink bug boll lesions.

WEED MANAGEMENT

On-Farm Glyphosate-Resistant Palmer Amaranth Management in Roundup Ready Flex, Liberty-Link, and Conventional Cotton Varieties

M. G. Patterson, C. D. Monks, B. A. Dillard, W. C. Birdsong, W. R. Goodman, and A. J. Price

A replicated field trial was conducted on-farm in Barbour county, Alabama, in 2010 to evaluate optimum weed management systems for Roundup Ready Flex (RF), Liberty-Link (LL), and conventional (non-transgenic) cotton varieties in an area infested with glyphosate-resistant palmer amaranth (*Amaranthus palmeri*). Varieties used were DP 1048 B2RF, FM 1845 LLB2, and CT 210. Cotton was planted in a reduced tillage field that had received a preplant foliar (burndown) application of Gramoxone Inteon (2 pints per acre) plus Diuron 4L (2 pints per acre) with surfactant two weeks prior to planting on May 12. Seed of each variety were put into four planters on a 12 row planter and three passes were made the length of the field (800 feet). Seeding rate for all varieties was two seed per 11.5 inches of row. Immediately after planting a preemergence application of Prowl (2 pints per acre) plus Reflex (1 pint per acre) was made in all varieties. Cotoran 4L was added to this mixture for the conventional variety (CT 210). Early postemergence treatments were made prior to the four-leaf cotton stage and before pigweed emergence. Roundup Power Max (22 fluid ounces per acre) plus Dual Magnum (1 pint per acre), Ignite 280 (29 fluid ounces per acre) plus Dual Magnum (1 pint per acre), and Staple LX (3 fluid ounces per acre plus surfactant) were applied to RF, LL, and conventional cotton, respectively. A layby treatment of Valor DF (2 ounces per acre) plus Diuron 4L (2 pints per acre) plus MSMA 6 (2.7 pints per acre) was made when cotton was approximately knee high. All treatments were activated by timely rainfall (within 7 days) following application.

Weed control ratings of Palmer amaranth were made on June 11 after early posttreatments (applied on June 2), at which time control in all varieties was 99 percent, and on June 29 when layby treatments were applied at which time control was 93, 92, and 88 percent for RF, LL, and conventional varieties, respectively. Palmer amaranth escapes were counted in each plot on July 16 showing 45, 5, and 39 plants per acre for RF, LL, and conventional varieties, respectively. These numbers were constant for the remainder of the season (cotton picked on October 5 and 6), primarily due to late-season drought. Lint yield for each variety was 1668, 1499, and 1331 pounds per acre for RF, LL, and conventional varieties, respectively. Input costs for seed and tech fees, herbicides, and hand weeding were $142, $89, and $89 per acre for RF, LL, and conventional varieties, respectively. Variable and fixed costs for all three varieties outside of weed management was $447 per acre. Net returns to land, operator labor, and management at a lint price of $0.95 per pound were $1,115 for RF, $1032 for LL, and $854 per acre for conventional. At $0.55 per pound, the net returns were $305, $286, and $192 per acre for RF, LL, and conventional varieties, respectively.

Table 1. Weed Control Programs for Different Cotton Varieties

Herbicide, rate	DP 1048 B2RF	FM 1845 LLB2	CT 210
Prowl H2O, 2 pt/A	$7.50	$7.50	$7.50
Reflex, 1 pt/A	$11.00	$11.00	$11.00
Cotoran 4L, 2 pt/A	—	—	$8.50
Dual Mag, 1 pt/A	$11.00	$11.00	—
Rdup Pmax, 32 oz/A	$5.60	—	—
Ignite 280, 29 oz/A	—	$9.50	—
Staple LX, 3 oz/A	—	—	$17.00
Valor DF, 2 oz/A	$7.75	$7.75	$7.75
Diuron 4L, 2 pt/A	$5.00	$5.00	$5.00
MSMA, 2.7 pt/A	$6.00	$6.00	$6.00
Total herbicide	***$53.85***	***$57.75***	***$62.75***
Hand weeding	$23.29	$2.69	$20.49
Total all control	***$77.14***	***$60.44***	***$83.28***

Table 2. Return on Investment at $0.95 or $0.55 per Pound of Cotton Lint

Herbicide	—DP 1048 B2RF—		—FM 1845 LLB2—		——CT 210——	
	$0.95	$0.55	$0.95	$0.55	$0.95	$0.55
Lint yield, lb/A	1668	1668	1499	1499	1331	1331
Seed cotton yield, lb/A	3819	3819	3911	3911	3441	3441
Seed value	$167	$143	$150	$147	$133	$128
Lint value	$1585	$917	$1567	$824	$1264	$732
Seed and tech fee (a)	$65	$65	$28	$28	$6	$6
Weed control costs (b)	$77	$77	$61	$61	$83	$83
Total control costs (a+b)	$142	$142	$89	$89	$89	$89
Variable and fixed costs	$447	$447	$447	$447	$447	$447
Total all costs	***$589***	***$589***	***$536***	***$536***	***$536***	***$536***
Net returns	***$1,115***	***$305***	***$1,032***	***$286***	***$854***	***$192***

Evaluation of Seed Treatments and Seed Quality in Cotton Seedling Disease Management in Alabama, 2010

K. S. Lawrence, S. R. Moore, G. W. Lawrence, C. H. Burmester, and B. E. Norris

Experimental seed treatments placed on high and low vigor cotton seed were evaluated for the management of cotton seedling disease in a naturally infested field on the Tennessee Valley Research and Education Center in Belle Mina, Alabama. The field had a history of cotton seedling disease incidence and was infested by *Rhizoctonia solani, Pythium* spp., *Thielaviopsis basicola,* and *Fusarium* spp. The soil was a Decatur silt loam (24 percent sand, 49 percent silt, 28 percent clay). The seed treatments were applied to the seed by Bayer Crop Science. Temik 15G (5 pounds per acre) was applied at planting on April 23 in the seed furrow with chemical granular applicators attached to the planter. 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. 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. Plots were irrigated with a sprinkler system as needed. Seedling stand was determined at two and four weeks after planting on May 14 and 28. Plots were harvested on October 21. Data were statistically analyzed by GLM and means compared using Fisher's protected least significant difference test ($P \leq 0.10$). Monthly average maximum temperatures from planting in April through harvest in September were 76.2, 81.2, 90.1, 93.1, 94.2, and 88.4 degrees F with average minimum temperatures of 50.6, 61.2, 69.7, 71.0, 72.1, and 61.0 degrees F, respectively. Rainfall accumulation for each month was 4.07, 2.46, 4.99, 2.24, 3.70, 1.22, and 0.05 inches with a total of 18.74 inches over the entire season.

Seedling disease pressure was high in 2010 due to excessive moisture and cool temperatures before and after planting. Plant stand was lower in the Low vigor Baytan + Vortex + Allegiance and Low vigor Treatment 2 + Dynasty CST fungicide treatments at 14 days after planting (DAP). By 28 DAP all fungicide treatments in the high vigor seeds increased stand over the non-treated controls. Only Dynasty CST increased stand over the untreated control in the low vigor seed treatments. The fungicide treatments increased stand as compared to the untreated control by 28 percent in the high quality seeds. The increase in stand was similar in the low quality seed treatments with an increase of 29 percent. Seed quality also affected yield. Seed cotton yields varied by 978 pounds per acre at harvest with an average of 3418.4 pounds per acre of seed cotton produced over all the fungicide treatments. The fungicide seed treatment combinations did not significantly increase yield over the control in the high vigor seed in 2010. However, seed cotton yield was increased in the low vigor seed in all fungicide treatments over the untreated control. Fungicides increased yield ($P \leq 0.10$) by an average of 302 pounds per acre in the low vigor seed as compared to the control.

Yield and Stand Count of Seed Cotton, 2010

Treatment and rate (oz/cwt)	Stand/10-ft row		Yield
	Apr. 29	May 13	*lb/A*
1 High vigor untreated	18.2 a	18.2 bc	3710.5 ab
2 High vigor Baytan 0.5 + Vortex 0.08 + Allegiance 0.75	19.2 a	25.4 a	3951.3 a
3 High vigor Trt 2 + Trilex Advanced 1.64	21.0 a	24.4 a	3528.5 ab
4 High vigor Trt 2 + Dynasty CST 3.94	22.8 a	26.0 a	3357.9 ab
5 Low vigor untreated	16.0 ab	14.6 c	2973.0 c
6 Low vigor Baytan 0.5 + Vortex 0.08 + Allegiance 0.75	15.4 b	19.8 abc	3046.9 b
7 Low vigor Trt 2 + Trilex Advanced 1.64	17.0 a	20.2 abc	3123.8 b
8 Low vigor Trt 2 + Dynasty CST 3.94	15.4 b	22.0 ab	3654.9 ab
LSD ($P \leq 0.10$)	***5.91***	***4.08***	***432.4***

Means within columns followed by different letters are significantly different according to Fisher's LSD ($P \leq 0.10$).

EVALUATION OF EXPERIMENTAL SEED TREATMENTS IN COTTON SEEDLING DISEASE MANAGEMENT IN ALABAMA, 2010

K. S. Lawrence, S. R. Moore, G. W. Lawrence, C. H. Burmester, and B. E. Norris

Experimental seed treatments were evaluated for the management of cotton seedling disease in a naturally infested field on the Tennessee Valley Research and Education Center in Belle Mina, Alabama. The field had a history of cotton seedling disease incidence and was infested by *Rhizoctonia solani*, *Pythium* spp., *Thielaviopsis basicola*, and *Fusarium* spp. The soil type was a Decatur silt loam (24 percent sand, 49 percent silt, 28 percent clay). The seed treatments were applied to the seed by Bayer CropScience. Fungicide treatments were mixed with $CaCO_3$ at 7 ounces per hundredweight, Secure at 1 ounce per hundredweight, Cruiser at 9 ounces per hundredweight, and Color Coat Red at 1 ounce per hundredweight, and 2.75 percent RTU-PCNB. Water, $CaCO_3$, Secure, Cruiser, and dye also were applied to the non-treated seed treatment at the same rate. Temik 15G (5 pounds per acre) was applied at planting on April 13 in the seed furrow with chemical granular applicators attached to the planter. 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. 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. Plots were irrigated with a sprinkler system as needed. Seedling stand was determined at 30 days after planting (DAP) on May 13. Plots were harvested on September 29. Data were statistically analyzed by GLM and means compared using Fisher's protected least significant difference test ($P \leq 0.10$). Monthly average maximum temperatures from planting in April through harvest in September were 76.2, 81.2, 90.1, 93.1, 94.2, and 88.4 degrees F with average minimum temperatures of 50.6, 61.2, 69.7, 71.0, 72.1, and 61.0 degrees F, respectively. Rainfall accumulation for each month was 4.07, 2.46, 4.99, 2.24, 3.70, 1.22, and 0.05 inches with a total of 18.74 inches over the entire season.

Seedling disease pressure was high in 2010 due to optimum moisture and cool temperatures. Plant stand was significantly greater in all the seed treatment combinations as compared to the untreated control at 30 DAP. The three and four fungicide combinations (Treatments 1 through 8, 10, and 13) increased plant stand as compared to the untreated control, RTU Baytan Thiram + Allegiance FL, RTU-PCNB, and Allegiance FL applied alone. Plant stands were low with 12.6 to 31.8 percent seedlings surviving producing 1.2 to 3.1 plants per foot of row. *Rhizoctonia solani, Pythium ultimum,* and *Fusarium* spp. were isolated from the diseased seedlings. Seed cotton yields were significantly increased by all fungicides that increased plant stand. Yields varied by 652 pounds per acre at harvest with an average of 394 pounds per acre average increase of seed cotton produced over all the fungicide treatments as compared to the untreated control.

EVALUATION OF EXPERIMENTAL SEED TREATMENTS, 2010

	Treatment and rate (oz/cwt)	Stand/10-ft row May 13	Yield *lb/A*
1	Baytan 30 0.75 + Allegiance FL 1.5 + Vortex FL 0.08 + SP1020 0.32	28.2 ab	3653.8 a
2	Baytan 30 0.5 + Allegiance FL 0.75 + Vortex FL 08	27.0 ab	3470.8 a
3	Apron XL 0.64 + Maxim 4FS 0.04 + Systhan 40 WP 0.84 + Dynasty CST 4.0	29.4 ab	3608.1 a
4	Apron XL 0.64 + Maxim 4FS 0.04 + Systhan 40 WP 0.84 + Dynasty CST 4.0 + Bion 0.03	26.4 ab	3552.4 a
5	Apron XL 0.64 + Maxim 4FS 0.04 + Systhan 40 WP 0.84 + A16148C 0.5	27.6 ab	3579.5 a
6	WECO 100 4.0 + Nu-Flow M HF 4.0 + Apron XL 0.32 + Nusan 30 EC 2.0	28.4 ab	3576.3 a
7	WECO 100 4.0 + Nu-Flow M HF 1.75 + Apron XL 0.32 + Nusan 30 EC 2.0	28.8 ab	3765.7 a
8	WECO 100 4.0 +Nu-Flow M HF 4.0 + Apron XL 0.32+ Nusan 30 EC 2.0 + WECO 1090 0.2	31.8 a	3448.4 a
9	Vitavax-PCNB 6.0 + Allegiance 0.75	21.0 bc	3472.3 a
10	RTU Baytan Thiram 3.0 + Allegiance FL 0.75	26.0 ab	3394.3 a
11	RTU-PCNB 14.5	20.6 bc	3111.4 b
12	Allegiance FL 1.5	17.0 c	3170.6 b
13	Baytan 30 0.5 + Allegiance FL 0.75 + Vortex FL 0.08[1]	31.8 a	3401.1 a
14	Non treated control	12.6 c	3114.1 b
LSD (P ≤ 0.10)		***6.50***	***538.33***

[1] Cruiser insecticide was not addted to this treatment.

Means within columns followed by different letters are significantly different according to Fisher's LSD (P ≤ 0.10).

Cotton Resistance to Root-Knot and Fusarium Wilt in Alabama, 2010

T. Z. Scott, K. S. Lawrence, K. Glass, and E. van Santen

Cotton cultivars were examined to determine their response to pathogens, root-knot nematode *(Meloidogyne incognita)* and *Fusarium oxysporum* f. sp. *vasinfectum*, causing Fusarium wilt of cotton. The test was located at the E. V. Smith Research Center, Plant Breeding Unit, in Tallassee, Alabama. Plots consisted of one row, 20 feet long with 36-inch row spacing separated by 6-foot wide alleys, and were planted in a randomized complete block design with four replications. The set of four test cultivars submitted, was evaluated as a group with two control plots within each replicate. All plots were maintained throughout the season using standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Initial plant counts were made on June 9. Wilted plants were counted and removed on June 23, July 7, July 21, August 4, and August 19. Three plants per plot were removed on 22 July and root knot nematodes were extracted from the root systems using 0.6 percent NaOCl agitation for four minutes. Reisolation of the Fusarium wilt fungus, *Fusarium oxysporum* f. sp. *vasinfectum*, was conducted to confirm the presence of the disease pathogen. The remaining live plants were counted and recorded on August 26. Data were statistically analyzed using Generalized Linear Mixed Models procedures as implemented in SAS® PROC GLIMMIX with a negative binomial distribution function for count variables.

Monthly average maximum temperatures from June to October were 90.1, 86.7, 87.1, 81.2, and 70.1 degrees F with average minimum temperatures being 66.7, 66.4, 66.9, 64.6, and 50.2 degrees F. Total rainfall amounts from June to October were 1.1, 5.5, 4.2, 4.6, and 6.5 inches. The total rainfall for the growing season was 21.9 inches.

Root-knot nematode numbers increased throughout the season in all the cotton samples submitted. The standard susceptible cotton, Rowden, averaged 2,149 root-knot eggs per gram of root while the M-315 resistant cotton supported 88 root-knot eggs per gram of root. Nematode juveniles and eggs extracted from the root systems for all the submissions ranged from a high of 4,718 in PHY 565 to a low of 1,951 in DP 0949. The reproductive potential observed varied widely from highly susceptible to low susceptibilities, depending on the cotton submission. The average percent of wilted plants for the susceptible, Rowden, was 16 percent, with a range from 11 to 23 percent, and the resistant, M-315, had an average of 0.4 percent wilted with a range of 0 to 4 percent on an individual plot basis. The fungal pathogen was not found in the resistant M -315 cotton but was readily isolated from Rowden. From all the cotton submissions planted, 76.25 percent were colonized by *Fusarium oxysporum* f. sp. *vasinfectum*. Yields ranged from 3,467 to 1,151 pounds per acre, with PHY 367, PHY 565 ST 4288, and ST 5458 producing significantly higher yields than Rowden.

Cotton Resistance to Root-Knot and Fusarium Wilt in Alabama, 2010

Variety	Fusarium wilted[1] %	Dunnett's P-value vs. Rowden	M-315[2]	*M. incognita/* 150 cm^3 soil	Dunnett's P-value vs. Rowden	M-315	*M. incognita/* egg/g root[3]	Dunnett's P-value vs. Rowden	M-315	Seed cotton yield *lb/A*	Dunnett's P-value vs. Rowden	M-315
M-315	0.4	0.013		77	1.000		88	<.0001		2777	0.017	
Rowden	16.3		0.005	77		1.000	2149		<.0001	1151		0.017
DP 0949 B2RF	7.6	0.378	0.044	174	0.973	0.973	775	0.318	0.003	1176	1.000	0.020
DP 1028 B2RF	2.6	0.013	0.326	97	1.000	1.000	1092	0.734	0.001	1768	0.793	0.272
DP 1050 B2RF	3.7	0.011	0.172	116	1.000	1.000	693	0.225	0.005	2316	0.150	0.951
FM 1740 B2F	5.4	0.019	0.080	290	0.680	0.680	1852	1.000	<.0001	1804	0.743	0.309
PHY 367 WRF	1.1	0.001	0.790	251	0.791	0.791	382	0.023	0.067	3467	0.000	0.691
PHY 375 WRF	2.5	0.011	0.335	97	1.000	1.000	1187	0.835	0.000	1808	0.738	0.313
PHY 485 WRF	3.3	0.006	0.207	695	0.376	0.376	1170	0.819	0.001	1535	0.985	0.109
PHY 565 WRF	6.9	0.065	0.046	773	0.112	0.112	1585	0.980	<.0001	3133	0.003	0.991
ST 4288 B2RF	3.4	0.004	0.188	77	1.000	1.000	893	0.217	<.0001	2603	0.042	1.000
ST 5458 B2RF	1.6	0.001	0.560	77	1.000	1.000	901	0.484	0.002	2784	0.017	1.000

[1] Percent of wilted plants of the total per plot. Wilted plants were counted biweekly for 6 weeks.

[2] Dunnett's P-value greater than 0.05 indicate significant differences from the susceptible Rowden and the resistant M-315 standards.

[3] Root-knot extracted from three cotton root systems collected on July 22.

NEMATODE MANAGEMENT

Evaluation of Cotton Seed Treatments for the Control of Root-Knot Nematode and Fusarium Wilt on Cotton, 2010

S. R. Moore, K. S. Lawrence, and S. Nightengale

Selected seed treatments were evaluated to determine their effect on root-knot nematodes and Fusarium wilt in cotton. The test was located at the Plant Breeding Center of the E. V. Smith Research and Extension Center, near Tallassee, Alabama. The field has a long history of root-knot nematode infestation, and the soil type was classified as a Kalmia loamy sand (80 percent sand, 10 percent silt, and 10 percent clay). Plots consisted of two rows, 25 feet long with 36-inch row spacing, and were planted in a randomized complete block design with five replications on April 22. Blocks were separated by a 20 foot-wide alley. All plots were maintained throughout the season using standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Stand counts and vigor ratings were conducted at 8 days after planting (DAP) on 10 feet of plot row and recorded. Soil samples were taken from each plot at 41 DAP. A 150 cm^3 sub-sample from each plot was processed and root-knot nematodes were extracted by the sucrose centrifugation-flotation methods and counted under the inverted microscope. Entire plots were harvested mechanically on September 30. Data were statistically analyzed by analysis of variance using the generalized linear models (GLM) procedure, and means compared using Fisher's protected least significant difference (LSD) test.

Stand counts at 8 DAP were significantly higher in Treatments 4 (Apron XL 3LS + Maxim 4FS + Systhane 40WP + Avicta Duo 4.03SC + Dynasty CST 125FS + A9625 + A16148) and 5 (Treatment 4 + Mertect Flowable) compared to Treatment 1 (Avicta Duo 4.03SC). Vigor ratings at 8 DAP were significantly higher in Treatments 2 (Apron XL 3LS + Maxim 4FS + Systhane 40WP + Avicta Duo 4.03SC + Dynasty CST 125FS), 5, and 7 (Apron XL 3LS + Maxim 4FS + Systhane 40WP + Avicta Duo 4.03SC + Dynasty CST 125FS + A9625 + Dividend Extreme 0.96FS) compared to Treatment 1. Treatments 2 and 7 were significantly higher than Treatment 3 (Apron XL 3LS + Maxim 4FS + Systhane 40WP + Avicta Duo 4.03SC + Dynasty CST 125FS + A9625). Root-knot nematode populations were the lowest in Treatment 7 and significantly so compared with Treatment 2. Seed cotton yields averaged 1,673 pounds per acre and were similar for all treatments.

Stand Count, Vigor, Nematode Populations and Yield of Cotton in Central Alabama Trial, 2010

Trt. no.	Treatment[1]	Rate	Stand/ 10 ft row 8 DAP	Vigor[1] 8 DAP	*Meloidogyne incognita* J2 and eggs/ g of root 41 DAP	Seed cotton yield *lb/A*
1	Avicta Duo 4.03SC	0.5 mg/seed	16.6 b	2.6 c	841 ab	1775.4 a
2	Apron XL 3LS	15.0 g/100kg seed	21.4 ab	3.3 a	2791 a	1423.2 a
	Maxim 4FS	2.5 g/100kg seed				
	Systhane 40WP	31 g/100kg seed				
	Avicta Duo 4.03SC	0.5 mg/seed				
	Dynasty CST 125FS	0.03 mg/seed				
3	Treatment 2					
	A9625	1.0 g/100kg seed	25.2 ab	2.7 bc	652 ab	1809.5 a
4	Treatment 3					
	A16148	20.0 g/100kg seed	27.8 a	3.0 abc	1090 ab	1483.6 a
5	Treatment 3					
	Mertect Flowable	20.0 g/100kg seed	26.0 a	3.1 ab	691 ab	1369.8 a
6	Allegiance-LS	15.0 g/100kg seed	24.2 ab	2.9 abc	1951 ab	1886.8 a
	Baytan 30	10.0 mg/seed				
	Thiram 42-S	31.0 g/100kg seed				
	Vortex 3.77FS	5.0 g/100kg seed				
	Avicta Duo 4.03SC	0.5 mg/seed				
	Dynasty CST 125FS	0.03 mg/seed				
7	Treatment 3					
	Dividend Extreme 0.96FS	10.0 g/100kg seed	24.4 ab	3.3 a	141 b	1964.1 a
	LSD ($P \leq 0.10$)		***8.84***	***0.49***	***2204.4***	***606.27***

[1] Plant vigor estimated on a 1 to 5 scale with 3 being the control. 4 and 5 are progressively better than the control and 1 and 2 are similarly worse than the control.

Means within columns followed by different letters are significantly different according to Fisher's LSD ($P \leq 0.10$).

Evaluation of Experimental Nematicides for the Control of Reniform Nematodes on Cotton in North Alabama, 2010

S. R. Moore, K. S. Lawrence, and B. E. Norris

Selected experimental seed treatments were evaluated to determine their efficacy against the reniform nematode (*Rotylenchulus reniformis*) on cotton in north Alabama. The soil was a Decatur silt loam (23 percent sand, 49 percent silt, 28 percent clay) that had a history of reniform nematode infestation. Soil temperature was 64 degrees F at a 4-inch depth on the day of planting with adequate soil moisture. All seed treatments were applied to the seed by the manufacturer. Orthene 90S (2 ounces per acre) was applied to all plots as needed for thrips control. Temik 15G was applied as a granular in-furrow treatment. Each plot consisted of four rows, 25 feet long with 40-inch row spacing, and plots were arranged in a randomized complete block design with five replications. Adjacent blocks were separated by 15-foot alleys. Standard herbicides, insecticides, and fertility production practices, as recommended by the Alabama Cooperative Extension System, were used throughout the season. Population densities of the reniform nematode were determined at 26 and 61 days after planting (DAP). Ten soil cores, 0.5 inch in diameter and 6 inches deep, were collected from the center two rows of each plot in a systematic sampling pattern. Nematodes were extracted using the gravity sieving and sucrose centrifugation technique. Ratings to determine plant vigor were recorded at 26 days after planting (DAP). Plots were mechanically harvested on September 13. Data were statistically analyzed by analysis of variance using the generalized linear models (GLM) procedure, and means compared using Fisher's protected least significant difference (LSD) test.

Vigor ratings at 26 DAP in all treatments were significantly higher compared to Treatment 1 (Apron XL 3LS + Maxim 4FS + Systhane 40WP + Dynasty CST 125FS). Treatment 6 (Apron XL 3LS + Maxim 4FS + Systhane 40WP + Trilex Flowable + Baytan 30 + Allegiance-LS + STP15273) was significantly higher compared to Treatment 4 (Apron XL 3LS + Maxim 4FS + Systhane 40WP + Dynasty CST 125FS + A16115 + Temik 15G). Nematode populations were the lowest for Treatments 5 (Treatment 1 + Temik 15G) and 6, and significantly so compared to Treatments 2 (Treatment 1 + Cruiser 5FS) and 4. Treatment 6 produced significantly lower numbers at 61 DAP compared to Treatment 2, with all other treatments producing similar populations. Seed cotton yields averaged 2968 pounds per acre in 2010 with Treatment 4 yielding the highest overall and significantly so compared to Treatments 2 and 7 (Treatment 6 + STP17217 + STP17170).

Vigor, Nematode Populations, and Yield of Cotton in North Alabama, 2010

Trt. no.	Treatment[1]	Rate	Vigor[1] 26 DAP	*Rotylenchulus reniformis*/ 150 cm^3 soil 26 DAP	*Rotylenchulus reniformis*/ 150 cm^3 soil 61DAP	Seed cotton yield *lb/A*
1	Apron XL 3LS	15.0 g/100kg seed	2.2 c	386.3 abc	571.7 ab	2802.3 ab
	Maxim 4FS	2.5 g/100kg seed				
	Systhane 40WP	21 g/100kg seed				
	Dynasty CST 125FS	0.03 mg/seed				
2	Treatment 1 +					
	Cruiser 5FS	0.34 mg/seed	3.4 ab	633.5 a	710.7 a	2445.7 b
3	Treatment 1 +					
	A16115	0.5 mg/seed	3.4 ab	278.1 bc	463.5 ab	3113.1 ab
4	Treatment 3 +					
	Temik 15G	840 g/ha	3.2 b	494.4 ab	540.8 ab	3576.1 a
5	Treatment 1 +					
	Temik 15G	840 g/ha	3.4 ab	139.1 c	278.1 ab	3294.9 ab
6	Apron XL 3LS	15.0 g/100kg seed	3.8 a	154.5 c	231.8 b	3035.9 ab
	Maxim 4FS	2.5 g/100kg seed				
	Systhane 40WP	21 g/100kg seed				
	Trilex Flowable	10 g/100kg seed				
	Baytan 30	5 g/100kg seed				
	Allegiance-LS	15 g/100kg/seed				
	STP15273	0.375 mg/seed				
7	Treatment 6 +					
	STP17217	0.375 mg/seed	3.6 ab	370.8 abc	401.7 ab	2510.2 b
	STP17170	10 mg/seed				
	Harpin	31.2 g/100kg seed				
LSD ($P \leq 0.10$)			***0.55***	***283.07***	***471.20***	***913.86***

[1] Plant vigor estimated on a 1 to 5 scale with 3 being the control. 4 and 5 are progressively better than the control and 1 and 2 are similarly worse than the control.

Means within columns followed by different letters are significantly different according to Fisher's LSD ($P \leq 0.10$).

EVALUATION OF EXPERIMENTAL NEMATICIDES FOR THE CONTROL OF RENIFORM NEMATODES ON COTTON IN SOUTH ALABAMA, 2010

S. R. Moore, K. S. Lawrence, and J. R. Akridge

Selected experimental seed treatments were evaluated to determine their efficacy against the reniform nematode (*Rotylenchulus reniformis*) in a naturally infested producer's field near Huxford, Alabama. The field had a history of infestation by reniform nematodes and the soil type was a Ruston very fine sandy loam (59 percent sand, 33 percent silt, 8 percent clay). Soil temperature was 90 degrees F at a 4-inch depth on the day of planting with adequate soil moisture. All seed treatments were applied to the seed by the manufacturer. Orthene 90S (2 ounces per acre) was applied to all plots as needed for thrips control. Temik 15G was applied as a granular in-furrow treatment.

Each plot consisted of two rows, each 25 feet long with 36-inch row spacing, and plots were arranged in a randomized complete block design with six replications. Adjacent blocks were separated by 15-foot alleys. Standard herbicides, insecticides, and fertility production practices, as recommended by the Alabama Cooperative Extension System, were used throughout the season. Population densities of the reniform nematode were determined at 28 and 72 days after planting (DAP). Ten soil cores, 0.5 inch in diameter and 6 inches deep, were collected from the two rows of each plot in a systematic sampling pattern. Nematodes were extracted using the gravity sieving and sucrose centrifugation technique. Ratings to determine plant vigor were recorded at 28 DAP. Plots were mechanically harvested on October 12. Data were statistically analyzed by analysis of variance using the generalized linear models (GLM) procedure, and means compared using Fisher's protected least significant difference (LSD) test.

Plant vigor at 28 DAP was significantly higher for all treatments compared to Treatment 1 (Apron XL 3LS + Maxim 4FS + Systhane 40WP + Dynasty CST 125FS) and all treatments with the exception of Treatment 1 were significantly higher than Treatment 2 (Treatment 1 + Cruiser 5FS). Reniform nematode populations were similar for all treatments at both 28 and 72 DAP. All treatments produced numerically higher yields compared to Treatment 1 by an average of 539 pounds per acre. All treatments with the exception of Treatments 2 and 6 (Apron XL 3LS + Maxim 4FS + Systhane 40WP + Trilex Flowable + Baytan 30 + Allegiance-LS + STP15273) produced significantly higher seed cotton yields compared to Treatment 1.

VIGOR, NEMATODE POPULATIONS, AND YIELD OF COTTON IN SOUTH ALABAMA, 2010

Trt. no.	Treatment[1]	Rate	Vigor[1] 28 DAP	*Rotylenchulus reniformis*/ 150 cm³ soil 28 DAP	*Rotylenchulus reniformis*/ 150 cm³ soil 72 DAP	Seed cotton yield *lb/A*
1	Apron XL 3LS	15.0 g/100kg seed	3.0 c	321.9 a	309.2 a	1875.4 b
	Maxim 4FS	2.5 g/100kg seed				
	Systhane 40WP	21 g/100kg seed				
	Dynasty CST 125FS	0.03 mg/seed				
2	Treatment 1 +					
	Cruiser 5FS	0.34 mg/seed	4.2 b	412.0 a	193.3 a	2253.0 ab
3	Treatment 1 +					
	A16115	0.5 mg/seed	4.7 a	682.4 a	257.7 a	2414.7 a
4	Treatment 3 +					
	Temik 15G	840 g/ha	4.8 a	476.4 a	180.3 a	2504.7 a
5	Treatment 1 +					
	Temik 15G	840 g/ha	4.8 a	566.5 a	270.5 a	2510.0 a
6	Apron XL 3LS	15.0 g/100kg seed	5.0 a	347.6 a	193.2 a	2350.3 ab
	Maxim 4FS	2.5 g/100kg seed				
	Systhane 40WP	21 g/100kg seed				
	Trilex Flowable	10 g/100kg seed				
	Baytan 30	5 g/100kg seed				
	Allegiance-LS	15 g/100kg/seed				
	STP15273	0.375 mg/seed				
7	Treatment 6 +					
	STP17217	0.375 mg/seed	5.0 a	515.0 a	245.0 a	2454.9 a
	STP17170	10 mg/seed				
	Harpin	31.2 g/100kg seed				
LSD (P ≤ 0.10)			***0.39***	***501.80***	***149.68***	***483.73***

[1] Plant vigor estimated on a 1 to 5 scale with 3 being the control. 4 and 5 are progressively better than the control and 1 and 2 are similarly worse than the control.

Means within columns followed by different letters are significantly different according to Fisher's LSD (P ≤ 0.10).

Evaluation of Cotton Varieties for Reniform Management in Cotton in South Alabama, 2010

K. S. Lawrence, S. R. Moore, W. S. Gazaway, G. W. Lawrence, and J. R. Akridge

Cotton varieties were evaluated with and without Telone II for the management of reniform nematodes in a naturally infested producer's field near Huxford, Alabama. The field has a history of reniform nematode infestation, and the soil type is a Ruston very fine sandy loam (59 percent sand, 33 percent silt, 8 percent clay). Telone II was injected with a modified ripper hipper at 3 gallons per acre 14 days before planting. The seed fungicide and insecticide treatments were applied to the seed by Bayer Crop Science. Orthene 90S at 4 ounces per acre was applied to all plots as needed for thrips control. Plots consisted of two rows, 25 feet long with 36-inch row spacing, and were arranged in a randomized complete block design with six replications. 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. Population densities of the reniform nematode were determined on May 13, June 8, July 22, and October 27. Ten soil cores, 1 inch in diameter and 8 inches deep, were collected from the two rows of each plot in a systematic sampling pattern. Nematodes were extracted using the gravity sieving and sucrose centrifugation technique. Plots were harvested on October 27. Data were statistically analyzed by SAS PROC GLM and means compared using Fisher's protected least significant difference test ($P \leq 0.10$). Monthly average maximum temperatures for May through October. were 88.1, 94.8, 95.1, 94.4, 93.4, and 85.2 degrees F with average minimum temperatures of 66.3, 72.3, 73.8, 75.3, 67.2, and 50.7 degrees F, respectively. Rainfall accumulation for each month was 5.09, 1.64, 3.76, 8.48, and 0.74 inches with a total of 19.71 inches.

Reniform nematode pressure was moderate in 2010 probably due to the drought in July and August. Reniform nematode numbers were low at planting averaging 195 vermiform life stages per 150 cm^3 of soil in the Telone II and control plots. Reniform numbers increased in the first 30 DAP in the varieties with no nematicide as compared to the Telone II plots. Phytogen 367, FiberMax 1740, Stoneville 5458, and FiberMax 9170 all increased nematode numbers in the untreated plots as compared the Telone II plots. However, the lack of rainfall in July reduced nematode numbers in the soil in all plots and by harvest no differences were observed between any variety or Telone II treatment. Seed cotton yields varied by 714.4 pounds per acre at harvest with an average of 2143 pounds per acre of seed cotton produced over all varieties. Telone II produced an average yield over all varieties of 2251.7 pounds per acre or a 217.5 pounds per acre increase over the untreated varieties. The Fiber Max varieties responded to the Telone II with the greatest yield increase as compared to the Stoneville and Phytogen varieties.

Evaluation of Cotton Varieites for Reniform Management in Cotton in South Alabama, 2010

Trt. no.	Variety and nematicide[1]	—*Rotylenchulus reniformis*/150 cm³— May 13	June 8	July 22	Oct. 27	Seed cotton yield *lb/A*
1	Phytogen 367 no nematicide	92.6 b	339.9 a	170.2 a	200.6 a	2095.7 ab
2	Fiber Max 1740B2R no nematicide	262.8 ab	448.1 a	201.2 a	278.2 a	1922.4 b
3	Stoneville 5458 B2RF no nematicide	232.0 ab	432.6 a	185.8 a	726.2 a	2222.7 ab
4	Stoneville 5327 B2RF no nematicide	386.6 a	293.6 ab	154.8 a	834.4 a	2177.4 ab
5	Fiber Max 9170 B2R no nematicide	293.8 ab	417.2 a	185.8 a	541.0 a	1753.4 b
6	Phytogen 367 + Telone II 3 g/a	108.2 b	108.2 b	92.8 b	278.2 a	2244.1 ab
7	Fiber Max 1740B2R + Telone II 3 g/a	139.2 b	108.2 b	139.2 a	649.0 a	2173.4 ab
8	Stoneville 5458 B2RF+ Telone II 3 g/a	108.4 b	77.3 b	139.0 a	448.4 a	2467.8 a
9	Stoneville 5327 B2RF+ Telone II 3 g/a	170.4 ab	154.5 b	108.4 a	432.8 a	2205.9 ab
10	Fiber Max 9170 B2R+ Telone II 3 g/a	154.8 ab	92.7 b	77.2 b	494.4 a	2167.3 ab
LSD (P ≤ 0.10)		***129.9***	***260.6***	***102.4***	***502.2***	***315.4***

[1] All seed also contain the fungicides Apron XL (3LS 15gai/100kg seed) + Maxim 4FS (2.5 gai/100kg seed) + Systhane 40 WP (21gai/100kg seed) + Dynasty CST 125 FS (0.3 mgai/seed).

Means followed by different letters are significantly different according to Fisher's LSD (P ≤ 0.10).

Evaluation of Seed Treatment Fungicides for the Control of Seedling Disease on Cotton in North Alabama, 2010

S. R. Moore, K. S. Lawrence, and B. E. Norris

Selected experimental seed treatments were evaluated to determine their efficacy against early season cotton diseases in north Alabama. The soil was a Decatur silt loam (23 percent sand, 49 percent silt, 28 percent clay) that had a history of seedling diseases. Soil temperature was 64 degrees F at a 4-inch depth on the day of planting with adequate soil moisture. All fungicide treatments were applied to the seed by the manufacturer. For the high incidence disease trial, plots were infested with millet seed inoculated with *Rhizoctonia solani* and *Pythium ultimum*. For the low incidence disease trial, plots were left naturally infested. Temik 15G (7.0 pounds per acre) was applied at planting on April 13 in the seed furrow with chemical granular applicators attached to the planter. Orthene 90S (2 ounces per acre) was applied to all plots as needed for thrips control. For each of the low and high disease pressure trials, each plot consisted of two rows, each 25 feet long with 40-inch row spacing. Plots were arranged in a randomized complete block design with five replications. Adjacent blocks were separated by 15-foot alleys. Standard herbicides, insecticides, and fertility production practices, as recommended by the Alabama Cooperative Extension System, were used throughout the season. Stand counts were recorded 16 and 30 days after planting (DAP) to determine stand density and percent seedling loss resulting from cotton seedling diseases. Plots were harvested on September 13. Data were statistically analyzed by analysis of variance using the generalized linear models (GLM) procedure, and means compared using Fisher's protected least significant difference (LSD) test.

Seedling disease pressure was high for early planted cotton in 2010. At 16 DAP, 62 percent and 81 percent of all seed planted did not emerge in the low and high disease incidence trials, respectively. Under low disease pressure there was no significant difference in seedling stand at 16 DAP; however, by 30 DAP all treatments had significantly higher stands compared to the Avicta Duo 4.03 SC control. All treatments produced higher seed cotton yields than the Avicta Duo 4.03 SC control by an average of 518 pounds per acre. Under high disease pressure, all treatments produced numerically higher stand counts at 16 DAP and significantly higher stands at 30 DAP compared to the Avicta Duo 4.03 SC control. All treatments produced significantly higher seed cotton yields compared to the Avicta Duo 4.03 SC control by an average of 2277 pounds per acre. While Treatments 1 through 8 produced comparable results under low disease pressure, Treatment 5 (Allegiance-LS + Baytan 30 + Thiram 42-S + A9625 +Avicta Duo 4.03 SC + Dynasty CST 125 FS) had superior performance under high disease pressure.

Evaluation of Seed Treatment Fungicides for the Control of Seedling Disease on Cotton in North Alabama, 2010

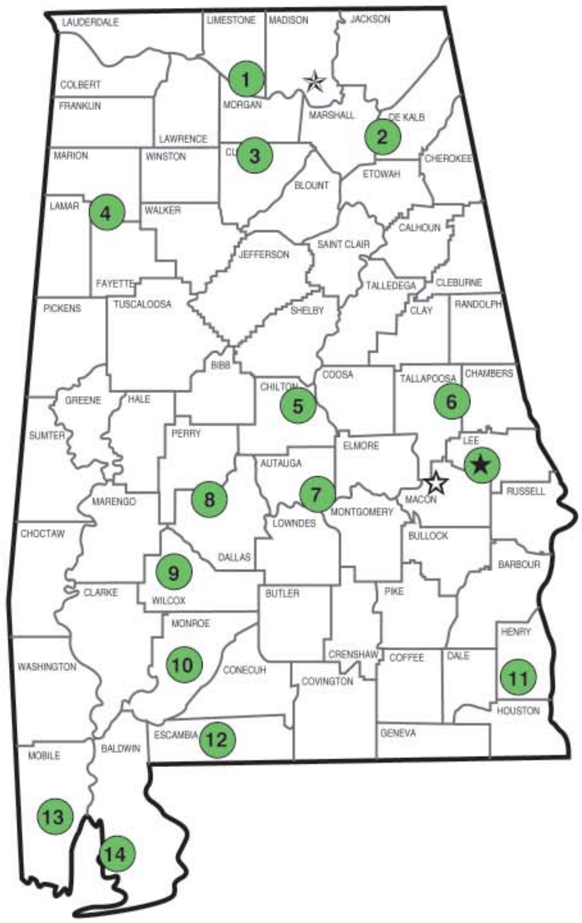
		Low disease pressure			High disease pressure		
		Stand/10 ft row		Seed cotton	Stand/10 ft row		Seed cotton
Treatment		16 DAP	30 DAP	*lb/A*	16 DAP	30 DAP	*lb/A*
1	Avicta Duo 4.03 SC 0.5 mg/seed	13.6 a	11.8 c	2973.9 b	2.2 c	1.8 d	737.9 c
2	Apron XL 3 LS 15.0 g/100kg seed Maxim 4 FS 2.5 g/100kg seed Systhane 40 WP 31.0 g/100kg seed Avicta Duo 4.03 SC 0.5 mg/seed Dynasty CST 125 FS 0.03 mg/seed	16.6 a	21.0 b	3634.9 a	6.2 bc	10.2 abc	3170.4 ab
3	Allegiance-LS 15.0 g/100kg seed Baytan 30 10.0 mg/seed Thiram 42-S 31.0 g/100kg seed Avicta Duo 4.03 SC 0.5 mg/seed Dynasty CST 125 FS 0.03 mg/seed	11.6 a	21.6 b	3481.9 a	15.8 a	10.4 abc	2979.7 ab
4	Apron XL 3 LS 15.0 g/100kg seed Maxim 4 FS 2.5 g/100kg seed Systhane 40 WP 31.0 g/100kg seed A9625 1.0 g/100kg seed Avicta Duo 4.03 SC 0.5 mg/seed Dynasty CST 125 FS 0.03 mg/seed	14.8 a	23.8 ab	3432.2 a	5.8 bc	8.0 bc	2713.1 b
5	Allegiance-LS 15.0 g/100kg seed Baytan 30 10.0 mg/seed Thiram 42-S 31.0 g/100kg seed A9625 1.0 g/100kg seed Avicta Duo 4.03 SC 0.5 mg/seed Dynasty CST 125 FS 0.03 mg/seed	14.4 a	23.2 ab	3499.1 a	7.2 bc	14.6 a	3396.6 a
6	Apron XL 3 LS 15.0 g/100kg seed Maxim 4 FS 2.5 g/100kg seed Systhane 40 WP 31.0 g/100kg seed A16148 20.0 g/100kg seed Avicta Duo 4.03 SC 0.5 mg/seed Dynasty CST 125 FS 0.03 mg/seed	16.6 a	27.0 a	3576.5 a	5.4 bc	7.4 c	3083.6 ab
7	Apron XL 3 LS 15.0 g/100kg seed Maxim 4 FS 2.5 g/100kg seed Systhane 40 WP 31.0 g/100kg seed A9625 1.0 g/100kg seed A16148 20.0 g/100kg seed Avicta Duo 4.03 SC 0.5 mg/seed Dynasty CST 125 FS 0.03 mg/seed	14.2 a	22.2 ab	3385.1 a	8.4 bc	12.2 ab	2966.5 ab
8	Allegiance-LS 15.0 g/100kg seed Baytan 30 10.0 mg/seed Thiram 42-S 31.0 g/100kg seed Avicta Duo 4.03 SC 0.5 mg/seed Allegiance-LS 15.0 g/100kg seed Baytan 30 5.0 mg/seed Trilex Flowable 10.0 g/100kg seed	14.6 a	21.2 b	3264.9 ab	6.2 bc	6.6 c	2856.3 ab
9	Apron XL 3 LS 15.0 g/100kg seed Maxim 4 FS 2.5 g/100kg seed Systhane 40 WP 31.0 g/100kg seed A9625 1.0 g/100kg seed A17823 21.1 g/100kg seed Avicta Duo 4.03 SC 0.5 mg/seed Dynasty CST 125 FS 0.03 mg/seed	14.2 a	21.0 b	3655.3 a	9.6 ab	12.8 a	2955.1 ab
LSD (P ≤ 0.10)		***6.43***	***4.99***	***398.85***	***6.50***	***4.67***	***632.70***

Means followed by different letters are significantly different according to Fisher's LSD (P ≤ 0.10).

CONTRIBUTORS INDEX

Alabama's Agricultural Experiment Station
AUBURN UNIVERSITY

With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, livestock, forestry, and horticultural producers in each region in Alabama. Every citizen of the state has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.



Research Unit Identification

★ Main Agricultural Experiment Station, Auburn.
☆ Alabama A&M University.
☆ E. V. Smith Research Center, Shorter.

1. Tennessee Valley Research and Extension Center, Belle Mina.
2. Sand Mountain Research and Extension Center, Crossville.
3. North Alabama Horticulture Research Center, Cullman.
4. Upper Coastal Plain Agricultural Research Center, Winfield.
5. Chilton Research and Extension Center, Clanton.
6. Piedmont Substation, Camp Hill.
7. Prattville Agricultural Research Unit, Prattville.
8. Black Belt Research and Extension Center, Marion Junction.
9. Lower Coastal Plain Substation, Camden.
10. Monroeville Agricultural Research Unit, Monroeville.
11. Wiregrass Research and Extension Center, Headland.
12. Brewton Agricultural Research Unit, Brewton.
13. Ornamental Horticulture Research Center, Spring Hill.
14. Gulf Coast Research and Extension Center, Fairhope.