Auburn University Crops:

Cotton Research Report 2013

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Alabama Agricultural Experiment Station, 2014
William Batchelor, Director
Auburn University
Auburn, AL

In cooperation with the Alabama Cooperative Extension System
(Alabama A&M University and Auburn University)

AUBURN
ALABAMA AGRICULTURAL EXPERIMENT STATION

Authors

D. L. Bailey
Graduate Student
Entomology & Plant Pathology
Auburn University, AL

K. S. Balkcom
National Soil Dynamics Lab
Auburn University, AL

L. Black
Student
Crop, Soil and Environmental Sciences
Auburn University, AL

K. B. Burch
Research Associate
Entomology & Plant Pathology
Auburn University, AL

C. H. Burmester
Agronomist
Tennessee Valley Research and
Extension Center
Belle Mina, AL

K.L. Bowen
Professor
Plant Pathology
Auburn University, AL

C.H. Campbell
Research Associate
Entomology and Plant Pathology
Auburn University, AL

R. Colquitt
County Extension Coordinator
Shelby County, AL

D. P. Delaney
Extension Specialist
Crop, Soil and Environmental Sciences
Auburn University, AL

D. Derrick
Regional Extension Agent, III
Cherokee County, AL

J.T. Ducar
Sand Mountain Research and
Extension Center
Sand Mountain, AL

M. L. Flessner
Research Associate IV
Crop, Soil and Environmental Sciences
Auburn University, AL

J. P. Fulton
Associate Professor
Biosystems Engineering
Auburn University, AL

K. M. Glass
Advisor III, Natural Resource Program
Crop, Soil and Environmental Sciences
Auburn University, AL

W. Griffith
County Extension Coordinator
Fayette County, AL

B. Guertal
Professor
Crop, Soil and Environmental Sciences
Auburn University, AL

Authors, Cont'd

M. Hall
Extension Specialist
Renewable Fuels,
Alabama Cooperative Extension System
Auburn, AL

A.K. Hagen
Professor of Plant Pathology
Auburn University, AL

C. Hicks
Regional Extension Agent, I
Alabama Cooperative Extension System
Auburn, AL

C. J. Land
Graduate Student
Entomology and Plant Pathology
Auburn University, AL

K.S. Lawrence
Professor
Entomology and Plant Pathology
Auburn University, AL

P. L. Mask
Asst. Director Agriculture, Forestry and
National Resources
Assistant Dean for Extension
Auburn University, AL

S. McElroy
Associate Professor
Crop, Soil and Environmental Sciences
Auburn University, AL

B. Meyer
Director, Agronomy and
Cooperative Services
Agri-AFC
Decatur, AL

C. C. Mitchell
Extension Specialist Professor
Crop, Soil and Environmental Sciences
Auburn University, AL

C. D. Monks
Professor and Extension Specialist
Crop, Soil and Environmental Sciences
Auburn University, AL

S. Nightengale
Director, Plant Breeding Unit
E.V. Smith Research Center
Tallassee, AL

C. Norris
Tennessee Valley Research and
Education
Center
Belle Mina, AL

B. V. Ortiz
Extension Specialist and Assistant
Professor
Crop, Soil and Environmental Sciences
Auburn University, AL

G. Pate
Director E.V. Smith Research Center
Shorter, AL

Authors, Cont'd

M. Patterson
Professor
Crop, Soil and Environmental Sciences
Auburn University, AL

J. Platt
Student
Crop, Soil and Environmental Sciences
Auburn University, AL

A. Price
National Soil Dynamics Lab
Auburn University, AL

T. Reed
Extension Specialist, Franklin County
Russellville, AL

S. Scott
Associate Director
Agr. Research and Extension Center
Shorter, AL

R.B. Sikkens
Research Associate, I
Entomology and Plant Pathology
Auburn University, AL

A.L. Smith
Graduate Student
Plant Pathology and Entomology
Auburn University, AL

R.H. Smith
Professor and Extension Spec., Emeritus
Entomology and Plant Pathology
Auburn University, AL

S. Virk
Research Engineer II
Biosystems Engineering
Auburn University, AL

D. Weaver
Professor
Crop, Soil and Environmental Sciences
Auburn University, AL

N. Xiang
Graduate Student
Entomology and Plant Pathology
Auburn University, AL

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Acknowledgements

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Confidential Report

I. Cotton Variety Trials

Enhancing Cotton Variety Selection Through On-Farm Evaluations, 2013

C.D. Monks, C.H. Burmester, D.Derrick, W. Griffith, C. Hicks and R. Colquitt

On-farm Producer Cooperator: Philip Barber, Kevin Holland, Stan McMichen, David Womack, Robert and John Ingram, and Chris Gary

Project #03-328AL, Enhancing Cotton Variety Selection in on-farm trials, was approved in 2012 for funding during 2013. Cotton varieties were supplied by: Americot, Delta and Pine Land, Bayer and Phytogen seed companies. The trials were either Roundup Flex or glytol tolerant and were initiated during April or May of 2013. The trial in Fayette County was planted but suffered inclement weather throughout the season. Harvest was delayed to the extent that the trial was abandoned and eventually scrapped by the producer. These trials are planned for 2014 with additional locations to be added in the southwestern counties.

County	Regional Agent	Contact Information
Cherokee	David Derrick	dderrick@aces.edu
Macon	Rudy Yates Christy Hicks	yatesrp@auburn.edu Agnewcd@auburn.edu
Fayette	Warren Griffith	griffwg@auburn.edu
Escambia	Kim Wilkins Christy Hicks	wilkikj@aces.edu agnewcd@auburn.edu
Shelby	Ricky Colquitt	colqurw@auburn.edu

Yield and fiber quality tables will be available for the 2013 on-farm trials at www. alabamacrops.com.

Funding from Cotton Incorporated and the Alabama Cotton Commission was used in conducting this trial. We appreciate the support that Alabama cotton producers provide to our educational programs each year.

Cherokee County Alabama
Cotton Variety Test, 2013

Farm: Randall and Nick McMichen
Planting Date: May 16th
Harvest Date: October 15th
Cooperators: D. Derrick, C. Burmester, C.Monks, T. Reed, K Glass, and J.Brasher

Variety	Weight (lb)	Harvest Area (acres)	Seed Cotton (lb/A)	Lint %	Lint (lb/A)	Mic	Length (in)	Strength (gr/tex)	Uniformity (%)
PHY 499 WRF	2716	0.7203	3771	0.437	1648	4.2	1.13	30	84.4
PHY 339 WRF	2122	0.5762	3682	0.431	1587	4.4	1.19	31.1	84.8
FM 1944 GLB2	3090	0.8643	3575	0.421	1505	4.5	1.19	31.9	83.3
PHY 375 WRF	3132	0.8643	3624	0.411	1489	4.2	1.16	32.1	84.7
DP 1321 B2RF	3076	0.8643	3559	0.418	1488	4.3	1.15	33.8	83.2
NG 1511 B2RF	2965	0.8643	3430	0.43	1475	4.5	1.15	30.1	85.9
FM 1740 B2RF	3020	0.8643	3494	0.418	1460	4.5	1.16	30.2	84.7
DP 1210 B2RF	2922	0.8643	3381	0.422	1427	4.6	1.19	33.3	84
DPL 1137 B2RF	2682	0.8643	3103	0.437	1356	4.5	1.15	29.8	84.6

Test information: Cotton was planted no-till in 30-inch rows. Cotton varieties were planted in two replications in the field. A total of nine cotton varieties were planted. Plots were 6, 30-inch rows that were 1255 feet long. Seed-cotton samples of each variety were also taken to measure fiber quality and lint percentage. Field was non-irrigated,but rainfall was very well-timed through the season, as noted by the high yields.

Funding from Cotton Incorporated and the Alabama Cotton Commission was used in conducting this trial. We appreciate the support that Alabama cotton producers provide to our educational programs each year.

*2013 On-Farm Cotton Variety Performances, Dallas County, Alabama**

Variety**	Lint Turnout %	Lint Yield lbs/ac
DPL 1050B2RF	45	1,067
ST 6448GLB2	42	1,032
DPL 1048B2RF	44	1,003
DPL 1034B2RF	44	972
PHY 499WRF	44	956
NG 5315B2RF	44	944
DPL 1321B2RF	43	912
DPL 1252B2RF	45	880
FM 1944GLB2	41	874
PHY 375WRF	43	873
PHY 367WRF	43	863
PHY 565WRF	42	855
NG 1511B2RF	44	824
DPL 1212B2RF	42	814

* On-farm cotton variety trials were conducted from support from cotton producers, the Alabama Cotton Commission, Cotton Inc. & seed company germplasm donations.

Planting date: May 28, 2013 in four 30-inch rows with a 2 X 1 skip pattern (15 ft width)
Harvest date: November 6, 2013
Cultural: Irrigated; 2012 crop- peanut; plot length ranged from 2,190 to 2,609 feet.

** Samples were hand cleaned & ginned on a 10-saw gin. Therefore, turnout is high relative to high commercial gins with multiple cleaners.

Investigators: Dale Monks, Christy Hicks, Jon Brasher and Kathy Glass; Alabama Cooperative Extension System and Auburn University.

Producer Cooperators: Jay Minter.

*2013 On-Farm Cotton Variety Performances, Escambia County, Alabama**		
Variety**	**Lint Turnout %**	**Lint Yield lbs/ac**
DP 1137B2RF	44	1595
NG 5315B2RF	43	1588
ST 6448GLB2	41	1529
DP 1034B2RF	43	1521
PHY 575WRF	41	1500
DP 1321B2RF	42	1471
DP 1050B2RF	45	1465
PHY 375WRF	44	1450
NG 1511B2RF	45	1433
PHY 499WRF	44	1394
DP 1252B2RF	45	1393
PHY 367WRF	42	1370
PHY 565B2RF	42	1318

* On-farm cotton variety trials were conducted from support from cotton producers, the Alabama Cotton Commission, Cotton Inc. & seed company germplasm donations.

Planting date: May 23, 2013 in 36 inch rows
Harvest date: November 25, 2013
Cultural: Non-irrigated; 6 rows/plot; 2012 crop- peanut; plot length- 1,750 feet.

** Samples were hand cleaned & ginned on a 10-saw gin. Therefore, turnout is high relative to high commercial gins with multiple cleaners.

Investigators: Dale Monks, Rudy Yates, Jon Brasher and Kathy Glass; Alabama Cooperative Extension System and Auburn University.

Producer Cooperators: David Womack and Kevin Holland.

*2013 On-Farm Cotton Variety Performances, Macon County, Alabama**		
Variety**	**Lint Turnout %**	**Lint Yield lbs/ac**
PHY 565WRF	44	938
DP 1050B2RF	45	905
PHY 499WRF	47	859
PHY 375WRF	46	857
NG 5315B2RF	44	849
ST 6448GLB2	42	844
DP 1048B2RF	44	838
DP 1252B2RF	45	815
DP 1137B2RF	46	815
DP 1212B2RF	44	793
FM 1944GLB2	42	714

* On-farm cotton variety trials were conducted from support from cotton producers, the Alabama Cotton Commission, Cotton Inc. & seed company germplasm donations.

Planting date: May 11, 2013 in 38 inch rows
Harvest date: November 12, 2013
Cultural: Non-irrigated; 4 rows/plot; 2012 crop- peanut; plot length-2,670 feet.

** Samples were hand cleaned & ginned on a 10-saw gin. Therefore, turnout is high relative to high commercial gins with multiple cleaners.

Investigators: Dale Monks, Christy Hicks, Jon Brasher and Kathy Glass; Alabama Cooperative Extension System and Auburn University.

Producer Cooperators: Ingram Farms.

*2013 On-Farm Cotton Variety Performances, Shelby County, Alabama**		
Variety**	**Lint Turnout %**	**Lint Yield lbs/ac**
PHY 375WRF	45	1184
PHY 339WRF	46	1153
DP 1028B2RF	47	1138
DP 1034B2RF	46	1136
PHY 499WRF	44	1103
DP 1137B2RF	46	1076
DP 1252B2RF	48	1071
PHY 367WRF	44	1065
NG 5315B2RF	45	1059
ST 6448GLB2	43	1057
PHY 575WRF	43	1047
DP1321B2RF	46	1041
FM 1944GLB2	43	1031
PHY 565WRF	44	1012
DP 1050B2RF	46	1010
NG 1511B2RF	46	1005
DP 1212B2RF	43	902

* On-farm cotton variety trials were conducted from support from cotton producers, the Alabama Cotton Commission, Cotton Inc. & seed company germplasm donations.

Planting date: May 22, 2013 in 38 inch rows
Harvest date: November 11, 2013
Cultural: Non-irrigated; 4 rows/plot; 2012 crop- peanut; plot length-2,805 feet.

** Samples were hand cleaned & ginned on a 10-saw gin. Therefore, turnout is high relative to high commercial gins with multiple cleaners.

Investigators: Dale Monks, Ricky Colquitt, Jon Brasher and Kathy Glass; Alabama Cooperative Extension System and Auburn University.

Producer Cooperators: Phillip Barber

Breeding Cotton for Yield and Quality in Alabama

D. B. Weaver

In 2013, we evaluated experimental lines for yield and fiber properties at Tallassee and Prattville. We tested approximately 80 new lines in two preliminary tests and 30 lines in advanced tests. F2, F3 and F4 generations of various populations were grown at Tallassee, and F4:5 progeny rows were grown, selected and submitted for fiber quality analysis. Crosses were made and F1 populations from these have already been sent to the winter nursery in Mexico and are up to good stands. These are to create new populations for future work. Most crosses involved advanced experimental lines from Auburn and other public programs, and newly released sources of resistance to reniform nematode, including BARBREN 713 and another recent germplasm release, BAR41. Complete yield and fiber quality data are now available from the 2012 Regional Breeders Testing Network at 14 yield locations from Westside, California to Suffolk, Virginia and several points in between. Auburn experimental lines ranked 6th, 8th, 17th, 18th and 19th in the 33-entry test (30 experimental lines plus 3 checks). The best of these lines, AU90915, had a yield of 1557 pounds lint/acre. Fiber quality of these lines was greatly improved over previous years and lines, a result of our concerted effort to select for fiber quality. Because of seed supply issues, none of these lines was continued in the 2013 RBTN test, but we have plans to re-enter the two best lines in 2014, along with lines that performed well in 2013. We have only a small amount of data available from the 2013 RBTN, but what preliminary data we have indicates the Auburn lines are performing well. Complete data on performance of these lines should be available soon.

We have continued to evaluate experimental lines (germplasm releases to breeders) and lines we have derived from these materials with most of the entries being resistant selections from several different populations. Based on the previous two-year study conducted in 2010 and 2011, we have decided to focus future work on BARBREN derived materials, and to discontinue developing populations derived from the LONREN resistance source. Several sources of resistance derived from G. barbadense accession 713 (referred to as the BARBREN source) have been released, and in a separate study we have evaluated seven different germplasm releases (some official, some unofficial) both in the field at the Tennessee Valley Research and Extension Center, Belle Mina, and in the greenhouse. Some of these materials have performed very well, both in terms of nematode resistance and agronomic traits, and our main objective is to identify the best parents to be used in crossing. In 2013, we increased several F2:3 lines from crosses with BARBREN 713, an early release and collected and evaluated DNA for markers associated with resistance. Lines have been identified that have various combinations of the resistance genes involved and these will be used to study the effects of the genes and in cultivar development with the objective of developing varieties with both good agronomic traits and good resistance to reniform nematodes.

A major accomplishment in 2013 was the publication of a paper on heat tolerance in cotton. While we have discontinued this line of research due to lack of funding, we have finally been able to publish our data and make this information available to the international cotton breeding community.

In a separate, Cotton Incorporated sponsored project, we have developed a technique for evaluating genotypes for resistance to Corynespora (Target spot) and have validated it in the field.

Commercial Cotton Varieties Responses to Verticillium Wilt

C. J. Land, K. S. Lawrence, K. Glass, C. H. Burmester, and B. Meyer

Abstract: Verticillium Wilt is caused by *Verticillium dahliae*, which colonizes the vascular cylinder of the plant and causes defoliation, stunting, and yield loss. Thirteen cotton varieties were planted and evaluated for resistance to *Verticillium dahliae*. The trial was planted on the Isbell farm in Northwest Alabama. Plots were six rows each, and approximately 500 feet long. The field was irrigated, when needed, with a center pivot irrigation system. Disease ratings were taken on September 20. Ten foot sections of the third row in each plot were observed for total number of plants and stems were cut longitudinally to assess disease incidence. Disease severity ratings of foliar symptoms were evaluated on a scale from 1-5 with 1 having no foliar wilting, 3 having interveinal chlorosis and necrosis of the leaves and 5 having completely defoliated plants. Four replications of each variety were counted. Petioles were taken from infected plants of each variety and re-isolated to confirm the presence of *Verticillium dahliae*. In regards to disease severity, the top 30 percent of plants displaying the least amount of foliar symptoms and the most resistant varieties were BX 1347 GLB2, FM 1944 GLB2, PHY 339 WRF, and DP 1044 B2RF. None of these varieties received averaged scores exceeding 3. In terms of disease incidence, the resistant check FM 1944 GLB2 had the lowest number of plants with darkened vascular systems. PHY 339 WRF, DP 1044 B2RF, DP 1321 B2RF, ST 6448 GLB2, ST 4946 GLB2, DP 1133 B2RF, DPLX 12R224 B2R2, BX 1347 GLB2, and DP 1137 B2RF all displayed vascular staining and average percent of disease incidence ranged from 45.5-68.1 percent. These percentages were statistically similar and performed better than the susceptible varieties but below the resistant check.

Introduction: This disease was first recorded in Virginia in 1918 by Carpenter who noted its presence on Upland cotton. Currently, it is present throughout the world affecting major cotton producing countries such as Australia, Brazil and China. In the United States it is present in most states in the cotton belt. Approximately ten million acres of cotton are grown in the U.S, and 97% is planted with Upland cotton. Cotton production is greatly reduced by the presence of fungal pathogens. Cotton losses from Verticillium Wilt for the U.S. are approximately 480 billion bales between 1990 and 2011. Verticillium is a serious disease in North Alabama that causes a decline in plant health and a decrease in yields. It is caused by the soil born fungus *Verticillium dahliae*, which colonizes the root and then moves upward in the vascular system of the plant. This colonization of the vascular system prevents water movement giving the plant a wilted appearance. Symptoms in Alabama are not noted until later in the season when boll formation is occurring and the plant prematurely begins to defoliate. Defoliation leads to stunting and yield decrease from the lack of photosynthetic activity. Verticillium Wilt causes stunting, lack of lateral growth, and decreases in yield, fiber quality and seed quality.

Verticillium wilt is often a difficult pathogen to control, with limited management options. Disease severity increases with the addition of irrigation and fertilization, two very expensive inputs for cotton that should result in yield increases. Producers are forced to use different tolerant cultivars to combat yield loss. Although producers must use these tolerant varieties, there has been little research conducted on cultivar response to Verticillium. Rotation to a non-host such as a monocot will reduce disease. However, due to restrictions of farm labor and machinery, this is not an economical route. Chemical and biological controls can help reduce disease severity, but due to cost increases and decreases in gross income, it may not be an option for many farmers. Several cotton cultivars produced by different seed companies are planted in Alabama every year. Little is known about the response to a majority of pathogens until they are released and tested in applied field settings. The research preformed is important to inform growers of their best option in heavily infested areas. A survey of the most widely grown cotton cultivars in the state and their severity responses, and incidence responses to Verticillium wilt can better inform producers about the potential financial losses that can be incurred with this pathogen.

Methods: Thirteen commonly grown cotton varieties were planted and evaluated for resistance to *Verticillium dahliae*. The varieties are listed below in Table 1. The trial was planted in a producer's field in Colbert County, located in northwest Alabama (34N 47' 53.65" 87W 56' 37.93"). The dominant soil types found, were Decatur silt loam (24 percent sand, 49 percent silt, 28 percent Clay) and Emory silt loam. Plots were organized to be six rows each, and approximately 500 feet long. The field was irrigated, when needed, with a center pivot irrigation system. Disease ratings were taken during the month of September when foliar disease symptoms were visible. Ten foot sections of the third row in each plot were evaluated for disease incidence and severity. The total number of plants and stems were cut longitudinally to assess disease incidence, as seen in Figure 1. Disease severity ratings of foliar symptoms were evaluated on a scale from 1-5 with 1 having no foliar wilting, 3 having interveinal chlorosis and necrosis of the leaves and 5 having completely defoliated plants (Figure 2). Four replications of each variety were counted. Petioles were taken from infected plants of each variety and re-isolated to confirm the presence of *Verticillium dahliae*. Yields were not taken due to an early season frost on the 26th of October. The average temperatures for that area are a high of 72ºF and a low of 48ºF. However, what was observed was a high of 68ºF and a low of 32ºF. Statistics were analyzed using JMP® 10.0. Data was analyzed by Means/Anova and means were compared using Tukey-Kramer HSD (α =.1).

Results: The results from the disease severity ratings were slightly variable between treatments. However, differences did appear when means were compared. Two cultivars had the lowest disease severity rating of the thirteen that were tested, Bayer Experimental

Figure 1. Vascular discoloration due to necrosis.

Figure 2. Foliar interveinal chlorosis and *Verticillium dahliae* in the cotton vascular tissues.

(BX) 1347 GLB2 and the resistant check Fiber Max (FM) 1944 GLB2. Both cultivars had an average visual rating of less than 2. The two cultivars that had the highest ratings were Deltapine Experimental (DPLX) 12R224 B2R4 and Phytogen (PHY) 375 WRF. Both cultivars had average scores above 4, meaning the plants were almost completely defoliated. Disease incidence had statistical differences among treatments. The resistant check, FM 1944 GLB2, had the fewest number of plants with discoloration in the vascular cylinder, less than 35 percent of the plants had signs of the disease.

The twelve other cultivars had higher percentages of vascular discoloration. Comparing the data between disease incidence and severity to find a correlation has shown an interesting result. There is a moderate correlation (R2=.5482; $P < 0.05$)?) between visual symptoms and the signs of the disease in the vascular system. Verticillium species were isolated on water ager from petioles of all varieties. There were no significant differences between the amounts of Verticillium species isolated from the thirteen different cultivars. All petiole tissues cultured were colonized with Verticillium species.

Two different species were found in the state, Verticillium dahlia, as seen in Figure 3, and *Verticillium albo-atrum*, as seen in Figure 4. Both species were found in the northern part of the state, however only *Verticillium albo-atrum* was found in the mid to southern part of the state. According to the Commonwealth Mycological Institute, *Verticillium dahliae* is characterized by its whorled, hyaline and tentatively erect conidiophore with phialides ranging in size from 16-35 x 1-2.5 μ. Conidia are found at the tip of the phialides. Microsclerotia arise centrally spreading outward and are dark in coloration. In appearance, microsclerotia are swollen almost globular cells with a variable shape of elongate to irregularly spherical. Microsclerotia can range in size from 15-50 μ. *Verticillium albo-atrum* is slightly different in regards to its morphological characteristics. Conidiophores are more abundant and less erect than *Verticillium dahliae*. They are also hyaline vertically branched phialids projecting out of each node. Phialids range in size 20-30 x 1.4-3.2 μ. Similar to V. dahliae, V. albo-atrum's conidia are found at the tip of the phialids. The primary factor separating the two species is the formation or absence of microsclerotia. V. albo-atrum is absent of microsclerotia but forms dark resting mycelium. The resting mycelia are swollen between septa and never bud to microsclerotia. Dark resting mycelium can range in size 3-7 μ. Verticillium is an economically important disease in the northern half of the state indicating that *Verticillium dahliae* is more pathogenic species in the state of Alabama in 2013.

Table 1.
Cotton Cultivar Results for Disease Severity and Disease Incidence Ratings

	Cotton Cultivars	Disease Severity	Disease Incidence %
1	BX 1347 GLB3	1.75 d*	57.0 % ab
2	DP 1044 B2RF	2.25 cd	46.1 % ab
3	DP 1133 B2RF	2.88 abcd	55.4 % ab
4	DP 1137 B2RF	3.50 abc	67.8 % ab
5	DP 1321 B2RF	3.00 abcd	51.7 % ab
6	DPLX 12R224 B2R2	2.88 abcd	56.3 % ab
7	DPLX 12R242 B2R2	4.25 a	78.4 % a
8	FM 1944 GLB2	2.00 cd	31.3 % b
9	PHY 339 WRF	2.25 cd	44.8 % ab
10	PHY 375 WRF	4.00 ab	72.6 % ab
11	PHY 499 WRF	3.25 abcd	48.1 % ab
12	ST 4946 GLB2	3.25 abcd	55.4 % ab
13	ST 6448 GLB4	2.63 bcd	52.9 % ab
Mean ($P < 0.10$)		2.913	55.2%

*Means followed by the same letter do not differ significantly at the 0.1 level of probability.

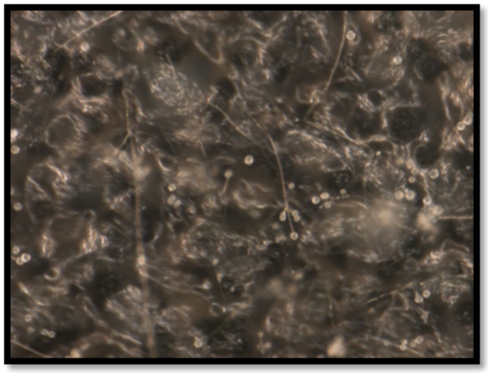

Figure 3. Verticillium dahliae

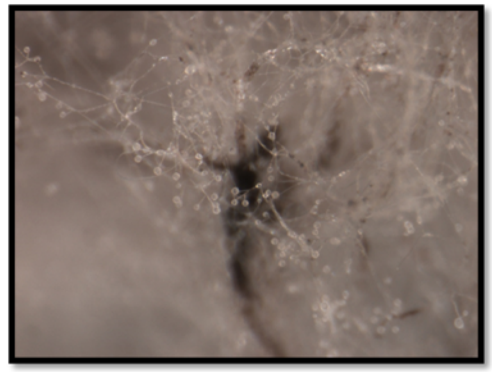

Figure 4. Verticillium albo-atrum

Summary: The results from the first year of tests indicate BX 1347 GLB2 and FM 1944 GLB2 supported the lowest disease severity score, and FM 1944 GLB2 had the lowest disease incidence for this trial. The varieties with low disease severity scores and high disease incidence would be considered tolerant to the disease if they also supported high yields. Yields would help definitively place theses cultivars in the tolerant category. However, yields are unavailable for this growing season. The correlation shows that visual symptoms only account for approximately half the disease present in the field. Cotton varieties are often taken off the market to make way for new and improved varieties or to avoid resistance build up. Continuing cultivar testing is needed to inform producers of responses to pathogens, particularly a yield injuring pathogen such as Verticillium wilt.

Two species of Verticillium were isolated from cotton petioles, unlike the *Fusarium* wilt fungus. Verticillium is found throughout the plant in the vascular system. The both species, *Verticillium dahliae* and *Verticillium albo-atrum*, were found in the northern part of the state. *Verticillium dahliae*, and V. albo-atrum's were often found together in the same fields in north Alabama where wilt was present. In the southern half of the state, Verticillium wilt is an extremely uncommon. Only *Verticillium albo-atrum* was found in the southern half of the state. This could be due to the consistently higher temperatures commonly observed in the area. *Verticillium albo-atrum* was isolated from symptomatic cotton in the southern and central areas of the state and may be more adapted to the warmer temperatures found there.

Commercial Cotton Varieties Responses to the Fusarium Wilt/Root-knot Nematode Disease Complex

A. Smith, K.S. Lawrence, K. Glass and E. Van Santen

Abstract: *Fusarium oxysporum* f. sp. vasinfectum (FOV) is the causal agent of the fungal disease *Fusarium* wilt in cotton. Objectives of this study are to (1) observe commercial variety responses to *Fusarium* wilt and root-knot nematodes (*Meloidogyne incognita*) and compare to yield; and (2) identify races of FOV present at the site of the Commercial Wilt *Fusarium* Trial. The projected outcome of these experiments is to be able to more effectively control the *Fusarium* wilt root-knot nematode disease complex in the southeastern United States with resistant varieties being the main control measures. Results showed three varieties having statistically higher yields than the susceptible check Rowden: FiberMax 1944 GLB2, Phytogen 339 WRF and Phytogen 499 WRF. Ten of the twelve varieties tested had statistically lower wilt percentages than the susceptible check Rowden: Croplan Genetics 3787 B2RF, Deltapine 1137 B2RF, Deltapine 12R242B2R2, Deltapine 1321 B2RF, FiberMax1944 GLB2, Phytogen 339 WRF, Phytogen 375 WRF, Phytogen 499 WRF, Stoneville 4946 GLB2 and Stoneville 6448 GLB2. Two varieties had similar root-knot reproduction factors as the resistant check M-315: Deltapine 12R242B2R2 and FiberMax 1944 GLB2.

Introduction: The intensity of *Fusarium* wilt disease pressure is increased by the presence of the Southern root-knot nematode, *Meloidogyne incognita*. There are currently no curatives for this disease and prevention methods available are minimal at best. This creates a dire need for research to discover cultivars that are resistant to both of these pathogens to help control disease severity and crop losses.

Fusarium oxysporum f. sp. vasinfectum (FOV) caused the loss of over $1.7 million and 4,000 bales of cotton for 2011 in Alabama. *Fusarium* wilt and the root knot nematode (RKN) are two pathogens that put great pressure on cotton crops throughout the Southeast. There are currently no commercial cotton cultivars that are resistant to this disease complex. The only available option for control is to fumigate soils to reduce nematode populations. Two downfalls to this control method are (1) the lack of economic feasibility for row crop farming to use these nematicides on a large scale; and (2) the discontinuation of most effective fumigants due to environmental concerns. It is crucial to find other means of controlling and preventing this disease complex in order to decrease yield losses and economic losses for present day and future farmers.

FOV was first documented in an Alabama cotton field by Atkinson in 1892. Symptoms and signs (Figure 1) that are present within affected cotton plants include chlorotic and necrotic leaves, abscission of affected leaves, wilting, reduced yield and death. A relationship between the *Fusarium* pathogen and nematodes was noticed early on. The fungal hyphae induce vascular discoloration and xylem blockage causing the plant to wilt.

The Commercial Wilt Trial has been utilized since 2003. Its purpose is to evaluate commercially available cotton cultivars for *Fusarium* wilt and root-knot resistance. Cultivars are provided by plant breeders and various companies for evaluation. Factors considered during evaluation are *Fusarium* incidence and severity, root-knot reproduction factors, and yield performance.

Figure 1a. *Fusarium* wilt foliar symptoms.

Figure 1b. Interveinal chlorosis and necrosis.

Figure 1c. Vascular discoloration of hypocotyl.

Figure 1d. Galling associated with root-knot nematode damage.

Methods: The Commercial *Fusarium* Wilt Trial was located at the Plant Breeding Unit of the E. V. Smith Research Center near Tallassee, Alabama. Commercial varieties that are commonly grown in Alabama and the Southeast are tested with this trial and compared to resistant (M-315) and susceptible (Rowden) checks. The trial was organized in a randomized, complete block design with four replications. Replications were set up as 10 foot, one-row plots with 36-inch row spacing, with 6-foot alleys separating blocks. The trial was planted May 23, 2013 and maintained throughout the growing season using standard practices for pesticide and fertilizer applications as recommended by the Alabama Cooperative Extension System. Initial stand counts were taken June 18 and final stand counts were taken September 5 to determine plant survival rates by plot. Four wilt disease evaluations were taken throughout the season on July 2 and 18, and August 7 and 22. Infected plants were counted and collected and the fungus was re-isolated onto half-strength APDA (Acidified Potato Dextrose Agar) 100 millimeter plates to confirm infection. FOV cultures will be identified to race using six primers to sequence identification of pathogenic races of FOV: two EF-1α primers (EF1 and EF2), two Beta-tubulin primers (BT3 and BT5) and two phosphate permease primers (PHO1 and PHO6). Three root systems per plot were sampled on July 23 and root-knot eggs were extracted by shaking in 0.6 percent NaCl for four minutes and collecting eggs on a 25µm sieve and counted at 40X using an inverted Nikon TSX microscope. Data were statistically analyzed using Generalized Linear Mixed Models with SAS® PROC GLIMMIX with a negative binomial distribution function for count variables. Seed cotton yield was analyzed using a normal distribution function. Dunnett's P-values were calculated to compare entries to resistant and susceptible checks.

Results: *Fusarium* wilt incidence was low in 2013. Monthly average maximum temperatures from planting in April through harvest in October were 74.7, 79.4, 87.1, 85.4, 86.5, 85.9 and 76.5°F with average minimum temperatures of 50.6, 56.1, 67.9, 68.9, 68.3, 63.1 and 52.0°F, respectively. Rainfall accumulation for each month was 3.80, 2.02, 7.10, 6.44, 5.16, 1.79 and 0.48 in with a total of 26.79 inches over the entire season. Some possible causes of low *Fusarium* wilt incidence could be differing weather patterns. Rainfall amounts for June and July of 2013 were more than doubled the amounts for 2012. Soil temperatures were much cooler in 2013 with a a 10°F higher temperature in July 2012 (94.7°F) than in July 2013 (84.2°F). Air temperatures were also cooler in 2013. The susceptible check Rowden had an average of 11.8 percent wilt, with the lowest amount of disease being 7.5 percent and the most disease observed was 18.1 percent. Ten cultivars displayed fewer *Fusarium* wilt symptoms than Rowden, including Croplan Genetics 3787 B2RF, Deltapine 1137 B2RF, Deltapine 12R242B2R2, Deltapine 1321 B2RF, FiberMax1944 GLB2, Phytogen 339 WRF, Phytogen 375 WRF, Phytogen 499 WRF, Stoneville 4946 GLB2 and Stoneville 6448 GLB2. Seven cultivars had statistically similar wilt percentages to the resistant check M-315. The lowest wilt percentages observed were FiberMax 1944 GLB, Phytogen 339 WRF, Stoneville 4946 GLB2, Phytogen 499 WRF and Stoneville 6448 GLB2 with 0.3 percent, 0.3 percent, 0.8 percent, 0.9 percent, 0.9 percent and 0.9 percent percent wilt, respectively.

The identification of races of FOV using DNA primers is currently in progress. Preliminary results indicate a diverse group of FOV present.

The susceptible check Rowden had an average of 510 root-knot nematode eggs per gram of root fresh weight (eggs/g RFW), with a range of 256 to 1016 eggs/g RFW. The resistant check M-315 had an average of 86 eggs/g RFW, and supported a range of only 43 to 170 eggs/g RFW. Two varieties were supported more root knot nematodes than the resistant check M-315: Phytogen 339 WRF and Phytogen 375 WRF, with averages of 681 and 602 eggs/g RFW, respectively. No varieties were statistically lower than the susceptible check Rowden, but two varieties supported only 111 eggs/g RFW: Deltapine 12R242B2R2 and FiberMax 1944 GLB2.

Table 1.
Fusarium Wilt Percentage Incidence as Observed by Variety

Cultivar	Avg	Lower	Upper	Rowden**	M-315**
CG 3787 B2RF*	2.5	1.1	5.7	0.004	0.186
DP 1050 B2RF	5.8	3.3	10.1	0.123	0.032
DP 1137 B2RF	3.7	1.8	7.2	0.012	0.281
DP 1252 B2RF	7.4	4.3	12.2	0.485	0.001
DP 12R242B2R2	4.3	2.3	7.8	0.013	0.01
DP 1321 B2RF	1.0	0.3	3.2	0.001	1.000
FM 1944 GLB2	0.3	0.0	2.6	0.01	0.998
PHY 339 WRF	0.3	0.0	2.3	0.007	0.891
PHY 375 WRF	1.1	0.4	3.5	0.001	0.999
PHY 499 WRF	0.9	0.2	3.0	0.001	1.000
ST 4946 GLB2	0.8	0.2	3.0	0.001	1.000
ST 6448 GLB2	0.9	0.2	3.1	0.002	1.000
M-315	0.9	0.3	2.6	<0.001	
Rowden	11.8	7.5	18.1		0.000

*Varieties that are shaded showed significantly lower wilt percentages than the susceptible check Rowden.
**Dunnett's P-values vs. checks.

The susceptible cultivar Rowden yielded an average of 1,963 pounds of seed cotton per acre, with a range of 759 to 3,167 pounds per acre. At .85 cents per pound (the average price of cotton lint in December 2013) the average profit per acre would be $667. The resistant check M-315 yielded an average of 2,994 pounds of seed cotton per acre, with a range of 1,789 to 4,198 pounds per acre. The average profit per acre for M-315 would be $1,018. Three varieties were statistically higher yielding than the susceptible check

Rowden: FiberMax 1944 GLB2, Phytogen 339 WRF, and Phytogen 499 WRF with 5,300, 4,712 and 4,806 pound averages per acre of seed cotton yield. FiberMax 1944 GLB2 profited $1,802 per acre, Phytogen 339 WRF $1,602 per acre, and Phytogen 499 WRF $1,634 per acre. The highest yielding cultivar – FiberMax 1944 GLB2 – produced an average of $1,135 more in profits than the susceptible check Rowden. This represents how imperative it is to be selective of the cultivar grown.

Table 2.
Root-Knot Eggs Per Gram of Root Fresh Weight From Each Cotton Variety

Cultivar	Avg	Lower	Upper	Rowden**	M-315**
CG 3787 B2RF	169	73	390	0.332	0.869
DP 1050 B2RF	141	61	325	0.176	0.982
DP 1137 B2RF	409	178	943	1.000	0.055
DP 1252 B2RF	252	109	580	0.841	0.362
DP 12R242B2R2*	111	48	255	0.064	1.000
DP 1321 B2RF	409	177	942	1.000	0.055
FM 1944 GLB2	111	48	257	0.066	1.000
PHY 339 WRF	681	295	1569	1.000	0.004
PHY 375 WRF	602	261	1389	1.000	0.008
PHY 499 WRF	183	79	422	0.424	0.778
ST 4946 GLB2	264	115	609	0.891	0.308
ST 6448 GLB2	999	434	2304	0.877	<0.001
M-315	86	43	170	0.006	
Rowden	510	256	1016		0.006

*Varieties that are shaded showed significantly lower wilt percentages than the susceptible check Rowden.
**Dunnett's P-values vs. checks.

Table 3.
Seed Cotton Yield in Pounds Per Acre

Cultivar	Avg	Lower	Upper	Rowden**	M-315**
CG 3787 B2RF	3303	1855	4751	0.748	1.000
DP 1050 B2RF	2781	1332	4229	0.987	1.000
DP 1137 B2RF	2904	1456	4352	0.963	1.000
DP 1252 B2RF	1902	454	3350	1.000	0.923
DP 12R242B2R2	3801	2352	5249	0.365	0.999
DP 1321 B2RF	2483	1035	3931	1.000	1.000
FM 1944 GLB2*	5300	3852	6748	0.008	0.164
PHY 339 WRF	4712	3264	6160	0.045	0.35
PHY 375 WRF	4211	2763	5659	0.157	0.791
PHY 499 WRF	4806	3358	6254	0.034	0.511
ST 4946 GLB2	4530	3082	5978	0.072	0.481
ST 6448 GLB2	2418	969	3866	1.000	1.000
M-315	2994	1789	4198	0.873	
Rowden	1963	759	3167		0.826

*Varieties that are shaded showed significantly lower wilt percentages than the susceptible check Rowden.
**Dunnett's P-values vs. checks.

Summary: The highest yielding variety was FiberMax 1944 GLB2, with an average of 5,300 pounds per acre of seed cotton yield. This variety also had the lowest *Fusarium* wilt percentage among all varieties. FiberMax 1944 GLB2 averaged 111 root-knot nematode eggs per gram of root fresh weight; this was higher than the resistant check M-315 (averaging 86 eggs/g RFW), and equal to Deltapine 12R242B2R2 and lower than all of the other cultivars tested in the trial. The next highest yielding variety was Phytogen 499 WRF with an average of 4806 lbs per acre of seed cotton yield. This variety had a moderate average of 183 root-knot nematode eggs/g RFW.

Average wilt percentage for Phytogen 499 WRF was 0.9 percent, which was statistically lower than the susceptible check Rowden. Phytogen 339 WRF yielded an average 4,712 pounds of seed cotton yield per acre. This variety had the second highest root-knot egg population per gram of fresh root weight with 681 eggs/g RFW. Average wilt percentage was 0.3 percent. This indicates a tolerance to the root-knot nematode, and potentially resistance to *Fusarium* wilt disease with Phytogen 339 WRF. Two other varieties yielded 4,000+ pounds per acre of seed cotton: Stoneville 4946 with 4530 lbs per acre and Phytogen 375 with 4,211 pounds per acre. Further testing will need to be done to confirm or deny resistance to FOV. Variety selection can be very important economically to the producer in the *Fusarium* wilt Root-knot nematode complex field.

II. Cultural Management

Continued Support of Long-term Research – The Old Rotation

C. Mitchell, D. Delaney, and K. 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).

Corn and cotton yields reflect N availability more than any other factor. There was a response to irrigation in 2013 by corn and soybean but not cotton.

Mean irrigated and non-irrigated lint yields across all treatments since 2003

Year	Lint Yield (lbs/ac)		Prob>F
	Irrigated	Non-Irrigated	
2003	861	952	NS
2004	1182	898	***
2005	750	895	** negative
2006	1102	1137	ns
2007	1221	544	***
2008	1264	602	***
2009	897	1097	*** negative
2010	926	721	**
2011	1121	886	***
2012	1611	1131	***
2013	1387	1338	NS
11-yr Mean	1120	930	**

Crop yields on the Old Rotation in 2013

Plot Number	Description	Crimson Clover Dry Matter (lbs/ac)		Wheat (bu/ac)	Corn (bu/ac)		Cotton Lint (lbs/ac)		Soybean (bu/ac)	
		Irrigated	Non-Irrigated		Irrigated	Non-Irrigated	Irrigated	Non-Irrigated	Irrigated	Non-Irrigated
1	no N/no legume	0	0				657	451		
2	winter legume	7673	6480				1539	1906		
3	winter legume	6493	3660				1399	1549		
4	cotton-corn	2609	4151		179	165	corn	corn		
5	cotton-corn + N	8921	5565		182	160	corn	corn		
6	no N/no legume	0	0				469	413		
7	cotton-corn	4483	9591				2065	1727		
8	winter legume	4934	5268				1831	1699		
9	cotton-corn + N	5925	3672				1755	1784		
10	3-year rotation	0	0	83.9			soy	soy	64.5	26.5
11	3-year rotation	0	0				1380	1070		
12	3-year rotation	5144	4717		222	193	corn	corn		
13	cont. cotton/no legume +N	0	0				1389	1446		
	Mean	5773	5388		194	173	1387	1338		

Continued Support of Long-term Research – Cullars Rotation

C. Mitchell, D. Delaney and K. Balkcom

The Cullars Rotation (circa 1911) is the oldest continuous soil fertility study in the Southern U.S. In commemoration of the 2011 Centennial Year for this experiment, a comprehensive Alabama Agricultural Experiment Station bulletin was published covering the first 100 years of this experiment.
(http://www.aaes.auburn.edu/comm/pubs/bulletins/bull676.pdf)
A poster was also presented at the 2012 Beltwide Cotton Conference. This study is non-irrigated and yields reflect growing conditions during the season. Note the dramatic yield response to added K by cotton. Highest cotton yields (1,493 pounds lint/acre) were produced on the treatment receiving a complete fertilizer plus micronutrients (boron). No added P (Plot 2) dramatically reduces wheat and corn yields more than cotton yields. Soybean yields are equally affected by P and K deficiencies. All fertilizers are applied to the cotton and wheat crops. The Cullars Rotation Experiment is an excellent site to see dramatic nutrient deficiencies compared to healthy crops each year. This type of comparison does not exist anywhere else in the USA.

Crop yields on the Cullars Rotation in 2013

Plot	Treatment description	Clover dry wt. (lbs/ac)	Wheat (lbs/ac)	Corn (bu/ac)	Cotton lint (lbs/ac)	Soybean (bu/ac)
A	no N/+legume	3978	29.4	168.1	742	45.8
B	no N/no legume	0	22.2	36.4	929	41.6
C	Nothing added	0	4.2	0.0	0	0.0
1	no legume	0	66.0	128.2	1014	38.0
2	no P	1896	35.6	31.1	544	18.5
3	complete	7256	63.8	184.0	901	35.5
4	4/3 K	4582	69.7	151.8	173	35.4
5	rock P	7406	55.9	172.3	1098	36.2
6	no K	3407	61.4	41.7	75	17.7
7	2/3 K	3233	69.7	190.7	1042	34.1
8	no lime (pH~4.9)	0	0.0	36.0	141	0.0
9	no S	8373	64.4	181.1	854	38.1
10	complete+ micros	5901	61.6	194.2	1493	39.4
11	1/3 K	6303	68.0	162.1	516	30.4
	Mean of all treatments	5234	56.0	129.0	957	34.2

Planter Unit Test Stand

J. Fulton, K. Balkcom, G. Pate and M. Hall

Amount: $2,500

Objectives: (1) To develop a means to calibrate planter, row-crop metering units, (2) to establish the ability to demonstrate planter technology and proper setup during Alabama Cooperative Extension System programming and similar educational activities and (3) to publish proper row-crop meter setup guidelines for Alabama farmers.

Results: A planter test stand was developed to evaluate individual row-crop metering units in early 2013. This test stand provided the ability to quantify actual seed metering in terms of population, seed spacing, skips, and multiples over a range of meter RPMs and vacuum pressures. Preliminary data has been collected from different meters to establish proper vacuum levels to maintain performance. Field tests were also conducted to compare and contrast test stand and in-field performance of meters. On-farm live population and spacing data were collected. Results indicated seed spacing standard deviations ranged between 1.6 and 3.8 inches. Further, the test stand has been used during field days and Extension activities to highlight proper setups and possible issues which may impact planter performance.

Recommendations:

1. Precision Planting eSet metering components provide improved performance over the Standard John Deere setup.

2. Preliminary data indicated that no significance difference exists between Precision Plantng eSet and John Deere ProMax 40 setups. We plan to finalize the comparisons between eSet and ProMax 40 in 2014.

3. Meter speeds above 35 RPM should be used cautiously. The performance of all meters tested indicated performance starts to quickly decrease above this value.

Potassium Rates for New Generation Cotton Cultivators- Year 1 Report

D. Weaver and B. Guertal

Introduction: The experiment was conducted at the Plant Breeding Unit (PBU), located in Tallassee, AL. The site was not irrigated, and had an initial soil test K of 126 pounds K per acre, a 'Medium' soil test (recommended fertilizer K2O application of 40 pounds per acre). Three cotton cultivars were used: Phytogen 499, Deltapine 1050 and Deltapine 491 (an older cultivar). Potassium rates (as KCl) were 0, 30, 60, 90 and 120 pounds K2O per acre. There were four replicates of each treatment for a total of 60 plots in the experiment (15 treatments). Each plot was 4 rows wide (36 inch row spacing) and 40 feet long, with the middle two rows of each plot harvested. All K was pre-plant broadcast applied and incorporated prior to planting.

Collected Data Included: (1) yield, (2) fiber quality, (3) date of first flower and first open boll, (4) plant height at first flower and first open boll, and, (5) tissue K (most recently emerged fully expanded leaves) at first flower and first open boll. Plots were harvested on November 8th, 2013.

Preliminary Results (yield data only at this point): For seed cotton yield, there was not a significant cultivar x K rate interaction, which indicates that the different cultivars responded similarly to increasing potassium. Phytogen 499 had a significantly higher yield than measured in Deltapine 1050 or Delta 491 (Table 1). As K rate increased there was a significant linear increase in seed cotton (Figure 1). There was not a different K response due to cultivar.

Figure 1. Seed cotton yield as affected by K_2O rate 2013, Tallasee, AL

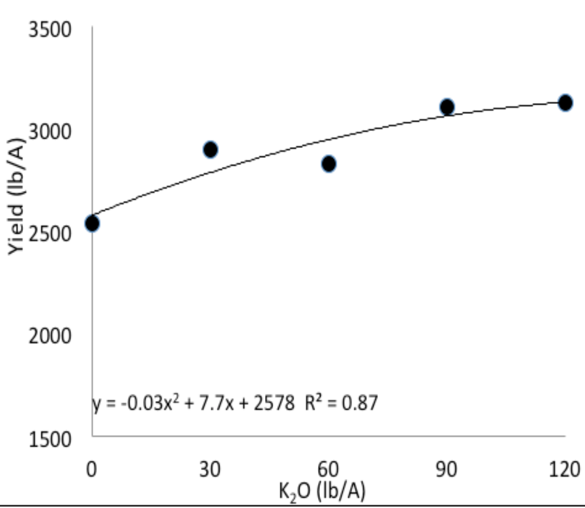

Table 1.
Seed Cotton Yield as Affected by Cultivar, 2013, Tallasee, AL

Cultivar	Yield (lbs/ac)
Phytogen 499	3,179 a
Deltapine 1050	2,839 b
Deltapine 491	2,683 b

Note: Means followed by the same letter are not significantly different from each other via mean's separation at an alpha of 0.10.

Performance of Planter Meters for Cotton

J. Fulton, K. Balkcom, S. Virk, G. Pate and M. Hall

Components and technology offerings to improve planter performance continue to increase. In particular, new row-meter parts allow units to improve what is called singulation (e.g. reducing skips and doubles) assuming the vacuum pressure is properly set. To help understand the value of all this new technology, a planter meter test stand was acquired to evaluate setups and help establish guidelines for Alabama cotton farmers. The test stand provided the ability to quantify actual seed metering in terms of population, seed spacing, skips and multiples over a range of meter RPMs and vacuum pressures. Data was collected from a John Deere Standard meter setup and a John Deere standard meter outfitted with Precision Planting's eSet components. Field tests were also conducted to understand in-field performance of meters with 4 ground speeds and 5 seeding rates treatments resulting in 20 unique meter speed combinations during planting. Plant population and seed spacing data were collected once 100% emergence occurred. Yield data was collected on a per plot basis. For these tests, both corn and cotton setups were evaluated.

Field results to date indicated Precision Planting eSet metering components provide improved performance over the Standard John Deere setup. The eSet setup provided reduced variation in cotton seed spacing but no significant difference in final seed cotton yield. Variation in planted seed population was less for the eSet meters. In other words, the eSet meters were able to maintain the target planting population more consistently.

Test stand data for the meters showed that speeds above 38 RPM tended to reduce performance for both meters. Low meter RPMs (<18 RPM) can caused higher variations in seed spacing as well with standard deviations in the 2.5 to 3.1 inches. We consider a standard deviation of seed spacing under 2.0 inches as acceptable which was attained in the field most times with meter RPMs between 18.3 and 33.0 RPM. Table 1 presents a range of meter RPMs for 36-inch row spacing as impacted by seeding rate and ground speed. One can use this table to ensure a proper meter RPM to maximize in-field performance for both meters.

Finally, vacuum level is important to maintain meter performance. Based on the type of meter and seed plant, the optimum vacuum level will be different. The following provides the manufacturer recommendations for each of these meter setups used in this study:

1. eSet vacuum recommended at 18 to 20 inches of water using their 60-hole cotton seed plate.

2. John Deere 64 hole seed plate recommended between 12 to 18 inches of water.

It should be noted that both companies indicated these area starting points for vacuum levels but should be checked and vacuum level adjusted to ensure maximum performance.

	Meter RPM for 36" Row Spacing										
Seeding Rate (ksds/ac)	**Ground Speed (mph)**										
	3.0	**3.5**	**4.0**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**	**7.0**	**7.5**	**8.0**
30.0	9	10	11	13	14	16	17	19	20	21	23
35.0	10	12	13	15	17	18	20	22	23	25	27
40.0	11	13	15	17	19	21	23	25	27	28	30
45.0	13	15	17	19	21	24	26	28	30	32	34
50.0	14	17	19	21	24	26	28	31	33	36	38
55.0	16	18	21	24	26	29	31	34	37	39	42
60.0	17	20	23	26	28	31	34	37	40	43	46
65.0	19	22	25	28	31	34	37	40	43	46	49
70.0	20	23	27	30	33	37	40	43	47	50	53
75.0	21	25	28	32	36	39	43	46	50	53	57
80.0	23	27	30	34	38	42	46	49	53	57	61

III. Weed Management

Herbicide Resistance Field Studies

C.H. Burmester, S. McElroy, J.T. Ducar, and A. Price

Each test sites in Limestone and Cherokee counties were treated and rated for control of horseweed and other winter weeds. All residual treatments (Table 1) did an excellent in job of inhibiting horseweed emergence at each site.

The fall foliar treatments produced surprising results. Ratings of the fall foliar treatments on December 11th indicated that all treatments, including Roundup alone, effectively controlled all emerged marestail plants (Table 2). Why Roundup alone controlled the glyphosate resistant horseweed at this stage will need further investigation. The fall foliar treatments containing Dicamba and Sharpen herbicide also produced excellent residual control of marestail through mid-March. The fall Roundup alone treatment had emerging marestail appearing in early to mid-February.

The spring herbicide results are also reported in Table 2. Results indicate that Roundup was no longer controlling any marestail plants. Dicamba control of marestail was also decreasing to about 96% with rating of the 8 and 16 ounces treatments on April 8th. These ratings are most likely high due to the fact that many of the horseweeds were twisted but still survived the application. The late April test (rated on May 8th) showed a very sharp decrease in marestail control (20-35%) with dicamba treatments. Only the Sharpen and Roundup treatment still provided 100 percent control of marestail.

This preliminary data supports the theory that marestail control problems using dicamba herbicide could be related to marestail size. Increasing dicamba rates only marginally increased marestail control. In this study marestail plants six inches or taller were not effectively controlled by dicamba treatments. Why the Roundup treatment controlled glyphosate-resistant marestail in December is still puzzling and will be further investigated. Sharpen appears to be a good herbicide with foliar and residual activity on marestail. Farmers will need to apply Sharpen herbicide according to label restriction on rates and timing of Sharpen application on various crops and soil types.

Table 1.
Residual and Foliar Herbicide Treatments Applied at Tennessee Valley Test Site, 2012-2013.

Residual[1]	Rate (oz/ac)	Foliar 2	Rate (oz/ac)
Valor	2.0	RPMax3	29
Zidua	2.0	Dicamba	8
Leadoff	1.0	Dicamba	16
Sharpen	2.0	RPMax + Dicamba	29 + 8
Fierce	3.0	RPMax + Dicamba	29 + 16
		RPMax + Sharpen	29 + 2

[1] Application made on November 26th. Emerged weeds controlled with 1 pt/A Grammoxone + 2 oz/A Sharpen.
[2] Application made on November 26th, March 26th and April 23rd. 3 RPMax = Roundup PowerMax.

Table 2.
Marestail control ratings made two weeks after application, Tenn. Valley Station, 2012-2013

Treatments	Rate (oz/ac)	12/11	4/8	5/8
RPMax[1]	29	100	0	0
Dicamba	8	100	96	20
Dicamba	16	100	96	35
RPMax + Dicamba	29 + 8	100	99	10
RPMax + Dicamba	29 + 16	100	100	15
RPMax +Sharpen	29 + 2	100	100	100

[1] Indicates Roundup PowerMax

Greenhouse Resistance Verification Studies

S. McElroy, C.H. Burmester, A. Price, J. Ducar and M. Flessner

Preface: The following research was conducted to determine if common ragweed and horseweed populations collected in Alabama were glyphosate and dicamba resistant, respectively. Each weed species will be discussed separately below. This information will be presented at the annual meeting of the Southern Weed Science Society in January 2014 in Birmingham, AL. Following this, the research will be submitted for publication in the journal Weed Technology. The Alabama Cotton Commission will be acknowledged as the primary funding source for this research. All the stated goals of the proposal have been fulfilled. This document should therefore be considered the final report.

Part I
Evaluation of Suspected Common Ragweed Resistance to Glyphosate

Introduction: Glyphosate resistant common ragweed (Ambrosia artemisiifolia) was first reported in Arkansas and Missouri in 2004 and has since been reported across the mid-west from the Dakotas to Pennsylvania. The mechanism of resistance is not fully understood but both target site mutation and reduced absorption and translocation mechanisms do not appear responsible. Common ragweed with suspected glyphosate resistance was collected in Madison County, AL in April 2012. The objective of this research was to evaluate common ragweed populations collected from Madison County for glyphosate resistance and compare their tolerance level to a known susceptible population.

Methods: Common ragweed was collected from the suspect glyphosate resistant population, which was named 'original field,' and transplanted in the greenhouse. Glyphosate was applied at 1.12 kg ae ha-1 to the transplants, and seed from plants with the quickest recovery were collected for a population named 'suspected one' (S1). Common ragweed from a different field in Madison County was also collected, and this population was named 'barn field.' Lastly, common ragweed seed was purchased from Azlin Seed Service (Leland, Mississippi) and used for a glyphosate-susceptible population named 'common.' Populations used for tolerance determination were established from seed in 10 centimeters2 pots with soil collected from a Wickham sandy loam (pH 6.3; 1.7 percent organic matter). Two maturity levels were evaluated. The 'small' stage characterized by 2 to 4 mature nodes above the cotyledons, 4 to 7 centimeters in height, and averaged 5 cm in width. The 'large' stage had > 6 nodes mature above the cotyledons and averaged 15 centimeters in height and 12 centimeters in width.

Glyphosate tolerance was evaluated using rate response studies in the greenhouse with conditions suited for common ragweed growth. Treatments included 0, 0.14, 0.28, 0.56, 1.12, 2.24, 4.5, 9.0, 18.0, and 36.0 kg ae ha-1 1 (0, 0.125, 0.25, 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, and 32.0 lb ae/a) glyphosate (Roundup ProMax®; Monsanto Co., St. Louis MO) applied at 280 L ha-1. Irrigation was withheld for 24 hours after treatment. Three replications per treatment were applied and the experiment was repeated in time. Data were collected 28 days after treatment and included percent visual control on a 0 to 100 scale where 0 corresponds to no injury and 100 corresponds to plant necrosis and above ground biomass (fresh weight). Mass data were transformed to a percent reduction relative to the nontreated mean for analysis. ANOVA indicated that maturity level was a significant factor, so subsequent analysis was conducted separately for each level. Nonlinear regression analysis was conducted using Prism® (GraphPad Software, La Jolla, CA) with the four parameter log-logistic model. I50 values (glyphosate rate resulting in 50 percent visual control or fresh weight reduction) were compared between populations using 95 percent confidence intervals.

Common Ragweed Results: Visual control data for the small growth stage was not able to separate populations' glyphosate tolerance. However, data from the large growth stage indicate that original field, barn field, and S1 were 24, 17, 12 times more tolerant to glyphosate than the common (susceptible) population, respectively. Fresh weight reduction data from the small growth stage indicate that original field and barn field were 3 to 4 times more tolerant than the common (susceptible) population; the S1 population had a similar tolerance to all other populations. Fresh weight reduction data from the large growth stage indicate that original field and barn field were approximately 3.4 and 7.9 times as tolerant to glyphosate as the common (susceptible population), respectively, while S1 and common were similar in tolerance. Previous reports of glyphosate resistance report a 10- to 21-fold tolerance increase. These results indicate that glyphosate resistant common ragweed does exist in Madison County, AL, with a 3.4 to 24 fold increase in tolerance.

I50 values were calculated to determine the glyphosate concentration needed to kill or control 50 percent of the weed population. On average, original field and barn field had I50 values of 1.1 and 0.71 kg ae ha-1 (1.0 and 0.63 pounds ae/acre) while the large growth stage had I50 values of 4.8 and 1.8 kg ae ha-1 (4.3 and 1.61 pounds ae/acre) as estimated by visual and mass reduction data types, respectively. Therefore, as is known with other glyphosate resistant weeds, the level of glyphosate resistance is dependent on size with smaller weeds able to be controlled and larger weeds being more resistant. Will earlier application timing will not completely negate glyphosate resistance, it certainly will increase the chances of control.

Evaluating PRE herbicide GPA Application Volume for Pigweed Control in Reduced-Tillage Cotton

A. Price, K. Balkcom, M. Patterson and C.D. Monks

Objective: To optimize weed management components for an integrated glyphosate-resistant Palmer amaranth management program.

Results: The following tables provide result details. In general, increasing application volume did not increase pigweed or other weed control in 2012 or 2013. These results reveal that in high residue conservation tillage systems, producers are realizing predictable weed control within the row and the row middles regardless of the range of typically utilized spray GPAs.

Table 1.*
Agronomic Response of Cotton to GPA[1] and Pre-Emergence Herbicide, Wiregrass 2012

GPA	Population (plants/Ha)	Seed Cotton Yield (kg/Ha)
None	39467	1716
10	60994	2921
15	64582	3269
20	66974	3355
25	57406	2758
30	59200	3106
60	52024	1998
Herbicide		
None	39467	1716
Prowl	54018	2751
Reflex	66376	3052

*All averages were obtained using the GLM Least Squares Means procedure in SAS.
[1]Gallons per acre of H_2O carrier.

Table 2.
**Early1 In-Row and Row-Middle Weed Response to GPA[2] and Pre-Emergence Herbicide Wiregrass 2012*

GPA	Weed Control (%)									
	In-Row					Row-Middle				
	Palmer Pigweed	Crabgrass	Coffee Senna	Yellow Nutsedge	Morning Glory	Palmer Pigweed	Crabgrass	Coffee Senna	Yellow Nutsedge	Morning Glory
None	0	0	0	0	0	0	0	0	0	0
10	98	85	0	96	0	98	72	0	92	0
15	98	89	0	67	0	98	77	0	68	0
20	98	91	0	89	0	98	87	0	80	0
25	99	91	0	96	0	99	82	0	96	0
30	99	89	0	96	0	99	81	0	98	0
60	98	79	0	81	0	96	66	0	81	0
Herbicide										
None	0	0	0	0	0	0	0	0	0	0
Prowl	98	92	0	89	0	97	91	0	91	0
Reflex	99	82	0	86	0	99	64	0	81	0

[*]All averages were obtained using the GLM Least Squares Means procedure in SAS.
[1]Weed ratings were taken before the first post-emergence herbicide application on 5/30/2012.
[2]Gallons per acre of H2O carrier.

Table 1.
[*]Agronomic Response of Cotton to GPA1 and Pre-Emergence Herbicide E.V. Smith 2013

GPA	Population (plants/Ha)	Seed Cotton Yield (kg/Ha)
10	89099	4452
15	103451	4252
20	99265	4334
25	98069	4591
30	104049	4554
60	103451	4466
Herbicide		
Prowl H_2O[2]	95877	4233
Reflex[3]	103252	4651
Non-treated[4]	100461	2905

[*]All averages were obtained using the GLM Least Squares Means procedure in SAS.
[1]Gallons per acre of H_2O carrier.
[2]Prowl H_2O (0.75 lbs a.i./A) was applied pre-emergence (at planting).
[3]Reflex (1 pt/A) was applied pre-emergence (at planting).
[4]No pre-emergence herbicide was applied.

Table 2.
**In-Row and Row-Middle Weed Response1 to GPA2 and Pre-Emergence Herbicide*
E.V. Smith 2013

GPA	Weed Control (%)							
	In-Row				Row-Middle			
	Smooth Pig-weed	Crab-grass	Pitted Morn-ing Glory	Yellow Nut-sedge	Smooth Pig-weed	Crab-grass	Pitted Morning Glory	Yellow Nutsedge
10	99	99	98	99	99	98	93	98
15	99	99	99	99	99	99	88	96
20	99	99	97	99	99	99	73	98
25	99	99	96	98	99	99	86	99
30	99	99	99	99	99	99	97	98
60	99	98	99	99	99	98	96	99
Herbicide								
Prowl H_20[3]	99	99	99	99	99	99	93	98
Reflex[4]	99	99	97	99	99	98	85	98
Non-treated[5]	33	33	61	28	97	93	33	92

[*]All averages were obtained using the GLM Least Squares Means procedure in SAS.
[1]Weed ratings were taken before the first post-emergence herbicide application.
[2]Gallons per acre of H_2O carrier.
[3]Prowl H_2O (0.75 lbs a.i./A) was applied pre-emergence (at planting).
[4]Reflex (1 pt/A) was applied pre-emergence (at planting).
[5]No pre-emergence herbicide was applied.

Wide vs. Narrow Strip Tillage for Pigweed Control in Reduced-Tillage Cotton

A. Price, K. Balkcom, M. Patterson and C. D. Monks

Location: Wiregrass Research and Extension Center.

Objective: To optimize weed management components for an integrated glyphosate-resistant Palmer amaranth management program.

Progress: The cover crop was established in the experimental areas in fall 2012 and cotton established in 2013. The following table provides result details for the initial year of research. In general, narrow tillage width disturbance increased weed control in high residue systems while wide tillage width provided higher control in low residue systems. Averaged over tillage width and residue level, cover crops provided substantial levels of weed control compared to soil-applied herbicides.

Table 1.
Weed Response to Tillage Width, Cover Crop Residue Level and Weed Control Methods in Cotton E.V. Smith 2013

	Weed Control (%)							
	In-Row				Row-Middle			
	Pigweed	Crab-grass	Pitted Morn-ing Glory	Sickle-pod	Pigweed	Crab-grass	Pitted Morning Glory	Sicklepod
Tillage Width								
Narrow[1]	76	71	69	65	67	50	50	57a
Wide[2]	61	65	70	55	48	35	32	33b
LSD (0.05)	22.4	21.9	18.7	21.1	25.0	23.4	21.2	22.0
Residue Level								
Low[3]	66	60	57b	48b	33b	27b	16b	17b
High[4]	70	76	83a	71a	81a	58a	67a	73a
LSD (0.05)	22.4	21.9	18.7	21.1	25.0	23.4	21.2	22.0
Weed Control								
Non-treated[5]	23b	23b	27b	19b	47b	17b	24b	26b
Pre (banded)[6]	82a	83a	89a	77a	43b	30b	36b	47ba
Pre (broad-cast)[7]	99a	98a	93a	84a	82a	81a	64a	62a
LSD (0.05)	27.4	26.8	22.9	25.8	30.6	28.6	25.9	26.9

[1]A 4-row KMC subsoiler was used in the plots.
[2]A 4-row KMC strip till with wavy coulters and a rolling basket was used in the plots.
[3]Rye was terminated early, so there was very little or no residue left on the plots.
[4]Rye was left growing until spring when it was then rolled flat prior to planting.
[5]No herbicide was used.
[6]Prowl H2O (29 oz/A) + Reflex (16 oz/A) was banded over the row in 8" strips after planting.
[7]Prowl H2O (29 oz/A) + Reflex (16 oz/A) was broadcasted over the plot after planting.

Table 2.
Agronomic Response of Cotton to Tillage Width, Cover Crop Residue Level, and Weed Control Methods in Cotton – E.V. Smith 2013

	Agronomics	
	Population (plants/ha)	**Seed Cotton Yield (kg/ha)**
Tillage Width		
Narrow[1]	109231	4710
Wide[2]	110029	5035
LSD (0.05)	7831.4	429.6
Residue Level		
Low[3]	108434	4805
High[4]	110826	4940
LSD (0.05)	7831.4	429.6
Weed Control		
Non-treated[5]	110029	4647
Pre (banded)[6]	110029	4970
Pre (broadcast)[7]	108833	5000
LSD (0.05)	9591.4	526.2

[1]A 4-row KMC subsoiler was used in the plots.
[2]A 4-row KMC strip till with wavy coulters and a rolling basket was used in the plots.
[3]Rye was terminated early, so there was very little or no residue left on the plots.
[4]Rye was left growing until spring when it was then rolled flat prior to planting.
[5]No herbicide was used.
[6]Prowl H2O (29 oz/A) + Reflex (16 oz/A) was banded over the row in 8” strips after planting.
[7]Prowl H2O (29 oz/A) + Reflex (16 oz/A) was broadcasted over the plot after planting.

IV. Disease Management

Impact of Variety Selection, Tillage and Crop Rotation on the Yield of Cotton as Influenced by Target Spot (Corynespora Leaf Spot)

A. K. Hagan, K. L. Bowen, C. H. Campbell and C. D. Monks

Due to excessive rainfall in May and June, poor stands were noted at in all cotton variety trials at outlying AAES units except for Prattville Ag Research Unit and Tennessee Valley Extension and Research Center.

Significant differences in target spot intensity were noted among cotton varieties with Croplan CG 3787, Phytogen 575, Phytogen 375, Phytogen 499, DPL 1048, Stoneville 4946, Dynagro 2619, Americot 1511 and Americot 5315 having similarly high disease ratings. Least leaf spotting and defoliation was noted on Stoneville 6448 and DPL 1219. In a second study at the Field Crops Unit of EV Smith Research Center, highest disease ratings with > 50 percent defoliation were recorded for Phytogen 499, while DPL 1050 suffered the least leaf spotting and premature defoliation (<25 percent). Yield was higher for Phytogen 499 than DPL 1050 and DPL 1252 but not Phytogen 565, DPL 1137, Fibermax 1944, and Stoneville 6448. Equally high boll counts were also recorded for DPL 1137, Phytogen 565, Phytogen 499, Fibermax 1944, and Stoneville 6448. A reduction in target spot intensity and increase in the number of mature bolls obtained with two applications of 9 fluid ounces/acre Headline 2.09SC did not results in a significant yield gain.

In studies at the Gulf Coast Research and Extension Center (GCREC), recommended fungicides were screened on Phytogen 499 and DPL 1252 for control of target spot. Target spot intensity was higher and yield lower for Phytogen 499 than Deltapine 1252. All fungicides, except the 9 fl oz/A Quadris 2.08SC, reduced target spot intensity when compared with the non-treated control. Poorer disease control was obtained with 9 fluid ounces/acre Quadris 2.08SC than the 7 fluid ounces/acre Twinline. However disease ratings for the remaining fungicide treatments were similar to the latter treatments. Significant yield gains on Phytogen 499 were obtained with all fungicide treatments compared with the non-treated control. Superior yield response was noted with both rates of Twinline compared with Quadris 2.08SC and two lower but not highest rate of Headline 2.09SC. Yield was not impacted by Twinline and Quadris 2.08SC application rate on Phytogen 499, although higher yields were obtained with the 12 fluid ounces than two lower rates of Headline 2.09SC. With the exception of Quadris 2.08SC at 9 fluid ounces/acre, similar yields were recorded for the fungicide treatments and the non-treated control on Deltapine 1252. Impact of fungicide application timing on target spot control on two cotton varieties was also assessed at the GCREC.

Target spot intensity was significantly higher on Phytogen 499 than DPL 1252. However, yield of the two varieties were similar. Lower target spot intensity ratings were recorded for the two later than two earlier application timing treatments and non-treated control on Phytogen 499 and DPL 1252. A full season Headline 2.09SC + Bravo WeatherStik program provided better target spot control than all timed treatments except for the 5th & 7th week of bloom program on Phytogen 499 and both the 3rd and 5th, and 5th and 7th week of bloom programs on DPL 1252. Similar target spot control was obtained on both varieties with the full season Bravo WeatherStik and 3rd & 5th and 5th & 7th week of bloom programs.

Higher yields were obtained with the 3rd and 5th, and 5th and 7th; but not the pinhead square & 1st and 1st and 3rd week of bloom programs, when compared with the non-fungicide-treated control. Yield response with the former two timing programs along with the full season Bravo WeatherStik and Headline 2.09SC + Bravo WeatherStik programs were similarly high. Impact of Headline 2.09SC application numbers of disease intensity and yield was evaluated to develop an estimate of yield loss attributed to target spot on Phytogen 499 and DPL 1252. Target spot intensity was significantly lower on DPL 1252 than on Phytogen 499; however, yield of the two varieties did not significantly differ. On both varieties, target spot intensity ratings were equally high for the non-fungicide treated control and cotton receiving one and two Headline 2.09SC applications. On Phytogen 499, the lowest level of target spot incited leaf spotting and defoliation was observed with the four Headline 2.09SC application program, while equally low disease ratings were noted with the three and four application programs on DPL 1252. Significant yield gains were obtained with a minimum of two and three Headline 2.09SC applications on Phytogen 499 and DPL 1252, respectively, when compared with the non-fungicide treated control.

The relationship between disease intensity and seed yield on Phytogen 499 and DPL 1252 is described by the equations seed yield = 4200/(0.0299*e(0.386*dis)+1) and Seed Yield = 3800/(0.00082*e(0.935*dis)+1), respectively. Estimated yield loss to target spot is estimated at 250 and 300 pounds of lint/acre for DPL 1252 and Phytogen 499, respectively, which translates into a loss at current prices of approximately $200 to 250 per acre. In an attempt to improve leaf coverage with fungicides, a drop and standard over the broadcast nozzle arrangement were compared for target spot control on two cotton varieties at the Brewton Ag Research Unit. While final target spot intensity and AUDPC values were significantly lower on DPL 1252 than on Phytogen 499, yield of the two varieties were similar. Higher target spot intensity and AUDPC values were recorded for the non-fungicide-treated control compared with Headline 2.09SC and Quadris 2.08SC, but the former fungicide provided superior target spot control. Although similar final target spot ratings were recorded with the broadcast and drop nozzle arrangements, better season-long disease control was obtained with the latter nozzle arrangement. Superior yield response was obtained with Headline 2.09SC than with Quadris 2.09SC but neither improved yields when compared with the non-fungicide-treated control. Nozzle arrangement also did not significantly impact seed cotton yield. Similar results were obtained in a similar study conducted at the Field Crops Unit at the EV Smith Research Center.

In the long term rotation study at the Wiregrass Research and Extension Center, cropping frequency has not impacted target spot intensity on Phytogen 499 and DPL 1252. The tillage research trial conducted at the Plant Breeding Unit was lost due to a poor stand resulting from heavy May and June rains at that location.

Corynespora 'Target Leaf Spot' in Alabama Cotton: Fungicide Effect and Variety Response

J. Platt, D. Monks, A.K. Hagan, K. Burch, S. Scott, S. Nightingale and G. Pate, and L. Black

An irrigated field study was conducted in 2013 in Shorter, AL to evaluate variety sensitivity and fungicide treatment in target leaf spot management. Treatments were replicated four times and arranged in a factorial design with variety (main plots) managed with or without fungicides (sub-plots).

Varieties: Phytogen (PHY) 499 WRF, PHY 565 WRF, Delta Pine (DP) 1137 B2RF, DP 1050 B2RF, DP 1252 B2RF, FiberMax (FM) 1944 GLB2 and Stoneville (ST) 5458 B2RF.

Fungicide treatment: Headline™ applied two times at 12 ounces/acre.

Data collected: Leaf spot severity every 2 weeks beginning after first bloom (WAB), nodes above white flower (NAWF) weekly WAB and yield.

•PHY 499 WRF consistently had the highest Target Leaf Spot severity ratings;
•Fungicide was effective for reducing leaf spot rating;
•Fungicide effect was the most obvious in late August when plants were between 2 and 3 NAWF;
•Cotton yield was not affected by fungicide treatment, regardless of variety;
•Fungicide effectiveness can vary with environmental conditions; therefore, more research is needed.

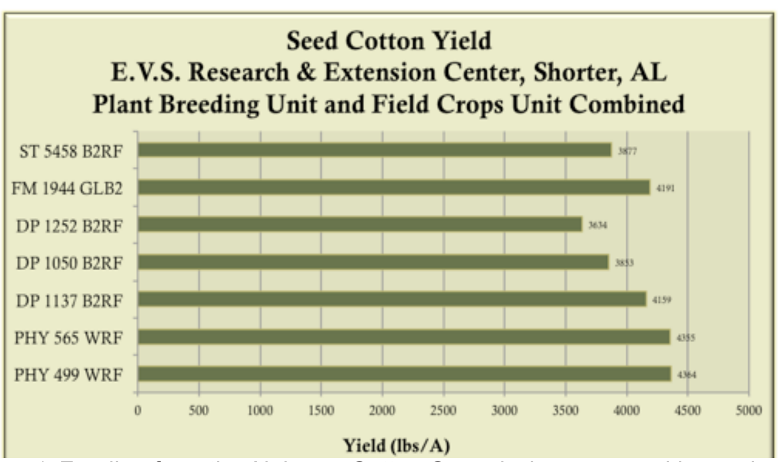

Figure 1. Funding from the Alabama Cotton Commission was used in conducting this trial. We appreciate the support that Alabama cotton producers provide to our educational programs each year.

Fungicide Combination Evaluations for Cotton Seedling Disease Management in North Alabama, 2013

K.S. Lawrence, R. B. Sikkens, C. J. Land and C. Norris

Seed treatment fungicides 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, AL. The field had a history of cotton seedling disease incidence and was infested by *Rhizoctonia solani, Pythium* species, *Thielaviopsis basicola,* and *Fusarium* species. 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. Temik 15G (5 pounds per acre) was applied at planting on 9 Apr in the seed furrow with chemical granular applicators attached to the planter. Plots consisted of 2 rows, 25 feet long, with 40-inrow 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 40 days after planting (DAP) on May 20. Plots were harvested on 8 Oct. Data were statistically analyzed by ARM 9 (Gylling Data Management, Inc.) and means compared using Fisher's protected least significant difference test ($P < 0.10$). Monthly average maximum temperatures from planting in April through harvest in September were 74.3, 78.8, 91.3, 91.2, 91.6, 80.2 and 73.4°F with average minimum temperatures of 52.2, 58.0, 68.3, 71.4, 68.1, 58.8 and 46.5°F, respectively. Rainfall accumulation for each month was 10.22, 2.53, 3.11, 4.28, 1.15, 3.15 and 1.47 in with a total of 25.91 in. over the entire season.

Seedling disease pressure was high in 2013 due to optimum moisture and cool temperatures. Plant stand at 40 DAP was significantly greater in nine of the fungicide seed treatment combinations as compared to the industry standard RTU-PCNB and the untreated control. Plant stands were low with 14 to 39 percent of seedlings surviving producing on average stand of less than two plants per foot of row. *Rhizoctonia solani, Pythium ultimum*, and *Fusarium* species were isolated from the diseased seedlings. Seed cotton yields were significantly increased by six fungicides that increased plant stand as compared to the untreated control and the Vitavax-PCNB + Allegiance FL seed treatment combination. The newer fungicide combinations improved yield over the old standard Vitavax-PCNB + Allegiance FL. Yields varied by 1198 pounds per acre at harvest with an average of 631 pounds per acre average increase of seed cotton produced over all the fungicide treatments as compared to the untreated control.

Fungicide Seed Treatment	**Rate**	**Stand/ 25 ft row***	**Seed Cotton (lb/A) ****
1. Vortex + Allegiance + Spera	0.08 + 0.75 + 1.8 oz/cwt	35.4 ab	3764.6 a
2. Vortex + Allegiance + Spera + Ever-Gol Prime	0.08 + 0.75 + 1.8 + 0.32 oz/cwt	35.2 ab	3599.9 a
3. Vortex + Allegiance + Spera + Ever-Gol Prime + Trilex 2000	0.08 + 0.75 + 1.8 + 0.32 + 1.0 oz/cwt	35.6 ab	3459.5 ab
4. Vortex + Allegiance + Spera + Ever-Gol Prime + Evergol Extend	0.08 + 0.75 + 1.8 + 0.32 + 1.0 oz/cwt	38.8 a	3333.8 ab
5. Apron XL + Maxim + Nuflow M	0.32 + 0.08 + 1.75 oz/cwt	31.2 ab	3437.3 ab
6. Apron XL + Maxim + Nuflow M + Nusan 30 EC	0.32 + 0.08 + 1.75 + 2 oz/cwt	24.0 abc	3330.6 ab
7. Apron XL 3 LS + Maxim 4 FS + Systhane 40 WP + Dynasty CST 125 FS	7.5 + 2.5 + 21.0 g ai/100kg seed + 0.03 (mg ai/seed)	36.2 ab	3655.9 a
8. Apron XL 3 LS + Maxim 4 FS + Systhane 40 WP + Dynasty CST 125 FS + A9625C + A16148C	7.5 + 2.5 + 21.0 oz/cwt + 0.03 (mg ai/seed) +1.0 + 2.5 g ai/100kg seed	34.4 ab	3523.9 a
9. Apron XL 3 LS + Maxim 4 FS + Systhane 40 WP + Dynasty CST 125 FS + A9625C + A16148C	7.5 + 2.5 + 21.0 oz/cwt + 0.03 (mg ai/seed) +1.0 + 5.0 g ai/100kg seed	31.6 ab	3478.5 ab
10. Vortex + Allegiance + Spera + Metlock + Rizolex	0.08 + 0.75 + 1.8 + 0.36 + 0.3 oz/cwt	29.0 abc	3601.0 a
11. RTU Baytan Thiram + Allegiance FL	3.0 + 0.75 oz/cwt	32.4 ab	3841.7 a
12. Vitavax-PCNB + Allegiance FL	6.0 + 0.75 oz/cwt	25.0 abc	2644.2 c
13. RTU-PCNB	14.5 oz/cwt	22.4 bc	3234.5 abc
14. Allegiance FL	1.5 oz/cwt	28.2 abc	3439.4 ab
15. Non-treated		14.0 c	2887.1 bc
LSD (0.10)		15.83	636.7

*Stand was the number of seedlings in a 25 foot of row at 30 days after planting.
**Means followed by same letter do not significantly differ according to Fishers LSD test ($P < 0.10$).

Evaluations for Cotton Disease with the Use of Fungicide Management in North Alabama, 2013

D. L. Bailey, K.S. Lawrence, R. B. Sikkens, C. J. Land and C. Norris

Cotton seeds were treated with fungicides and evaluated for the management of cotton disease in a naturally infested field on the Tennessee Valley Research and Education Center in Belle Mina, AL. The field had a history of cotton seedling disease incidence and was infested with *Rhizoctonia solani*, and *Fusarium* species The soil type was a Decatur silt loam (24 percent sand, 49 percent silt, 28 percent clay). Each treatment was planted in two row plots where the first row was infested by the disease naturally and the second row was inoculated with *Rhizoctonia* and *Fusarium* species by autoclaved seeds infested with the fungi. The seed treatments were applied to the seed by Bayer CropScience. Plots consisted of 2 rows, 7.62 meters long, with 101.6 centimeters row spacing and were arranged in a randomized complete block design with five replications. Blocks were separated by a 6.09-meter 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 40 days after planting (DAP) on May 21. Plots were harvested on 9 Oct. Data were statistically analyzed by JMP Pro and means compared using Fisher's Least Significant Difference test ($P < 0.05$). Monthly average maximum temperatures from planting in April through harvest in September were 74.3, 78.8, 91.3, 91.2, 91.6, 80.2 and 73.4°F with average minimum temperatures of 52.2, 58.0, 68.3, 71.4, 68.1, 58.8 and 46.5°F, respectively. Rainfall accumulation for each month was 10.22, 2.53, 3.11, 4.28, 1.15, 3.15 and 1.47 inches with a total of 25.91 inches over the entire season.

Seedling disease pressure was high in 2013 due to optimum moisture and cool temperatures. Plant stands had no significant differences over all treatments ($P \leq 0.125$) in rows that were naturally infested. In the rows that were inoculated, stand numbers and seed cotton yield were drastically reduced. Treatment 3 (Vortex FL + Allegiance FL + BYF 14182 + Spera + Aeris seed applied system) had a significantly higher stand count than the control without supplemental fungicides to the Aeris system ($P \leq 0.041$). No significant differences in seed cotton yield were found over the treatments in the naturally infested rows. Seed cotton yields in the inoculated rows, however, were significantly higher ($P \leq 0.0001$) across all treatments compared to the control treatment of Aeris without a fungicide. Treatments containing EverGol had significantly higher yields than the control ($P \leq 0.0001$) and were similar to the rest of the treatments. Under high disease pressure, seed cotton yields increased with the application of fungicides compared to a control with no supplemental fungicides. Yields varied across all treatments with the control 198.6 kg and an average of 1053.5 kg. This trial indicates that there are multiple fungicides available that can significantly raise yields.

Fungicide Seed Treatment	Rate	Natural Stand/ 7.62 m row*	Infested Stand 7.62 m row*	Natural Stand Seed Cotton (kg/ac)**	Infested Stand Seed Cotton (kg/ac) **
1. Aeris seed applied system	782 g ai/100kg	36 a	1 b	2053.7 a	198.6 b
2. Vortex FL + Allegiance FL + Spera + Aeris seed applied system	2.5 + 15.6 + 27 + 782 g ai/100kg	38.4 a	7.6 ab	1969.4 a	940.7 a
3. Vortex FL + Allegiance FL + BYF 14182 + Spera + Aeris seed applied system	2.5 + 15.6 + 5 + 27 + 782 g ai/100kg	40.4 a	17.6 a	1937.6 a	1161 a
4. Trilex 2000 + Vortex FL + Allegiance + BYF 14182 + Spera + Aeris seed applied system	9.03 + 2.5 + 15.6 + 5 + 27 + 782 g ai/100kg	38.6 a	8.4 ab	1931.9 a	1127 a
5. Trilex 2000 + Vortex FL + Allegiance + BYF 14182 + Spera + Aeris seed applied system	18.06 + 2.5 + 15.6 + 5 + 27 + 782 g ai/100kg	38.2 a	8.6 ab	1856.8 a	1019.7 a
6. EverGol extend + Vortex FL + Allegiance + BYF 14182 + Spera + Aeris seed applied system	10.04 + 2.5 + 15.6 + 5 + 27 + 782 g ai/100kg	34.8 a	12 ab	1845.7 a	1286.1 a
7. EverGol extend + Vortex FL + Allegiance + BYF 14182 + Spera + Aeris seed applied system	11.51 + 2.5 + 15.6 + 5 + 27 + 782 g ai/100kg	35.6 a	13.2 ab	1842.8 a	1251.5 a
8. EverGol extend + Vortex FL + Allegiance + BYF 14182 + Spera + Aeris seed applied system	23.03 + 2.5 + 15.6 + 5 + 27 + 782 g ai/100kg	40.9 a	9.2 ab	1841.8 a	1160.6 a
9. Trilex Advanced FS + Vortex FL + Allegiance + BYF 14182 + Spera + Aeris seed applied system	31.3 + 2.5 + 15.6 + 5 + 27 + 782 g ai/100kg	44 a	8 ab	1828.3 a	1344.9 a

Cotton Variety and Fungicide Combinations for Seedling Disease Management in North Alabama, 2013

D. L. Bailey, K.S. Lawrence, C. J. Land, R. B. Sikkens, C.H. Burmester and C. Norris

Seven fungicide combinations were evaluated for cotton seedling disease on three cotton varieties. The field site is located on the Tennessee Valley Research Center near Belle Mina, AL. This field has been cultivated in cotton for over 15 years and is naturally infested with *Rhizoctonia solani*, and *Fusarium* species The soil is a Decatur silt loam (24 percent sand, 49 percent silt, 28 percent clay). The cotton varieties were treated with fungicide seed treatments by Bayer CropScience. Plots were planted on May 1 with a soil temperature of 22.7°C at a 10 centimeters depth and adequate soil moisture. Plots consisted of 2 rows, 7.6 meters long with 1.0-meter row spacing and were arranged in a randomized complete block design with five replications. Blocks were separated by a 6.1-meter 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 15 days after planting (DAP) and 35 DAP. Plots were harvested on October 8. Data were statistically analyzed using SAS and means compared using Fisher's protected least significant difference test ($P < 0.10$). Monthly average maximum temperatures from planting in April through harvest in October were 22.0, 25.8, 31.4, 30.66, 30.7, 30.1 and 24.2°C with average minimum temperatures of 10.3, 14.5, 19.8, 20.6, 20.2, 17.4 and 9.3°C, respectively. Rainfall accumulation for each month was 12.24, 14.99, 7.72, 27.03, 3.89, 9.23 and 1.98 cm with a total of 77.08 centimeters over the entire season. The rainfall was very dry in May and June but adequate in July. Temperatures did not reach upward of 37.7°C thus this season was cooler than normal in July and early August.

Seedling disease pressure was high in 2013 due to optimum moisture and cool temperatures. Statistically, no interaction occurred between the cotton varieties and fungicides, thus fungicides and varieties are presented separately. Plant stands at 15 and 35 DAP was similar between all fungicides. No significant differences in yield were observed for any of the treatments. When examining the varieties of cotton that was studied, some statistical differences were found. Varieties FM1740B2 and ST4946GL were found to have significantly higher stand counts than FM1944GL. ST4946GL and FM1944GL were higher yielding varieties than FM1740B2. Examination of this data indicates that careful selection of the varieties grown may lead to improved production in fields with high seedling disease pressure.

Fungicide Seed Treatment	Rate	Stand/ 7.62 m row* 15 DAP	Stand/ 7.62m row* 35 DAP	Seed Cotton (kg/A) **
1. GAUCHO 600 FS+VORTEX FL+BAYTAN 30+ALLEGIANCE FL	0.375 mg ai/seed, 2.5 g ai/100 kg, 10g ai/100 kg,15.6 g ai/100 kg	50.3a	38.5a	1727.8a
2. GAUCHO 600 FS+VORTEX FL+BAYTAN 30+ALLEGIANCE FL+L 1946	0.375 mg ai/seed, 2.5 g ai/100 kg, 10g ai/100 kg,15.6 g ai/100 kg, 1 miu/ seed	45.5a	32.9a	1810.7a
3. GAUCHO 600 FS+VORTEX FL+BAYTAN 30+ALLEGIANCE FL+L 1999	0.375 mg ai/seed, 2.5 g ai/100 kg, 10g ai/100 kg,15.6 g ai/100 kg, 1 miu/ seed	44.8a	32.2a	1668.6a
4. GAUCHO 600 FS+VORTEX FL+BAYTAN 30+ALLEGIANCE FL+L 1947	0.375 mg ai/seed, 2.5 g ai/100 kg, 10g ai/100 kg,15.6 g ai/100 kg, 1 miu/ seed	52.0a	37.2a	1788.7a
5. GAUCHO 600 FS+VORTEX FL+BAYTAN 30+ALLEGIANCE FL+TEST COMPOUND 1	0.375 mg ai/seed, 2.5 g ai/100 kg, 10g ai/100 kg,15.6 g ai/100 kg, 1 miu/ seed	48.5a	31.2a	1705.0a
6. GAUCHO 600 FS+VORTEX FL+BAYTAN 30+ALLEGIANCE FL+VOTIVO 240FS	0.375 mg ai/seed, 2.5 g ai/100 kg, 10g ai/100 kg,15.6 g ai/100 kg, 1 miu/ seed	48.7a	33.6a	1706.8a
7. AERIS SEED APPLIED SYSTEM+VORTEX FL+BAYTAN 30+ALLEGIANCE FL	0.375 mg ai/seed, 2.5 g ai/100 kg, 10g ai/100 kg,15.6 g ai/100 kg	51.3a	36.5a	1701.7a
LSD (P < 0.10)		8.67	8.96	451.04
FM1740 B2F		58.2a	37.2a	1610.8b
FM1944GLB2		34.1b	27.2b	1747.6a
ST4946GLB2		53.8a	39.3a	1831.3a

*Stand was the number of seedlings in 7.6 meters of row.
**Means followed by same letter do not significantly differ according to Fisher's LSD test (P < 0.10).

Cotton Seed Treatment Combinations for Fusarium Wilt and Root-Knot Nematode Management in Alabama, 2013

A. Smith, K.S. Lawrence and S. Nightengale

The trial was located at the Plant Breeding Unit near Tallassee, AL on a Kalmia loamy sand (80 percent sand, 10 percent silt, 10 percent clay). The field has a history of a continuous cotton rotation and natural *Fusarium* wilt and root-knot nematode infections. Plots consisted of two rows with 1 meter row spacing, five replications, and rows were 7.6 meters long with 3-meter alleys. Fungicide and insecticide treatments along with fertilizer management practices were applied as necessary according to the Alabama Cooperative Extension System. Plots were irrigated as needed. Seed treatments were applied by Syngenta. Stand counts, phytotoxicity, and vigor ratings were taken May 30. Plant heights, root fresh weights (RFW), shoot fresh weights (SFW), and root-knot nematode egg counts were collected June 18. Root-knot egg counts were obtained from three whole root systems per plot. Disease evaluations and second vigor ratings were taken July 23. Cotton was harvested October 9. Monthly average maximum temperatures from planting in April through harvest in October were 23.7, 26.3, 30.6, 29.7, 30.3, 29.9 and 24.7°C with average minimum temperatures of 10.3, 13.4, 19.9, 20.5, 20.2, 17.3 and 11.1°C, respectively. Rainfall accumulation for each month was 9.65, 5.13, 18.03, 16.36, 13.11, 4.55 and 1.22 cm with a total of 68.05 centimeters over the entire season. Data were analyzed by ANOVA and means compared with Tukey's HSD test using JMP® Pro by SAS Institute, Inc. (P=0.10).

Fusarium wilt disease incidence was measured using visual ratings. Wilt incidence was low in 2013 due to high rainfall early in the season and cooler temperatures throughout the summer. Vigor ratings were similar among all treatments with averages ranging from 2.8-3.2. Stand counts were also similar among all treatments and ranged from 27 to 31 plants per foot of row. Root-knot nematode numbers were very high in 2013. Although no significant differences were found, nematode eggs numbers ranged from a low of 9,576 root knot eggs in seed treatment 3 of Avicta Duo with Cruiser and Dynasty and three experimental compounds to a high of 30,438 eggs in seed treatments 5 of Avicta Duo with Cruiser and Dynasty and four experimentals. Root-knot nematode eggs per gram of fresh root weight had a range of 3,790 for treatment 2 (a combination often used in production by farmers) to 9,325 for treatment 5 of Avicta Duo with Cruiser and Dynasty and four experimentals. Seed cotton yields in kg/ha varied by 534 kg/ha with no significant differences between the treatments. Treatment 6, which was one experimental with all the standard fungicides, insecticides and nematicides, yielded 133 kg/ha more than the industry standard check (treatment 1). Fungicide seed treatments in addition to varietal resistance will be crucial to controlling *Fusarium* wilt and root-knot nematodes in the future, and more work will be done to determine the most effective controlling combination.

Seed treatment and rate	Stand/3m row[xz] 30 DAP	Vigor[y] 30 DAP	Meloido-gyne Incognita Eggs	Meloido-gyne Incog-nita Eggs/g of Root	Seed Cotton Yield (kg/ha)
1. Avicta Duo 4.03 SC 0.49 mgai/seed Cruiser 5 FS 0.035 mgai/seed	90	3	19303	5420	1186
2. Apron Xl 3 LS 7.5 gai/100kgseed Maxim 4 FS 2.5 gai/100kgseed Systhane 40 WP 21 gai/100kgseed Avicta Duo 4.03 SC 0.49 mgai/seed Cruiser 5 FS 0.035 mgai/seed Dynasty CST 125 FS 0.03 mgai/seed	79	3	12889	3790	898
3. STP15142 15 gai/100kgseed A17823 21 gai/100kgseed STP15101 2.5 gai/100kgseed Avicta Duo 4.03 SC 0.49 mgai/seed Cruiser 5 FS 0.035 mgai/seed Dynasty CST 125 FS 0.03 mgai/seed	85	3	9576	4617	785
4. Apron Xl 3 LS 7.5 gai/100kgseed Maxim 4 FS 2.5 gai/100kgseed Systhane 40 WP 21 gai/100kgseed A9625 0.0009 mgai/seed Avicta Duo 4.03 SC 0.49 mgai/seed Cruiser 5 FS 0.035 mgai/seed Dynasty CST 125 FS 0.03 mgai/seed	89	2.8	20542	5322	822
5. STP15142 15 gai/100kgseed A17823 21 gai/100kgseed STP15101 2.5 gai/100kgseed A9625 0.0009 mgai/seed Avicta Duo 4.03 SC 0.49 ‘mgai/seed Cruiser 5 FS 0.035 ‘mgai/seed Dynasty Cst 125 FS 0.03 mgai/seed	92	3.2	30438	9325	1116
6. Apron Xl 3 LS 7.5 gai/100kgseed Maxim 4 FS 2.5 gai/100kgseed Systhane 40 WP 21 gai/100kgseed A9625 0.0018 mgai/seed Avicta Duo 4.03 SC 0.49 mgai/seed Cruiser 5 FS 0.035 mgai/seed Dynasty Cst 125 FS 0.03 mgai/seed	90	3.2	26454	7946	1319

7. Apron Xl 3 LS 7.5 gai/100kgseed Maxim 4 FS 2.5 gai/100kgseed Systhane 40 WP 21 gai/100kgseed A9625 0.0036 mgai/seed Avicta Duo 4.03 SC 0.49 mgai/seed Cruiser 5 FS 0.035 mgai/seed Dynasty Cst 125 FS 0.03 mgai/seed	82	3.2	16540	4959	1114
8. STP15142 15 gai/100kgseed A17823 21 gai/100kgseed STP15101 2.5 gai/100kgseed Avicta Duo 4.03 SC 0.49 mgai/seed Cruiser 5 FS 0.035 mgai/seed STP15142 15 gai/100kgseed STP16191 5 gai/100kgseed	93	3	18406	6192	966

[z]Stand counts represent 7.6 m row of each plot.
[y]Vigor is based on a 5 point scale, with 1 being the worst and 5 being the best.
xData were analyzed by ANOVA and means compared with Tukey's HSD test using JMP® Pro by SAS Institute, Inc. (P=0.10).

V. Nematode Management

Evaluation of Experimental Nematicides for the Management of the Reniform Nematode in North Alabama, 2013

C. J. Land, K.S. Lawrence, C.H. Burmester, and C. .Norris

Eight different nematicide combinations were evaluated for efficacy for control of the reniform nematode. The field has a history of cotton production and is located at the Tennessee Valley Research and Extension Center and the soil is a Decatur silt loam (24 percent sand, 49 percent silt, 28 percent clay). The cotton seed was treated by Bayer CropScience. Plots were planted at a 2.5-centimeter depth and adequate soil moisture was provided from pivot irrigation. Plots consisted of two rows, 7.3 meters long with 1.0-meter row spacing and were arranged in a randomized complete block design with five replications. Blocks were separated by a 6 meter alley. Plots were uniformly maintained with herbicides, insecticides, and fertilizers upon recommendations of the Alabama Cooperative Extension System. Initial reniform nematode numbers were taken with soil probes at the time of planting. Plant stands were recorded and vigor ratings were assigned on a scale of 1-5, with 1 being plants with stunting, chlorosis, and necrosis of the leaves and 5 are plants with a healthy appearance. Eggs per gram of root from three root systems per plot were taken 42 days after planting (DAP). The trial was harvested for seed cotton on October 22. The data was analyzed with JMP Pro 10.0 (SAS Institute), means were compared using pairwise Student's T Test ($\alpha \leq .10$).

Nematode pressure was moderate for the beginning of the season. The average reniform count across the field was 5,778 vermiform life stages per 150 centimeters3 of soil. Treatments had an average stand ranging from 66-73 plants per 7.3-meter row at 33 DAP. After 42 days, total egg counts showed differences among treatments. The Temik 15 G standard had the highest number of eggs, while Treatment 4, the BCS-AR83685 experimental, and Treatment 6, 7 and 8, which are the SP experimental Velum Total at the low, mid, and high rates, had the lowest number of eggs. Differences were observed between yields as well. Treatment 7- Gaucho 600 FS (.19) + SP experimental (4.6) had significantly higher yields than the other seven treatments. Treatment 7 had the ability to increase yields 66 percent compared to the insecticide check of Treatment 1 Gaucho 600 FS (.375). The SP experimental treatments averaged a 398 kilograms per hectare increase over the Gaucho 600 FS control. All treatments significantly increased yields compared to the insecticide check, except for Treatment 5 which was the high rate of the BCS-AR83685 experimental. Treatment 1- Gaucho 600 FS (.375), the check, had the poorest yield. Overall each of the nematicide combinations increased yield in comparison to the Gaucho 600 FS insecticide check.

Treatments [y]	Dose/ Units	42 DAP		
		Total Reniform	**Reniform Eggs per gm of Root**	**Seed Cotton Yeilds (kg/ha)**
1. GAUCHO 600 FS	.375 (mg A/ Seed)	1874 ab [z]	1591.36 ab	473.73 bc
2. TEMIK	841 (g A/ HA)	3893 a	3275.44 a	670.59 ab
3. GAUCHO BCS-AR83685 AERIS SEED APPLIED SYSTEM	.375 (mg A/ Seed) .175 (mg A/ Seed) .75 (mg A/ Seed)	1514 b	1313.28 ab	556.6 abc
4. GAUCHO 600 FS BCS-AR83685	.375 (mg A/ Seed) .263 (mg A/ Seed)	762.24 b	684.98 b	562.31 abc
5. GAUCHO 600 FS BCS-AR83685	.375 (mg A/ Seed) .35 (mg A/ Seed)	1807 ab	1606.82 ab	382.69 c
6. GAUCHO 600 FS SP102000026966 Velum Total	.19 (mg A/ Seed) 321.5 (g A/ HA)	916 b	777.68 b	578.6 abc
7. GAUCHO 600 FS SP102000026966 Velum Total	.19 (mg A/ Seed) 450 (g A/ HA)	1236 b	1096.96 b	786.98 a
8. GAUCHO 600 FS SP102000026966 Velum Total	.19 (mg A/ Seed) 578.7 (g A/ HA)	782 b	762.24 b	652.85 ab

[z] Column numbers followed by the same letter are no significantly different at α = .1 as determined by pairwise Student's T Test
[y] All seeds were treated by Bayer CropScience with additional chemical such as Votex FL, Baytan 30, and Alliance FL.

Experimental Nematicides for Management of the Reniform Nematode in North Alabama, 2013

C. J. Land, K.S. Lawrence, C.H. Burmester and C. Norris

Eight different nematicides combinations were evaluated for control of the reniform nematode. The field has a history of cotton production at the Tennessee Valley Research and Extension Center and the soil is a Decatur silt loam (24 percent sand, 49 percent silt, 28 percent clay). The cotton seed was treated by Bayer Crop Science. Plots were planted at a 2.5-centimeter depth and adequate soil moisture was provided from pivot irrigation. Plots consisted of two rows, 7.3 meters long with 1.0-meter row spacing and were arranged in a randomized complete block design with five replications. Blocks were separated by a 6-meter alley. Plots were uniformly maintained with herbicides, insecticides, and fertilizers upon recommendations of the Alabama Cooperative Extension System. Initial vermiform reniform nematode numbers were taken with soil probes at the time of planting. Plant stands were recorded and vigor ratings were given on a scale of 1-5, with 1 being plants with stunting, chlorosis, and necrosis of the leaves; and 5 being plants with a healthy appearance. Nematodes were collected for nematode analysis by digging up 3 random plants per plot at 42 days after planting (DAP). Nematodes were extracted from the root systems using 6 percent NaOCl and collecting the nematodes on a 25 µm sieve. The trial was harvested for seed cotton on 22 October. The data was analyzed with JMP Pro 10.0 (SAS Institute), means were compared using pairwise Student's T Test ($\alpha \leq .10$).

Nematode pressure was very high for the beginning of the season. The field had an average reniform count of 10,537 vermiform per 150 centimeters3 of soil at planting. Treatments had an average stand ranging from 66-73 plants per 7.3-meter row 34 DAP with no differences between any treatment. After 42 days, total egg counts showed differences among treatments. Treatment 7- Aeris (.75) + BCS-AR83685 (.35) had the lowest number of eggs followed by treatment 3- Gaucho (.375) + BCS-AR83685 (.35). Differences were observed between yields. Treatment 6- Gaucho 600 FS (.375) + BCS-AR83685 (.175) + Poncho/Votivo (.424), treatment 5- Gaucho 600 FS (.375) + BCS-AR83685 (.35) + Poncho/Votivo (.424), and treatment 3- Gaucho 600 FS (.375) + BCS-AR83685 (.35) all had significantly higher yields than the other five treatments. These treatments increased yields 48-45 percent compared to the check. All treatments significantly increased yields compared to the insecticide check, treatment 1- Gaucho 600 FS (.375), which had the poorest yield. Overall, the addition of each nematicide combination increased yield.

Treatment [y]	Dose/ Units	42 DAP		
		Total Reniform [x]	Reniform Eggs per gm of Root	Seed Cotton Yeilds (kg/ha)
1. GAUCHO	.375 (mg A/ Seed)	10511 a	8038.98 ab	274.96 b
2. AERIS SEED APPLIED SYSTEM	.75 (mg A/ Seed)	11598 a	5874 a	388.04 ab
3. GAUCHO BCS-AR83685	.375 (mg A/ Seed) .35 (mg A/ Seed)	1746 bc	1442.36 cd	506.79 a
4. GAUCHO PONCHO/VOTIVO	.375 (mg A/ Seed) .424 (mg A/ Seed)	8183 ab	7327.8 abc	382.74 ab
5. GAUCHO BCS-AR83685 PONCHO/VOTIVO	.375 (mg A/ Seed) .35 (mg A/ Seed) .424 (mg A/ Seed)	3156 bc	2448.75 bcd	514.05 a
6. GAUCHO 600 FS BCS-AR83685 PONCHO/VOTIVO	.375 (mg A/ Seed) .175 (mg A/ Seed) .424 (mg A/ Seed)	3590 bc	781.54 bcd	500.94 a
7. AERIS SEED APPLIED SYSTEM BCS-AR83685	.75 (mg A/ Seed) .35 (mg A/ Seed)	1276	722.35 d	446.51 ab
8. AVICTA COMPLETE PAK - AVICTA AVICTA COMPLETE PAK - CRUISER	.15 (mg A/ Seed) .375 (mg A/ Seed)	3528 bc	1916.76 bcd	381.38 ab

[z] Column numbers followed by the same letter are no significantly different at α = .1 as determined by pairwise Student's T Test
[y] All seeds were treated by Bayer CropScience with additional chemical such as Votex FL, Baytan 30, and Alliance FL.

Soybean Nematicide Combinations for Root knot Management in Alabama, 2013

N. Xiang and K.S. Lawrence

Poncho Votivo, Poncho 600 FS, Gaucho 600 FS, and two experimental compounds were evaluated for the management of cotton root knot nematode on soybean in the field at the Plant Breeding Unit of the E V Smith Research Center near Tallassee, AL. The soil is Kalmia loamy sand (80 percent sand, 10 percent clay, and 10 percent silt). Seed treatments were applied by Bayer Crop Science. BCS-AR83685 was applied on May 7 as an in-furrow application at planting. Seed were sowed on May 7, 2013. Plots consisted of two rows, 7 meters long with 0.9-meter row spacing and were arranged in a randomized complete block design with five replications. Blocks were separated by a 6-meter wide alley. All plots were maintained throughout the season with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Plant stand and vigor were counted and rated at 23 DAP. Nematode numbers were determined by extracting eggs from 3 roots systems per plot at 49 DAP. Plots were harvested on October 18. Data were statistically analyzed by JMP (SAS Institute Inc.) and means compared using Student's t with $P \leq 0.10$. Monthly average maximum temperatures from planting in April through harvest in October were 74.7, 79.4, 87.1, 85.4, 86.5, 85.9 and 76.5°F with average minimum temperatures of 50.6, 56.1, 67.9, 68.9, 68.3, 63.1 and 52.0°F, respectively. Rainfall accumulation for each month was 3.80, 2.02, 7.10, 6.44, 5.16, 1.79 and 0.48 in with a total of 26.79 inches over the entire season.

Root knot disease pressure was ideal for soybean in 2013 with an initial population of 77.4 root knot nematode per plot. The season started and ended with a drought in May and September but rainfall was more than normal the end of June through August. Temperatures did not reach the 100's thus this season which was cooler than normal. Plant stand and plant vigor were similar among all the treatments at 23 DAP. Root knot nematode total egg numbers and numbers of eggs per gram of root were significantly reduced by Poncho 600 FS 0.11 mg ai/seed + BCS-AR83685 3.57 oz ai/a (Trt 8) at 49 DAP compared to Poncho Votivo 0.13 mg ai/seed + USF0738 0.0375 mg ai/seed (Trt 4). Seed soybean yields were not different and varied by 7.8 bushels per acre across all treatments. Poncho 600 FS 0.11 milligrams ai/seed + BCS-AR83685 3.57 ounces ai/a (Trt 8) which reduced nematode numbers ranked second following Poncho Votivo 0.13 mg ai/seed + USF0738 0.075 milligrams ai/seed (Trt 3) for seed yield.

Treatment[z]	Rate	23 DAP Stand[y]	23 DAP Vigor[x]	*Meloidogyne incognita* (49 DAP) Eggs/3 root systems	*Meloidogyne incognita* (49 DAP) Eggs/g root	Soybean Yield bu/ac
1. Poncho Votivo	0.13 mg ai/seed	28.0	2.8	15885.0 ab[w]	1208.0 ab	54.3
2. Poncho Votivo USF0738	0.13 mg ai/seed 0.15 mg ai/seed	31.7	3.0	10069.0 b	670.0 ab	55.6
3. Poncho Votivo USF0738	0.13 mg ai/seed 0.075 mg ai/seed	31.5	3.0	8434.0 b	542.0 ab	57.9
4. Poncho Votivo USF0738	0.13 mg ai/seed 0.0375 mg ai/seed	26.4	3.0	24160.0 a	1459.0 a	54.5
5. Poncho 600 FS	0.11 mg ai/seed	28.1	3.0	11418.0 ab	769.0 ab	52.5
6. Poncho 600 FS USF0738	0.11 mg ai/seed 0.15 mg ai/seed	31.2	3.0	9819.0 b	695.0 ab	50.1
7. Gaucho 600 FS USF0738	0.101 mg ai/seed 0.15 mg ai/seed	27.3	3.0	12163.0 ab	779.0 ab	54.1
8. Poncho 600 FS BCS-AR83685	0.11 mg ai/seed 3.57 oz ai/a	31.9	3.0	6061.0 b	367.0 b	56.1

wNematicide treatments included a base fungicide application of 0.019 mg ai/seed of Evergol Energy and 0.02 mg ai/seed of Allegiance FL.
zStand was the number of seedlings per 5 ft of row.
xMeans followed by same letter do not significantly differ according to Student's t test (P≤0.10).
yVigor ratings from 1 to 5 with 5 being the best and 1 the worst.

Soybean Nematicide Combinations for Reniform Nematode Management in North Alabama, 2013

N. Xiang, K.S. Lawrence and C. Norris

Poncho Votivo, Poncho 600 FS, Gaucho 600 FS, and two experimental compounds were evaluated for the management of reniform nematode on soybean in the field at Tennessee Valley Research and Education Center of Belle Mina, AL. The soil is Decatur silt loam (24 percent sand, 28 percent clay, and 49 percent silt). Seed treatments were applied by Bayer Crop Science. BCS-AR83685 was applied as an in-furrow application at planting. Seed were sowed in the field on May 21, 2013. Plots consisted of two rows, 7.3 meters long with 1.0-meter row spacing and were arranged in a randomized complete block design with five replications. All plots were maintained throughout the season with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Plant stand and vigor were counted and rated at 14 DAP. Nematode numbers were determined by extracting eggs from 3 roots systems per plot at 42 DAP. Plots were harvested on 23 Oct. Data were statistically analyzed by JMP (SAS Institute Inc.) and means compared using Student's t with $P \leq 0.10$. Monthly average maximum temperatures from planting in April through harvest in October were 71.6, 78.5, 88.6, 87.0, 87.2, 86.2 and 75.6°F with average minimum temperatures of 50.5, 58.1, 67.7, 69.1, 68.3, 63.3 and 48.8°F, respectively. Rainfall accumulation for each month was 4.82, 5.90, 3.04, 10.64, 1.53, 3.75 and 0.78 in with a total of 30.46 in over the entire season.

Reniform disease pressure was ideal for soybean in 2013 with an initial population of 2,513 reniform nematode per 150 centimeters3 of soil. The rainfall was adequate in May and July but became limited through the remainder of the season. Temperatures did not reach the 100's thus this season and was cooler than normal. Plant stand was similar among all the treatments ranging from 25 to 29 plants per 5 feet of row at 14 DAP. Seedling vigor was significantly increased by Poncho Votivo 0.13 milligrams ai/seed + USF0738 0.0375 mg ai/seed (Trt 4) and Poncho 600 FS 0.11 mg ai/seed+ BCS-ARS3685 3.57 ounces ai/a (Treatment 8). Reniform nematode total egg numbers and eggs per gram of root were similar among all the treatments at 42 DAP, although Poncho 600 FS 0.11 mg ai/seed+ BCS-ARS3685 3.57 ounces ai/a (Treatment 8) supported the fewest. Differences in seed soybean yield varied by 9.3 bushels per acre, but were not significantly different. Ranking the treatments indicated Poncho 600 FS 0.11 mg ai/seed (Treatment 5) had very high number of eggs on the root, but produced the greatest yield in the test. Poncho 600 FS 0.11 mg ai/seed+ BCS-

ARS3685 3.57 ounces ai/a (Treatment 8) which supported the fewest nematode numbers produced lowest seed yield which was ranked eighth among all the eight treatments.

		23 DAP			*Rotylenchulus reniformis* **(49 DAP)**		
Treatment[z]	**Rate**	**Stand**[x]	**Vigor**[y]		**Eggs/3 root systems**	**Eggs/g root**	**Soybean Yield bu/ac**
1. Poncho Votivo	0.13 mg ai/seed	28.6	3.0 b [x]		5057.1	370.1	52.1
2. Poncho Votivo USF0738	0.13 mg ai/seed 0.15 mg ai/seed	27.4	3.0 b		4790.5	368.8	51.4
3. Poncho Votivo USF0738	0.13 mg ai/seed 0.075 mg ai/seed	26.8	3.0 b		4621.8	288.7	56.2
4. Poncho Votivo USF0738	0.13 mg ai/seed 0.0375 mg ai/seed	25.2	3.4 a		3712.8	345.9	55.2
5. Poncho 600 FS	0.11 mg ai/seed	27.4	3.0 b		5151.4	335.6	57.2
6. Poncho 600 FS USF0738	0.11 mg ai/seed 0.15 mg ai/seed	28.4	3.0 b		4057.6	245.8	54.1
7. Gaucho 600 FS USF0738	0.101 mg ai/seed 0.15 mg ai/seed	27.0	3.0 b		3676.5	246.5	52.0
8. Poncho 600 FS BCS-AR83685	0.11 mg ai/seed 3.57 oz ai/a	25.2	3.4 a	–	3639.9	180.8	47.9

[y]Stand was the number of seedlings in 5 feet of row.
[x]Vigor ratings of the plants per plot from 1 to 5 with 5 being the best and 1 the worst.
[z]Nematicide treatments included a base fungicide application of 0.019 mg ai/seed of Evergol Energy and 0.02 mg ai/seed of Allegiance FL.
[w]Means followed by same letter do not significantly differ according to Student's t test (P≤0.10).

Cotton Variety and Nematicide Combinations for Reniform Management in North Alabama, 2013

K.S. Lawrence, C. J. Land, R. B. Sikkens, C.H. Burmester and C. Norris

Six nematicide combinations were evaluated for reniform nematode management on two cotton varieties. The field site is located on the Tennessee Valley Research Center near Belle Mina, AL. This field has been cultivated in cotton for over 15 years and was inoculated infested with the reniform nematode in 1997. The soil is a Decatur silt loam (24 percent sand, 49 percent silt, 28 percent clay). The cotton varieties were treated with nematicide seed treatments by Bayer CropScience. Temik 15 G was applied at planting with granular hoppers attached to the planter. Vydate CLV was applied as a foliar spray at the 6 to 8 leaf stage using a CO2-charged backpack sprayer. Plots were planted on 1 May with a soil temperature of 22.7°C at a 10 centimeters depth and adequate soil moisture. Plots consisted of two rows, 7.6 meters long with 1.0-meter row spacing and were arranged in a randomized complete block design with five replications. Blocks were separated by a 6.1m 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.

Seedling stand was determined at 34 days after planting (DAP) on May 31. Nematodes were collected for nematode analysis by digging up three random plants per plot on 11 June. Nematodes were extracted from the root systems using 6 percent NaOCl and collecting the nematodes on a 25 µm sieve. Plots were harvested on October 22. Data were statistically analyzed using SAS and means compared using Fisher's protected least significant difference test ($P < 0.10$). Monthly average maximum temperatures from planting in April through harvest in October were 22.0, 25.8, 31.4, 30.66, 30.7, 30.1 and 24.2°C with average minimum temperatures of 10.3, 14.5, 19.8, 20.6, 20.2, 17.4 and 9.3°C, respectively. Rainfall accumulation for each month was 12.24, 14.99, 7.72, 27.03, 3.89, 9.23 and 1.98 centimeters with a total of 77.08 centimeters over the entire season. The rainfall was very dry in May and June but adequate in July. Plots were irrigated with a sprinkler system as needed. Temperatures did not reach 38 C this season and soil temperatures were 4 °C lower in July and early August than 2012.

Reniform nematode disease pressure was high for irrigated cotton in 2013. Statistically, no interactions occurred between the cotton varieties and nematicides, however all the data are presented for comparisons. Plant stand at 34 DAP was similar for all varieties and nematicides with an average of 12 plants per meter of row. All stands were within the optimal rage of 4 to 12 plants per meter of row. FM 1740 B2F supported the greatest stand compared to the ST 4946 GLB2 variety. The Temik 15 G treatments had the greatest number of seedlings compared to Aeris and the Poncho/Votivo Aeris seed treatment combinations. Reniform nematode population densities were very high at 41

DAP. FM 1740 B2F supported greater numbers of nematodes per gram of root than did ST 4946GLB2. The nematicide treatments including Temik 15 G (2 and 6) the Aeris plus Fluopytam seed treatment (5) reduced the reniform density compared to the Velum Total + Poncho/Votivo + Aeris (3). Seed cotton yield was significantly greater in the ST 4946GLB2 variety compared to the FM1740B2F. Yields were also greater in the Temik 15G alone and with Vydate CLV foliar nematicide spray and for the Aeris seed treatment plus Fluopytam (5) as compared to the Gaucho seed treatment (1). This yield increase was equal to 217 kilograms per hectare of lint cotton. ST 4946 GLB2 was more tolerant to the reniform nematode supporting an increase of 576 kilograms per hectare increase in yield compare to FM 1740 B2RF. Ranking the nematicides indicated that Temik 15G with or without Vydate CLV and the seed treatments Aeris plus Fluopytam produced similar seed cotton yields in both varieties.

Cotton Variety	Seed Treatment and Rate	Stand (plants/ 7.6 m row*) 30 DAP	*Rotylenchulus reniformis* 3 plants	*Rotylenchulus reniformis* gm/root	Seed Cotton Yield (kg/ha)
ST 4946GLB2	1. Gaucho 600 (0.5 mg ai/seed)	63.4	7154	8402	953.6
ST 4946GLB2	2. Temik 15 G 0.9 kg/ha	70.2	5382	6570	1498.5
ST 4946GLB2	3. Velum Total + Poncho (0.424 mg ai/seed)/ Votivo + Aeris (0.75 mg ai/seed)	66.8	6273	7534	1225.0
ST 4946GLB2	4. Aeris (0.75 mg ai/seed)	71.4	8101	8386	1309.4
ST 4946GLB2	5. Aeris (0.75 mg ai/seed) + Fluopytam	70.2	2869	2396	1560.8
ST 4946GLB2	6. Temik 15 G 0.9 kg/ha + Vydate 0.2 l/ha	66.0	5706	5257	1699.1
FM 1740 B2F	1. Gaucho 600 (0.5 mg ai/seed)	70.4	5732	8459	823.7
FM 1740 B2F	2. Temik 15 G 0.9 kg/ha	68.4	7946	10015	1132.0
FM 1740 B2F	3. Velum Total + Poncho (0.424 mg ai/seed)/ Votivo + Aeris (0.75 mg ai/seed)	74.2	7905	10761	1048.6
FM 1740 B2F	4. Aeris (0.75 mg ai/seed)	72.4	7159	10604	1024.3
FM 1740 B2F	5. Aeris (0.75 mg ai/seed) + Fluopytam	80.0	3677	3610	1110.9
FM 1740 B2F	6. Temik 15 G 0.9 kg/ha + Vydate 0.2 l/ha	74.2	9198	10319	1165.8
LSD (P < 0.10)		7.08	4004.9	5515.5	268.56
	1. Gaucho 600 (0.5 mg ai/seed)	63.7	4815 b	7777 ab	888.7 b
	2. Temik 15 G 0.9 kg/ha	69.7	5915 b	7719 ab	1315.3 a
	3. Velum Total + Poncho (0.424 mg ai/seed) /Votivo + Aeris (0.75 mg ai/seed)	72.7	9834 a	10647 a	1136.8 b
	4. Aeris (0.75 mg ai/seed)	74.4	6891 b	8150 ab	1166.9 ab
	5. Aeris (0.75 mg ai/seed) + Fluopytam	73.5	5781 b	6611 b	1335.9 a
	6. Temik 15 G 0.9 kg/ha + Vydate 0.2 l/ha	69.8	5915 b	5253 b	1432.5 a
LSD (P < 0.10)		4.85	2693.6	3708.5	269.01
ST 4946GLB2		66.7 b	5933.0	6424 b	1501 a
FM 1740 B2F		74.5 a	6917.4	8961 a	925 b
LSD (P < 0.10)		2.79	1555.1	2177.3	185.31

Cotton Variety and Nematicide Combinations for Root-knot Management in Central Alabama, 2013

K.S. Lawrence, C. J. Land, and R. B. Sikkens

Six nematicide combinations were evaluated for root-knot nematode management on two cotton varieties. The field site is located on the Plant Breeding unit of the E. V. Smith Research Center near Tallassee, AL. This field has been cultivated in cotton for over 15 years and was infested with the root knot. The soil is a Kalmia loamy sand (80 percent sand, 10 percent silt, 10 percent clay). The cotton varieties were treated with nematicide seed treatments by Bayer CropScience. Temik 15 G was applied at planting with granular hoppers attached to the planter. Vydate CLV was applied as a foliar spray at the six to eight leaf stage using a CO2 charged backpack sprayer. Plots were planted on May 8 with a soil temperature of 22.7°C at a 10 centimeter depth and adequate soil moisture. Plots consisted of two rows, 7.6 meter long with 1.0-meter row spacing and were arranged in a randomized complete block design with five replications. Blocks were separated by a 6.1-meter 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 34 days after planting (DAP) on 30 May. Nematodes were collected for nematode analysis by digging up three random plants per plot on 18 June. Nematodes were extracted from the root systems using 6 percent NaOCl and collecting the nematodes on a 25 µm sieve. Plots were harvested on October 9. Data were statistically analyzed using SAS and means compared using Fisher's protected least significant difference test ($P < 0.10$). No interactions were observed between variety and nematicides, although all data are presented for multiple comparisons. Monthly average maximum temperatures from planting in April through harvest in October were 23.7, 26.3, 30.6, 29.7, 30.3, 29.9 and 24.7°C with average minimum temperatures of 10.3, 13.4, 19.9, 20.5, 20.2, 17.3 and 11.1°C, respectively. Rainfall accumulation for each month was 9.65, 5.13, 18.03, 16.36, 13.11, 4.55 and 1.22 centimeters with a total of 68.05 centimeters over the entire season.

Root knot nematode disease pressure was high for irrigated cotton in 2013. Statistically, no interactions occurred between the cotton varieties and nematicides, however all the data are presented for comparisons. Plant stand at 21 DAP was similar for all varieties and nematicides with an average of 11.3 plants per meter of row. ST 4946GLB2 supported the greatest stand compared to FM 1740 B2F and nematicide did not affect seedling stand as compared to the Gaucho insecticide control. Although all stands were within the optimal rage of four to twelve plants per meter of row. Root knot population densities were high at 40 DAP. FM 1740 B2F supported greater numbers of nematodes per gram of root than ST 4946GLB2. Temik 15G nematicide treatments reduced the root knot density compared to the Gaucho control. The Aeris seed treatment plus the Fluopytam reduced root- knot densities on ST 4946GLB2 but not on FM1740B2F. Seed cotton yield was significantly greater in the ST 4946GLB2 variety compared to the FM1740B2F. Yields were also greater in the Temik 15G alone and with Vydate CLV foliar nematicide spray compared to the Gaucho seed treatment. This yield increase was equal to 728 kg/ha of lint cotton. Interestingly, ST 4946GLB2 and FM1740B2F both responded to the nematicides with an average increase of 634 and 1,104 kilograms per hectare increase, respectively, in seed cotton over all four nematicide treatments compared to the Gaucho control. Ranking the nematicides indicated that Temik 15G with or without Vydate CLV and the seed treatments Aeris with Fluopytam produced similar seed cotton yields in ST 4946GLB2 but not FM1740B2F.

		Stand (plants/ 7.6 m row*)	*Meloidogyne incognita*		
Cotton Variety	**Seed Treatment and Rate**	**30 DAP**	**3 plants**	**gm/root**	**Seed Cotton Yield (kg/ha)**
ST 4946GLB2	1. Gaucho 600 (0.5 mg ai/seed)	85	2227 ab	451	1846.9 ab
ST 4946GLB2	2. Temik 15 G 0.9 kg/ha	83	468 b	77	2480.0 a
ST 4946GLB2	3. Velem Total + Poncho /Votivo (0.424 mg ai seed) + Aeris (0.75 mg ai/seed) +Vydate (0.2 l/ha	83	3341 a	654	2108.3 ab
ST 4946GLB2	4. Aeris (0.75 mg ai/seed)	87	1393 ab	264	1910.8 ab
ST 4946GLB2	5. Aeris (0.75 mg ai/seed) + Fluopytam	89	591 b	115	1864.4 ab
ST 4946GLB2	6. Temik 15 G 0.9 kg/ha + Vydate 0.2 l/ha	83	155 b	40	2334.8 a
FM 1740 B2F	1. Gaucho 600 (0.5 mg ai/seed)	84	6662 a	1833 a	1341.6 b
FM 1740 B2F	2. Temik 15 G 0.9 kg/ha	89	437 b	94	2445.2 a
FM 1740 B2F	3. Velem Total + Poncho /Votivo (0.424 mg ai seed) + Aeris (0.75 mg ai/seed) +Vydate (0.2 l/ha)	89	4392 a	1033	1736.6 ab
FM 1740 B2F	4. Aeris (0.75 mg ai/seed)	85	4553 a	1036	1318.4 b

FM 1740 B2F	5. Aeris (0.75 mg ai/seed) + Fluopytam	87	4246 a	1112	1423.0 b
FM 1740 B2F	6. Temik 15 G 0.9 kg/ha + Vydate 0.2 l/ha	82	1729 ab	310	2027.0 ab
LSD (P < 0.10)…		5.8	13779	2452.5	503.8
	1. Gaucho 600 (0.5 mg ai/seed)	84.5 ab	4444 a	1142 a	1594.3
	2. Temik 15 G 0.9 kg/ha	86.0 ab	452	86	2462.6
	3. Velem Total + Poncho /Votivo (0.424 mg ai seed) + Aeris (0.75 mg ai/seed) +Vydate (0.2 l/ha)	86.0 ab	3866 ab	844	1922.5
	4. Aeris (0.75 mg ai/seed)	86.0 ab	3271 ab	715	1717.2
	5. Aeris (0.75 mg ai/seed) + Fluopytam	88.0 a	2419	614	1643.7
	6. Temik 15 G 0.9 kg/ha + Vydate 0.2 l/ha	82.5 b	942	175	2180.9
LSD (P < 0.10)…		4.95	3494.8	1693.1	355.71
ST 4946GLB2		85 a	1362.5b	266.8 b	2090.9 a
FM 1740 B2F		74 b	3146.4 a	775.0 a	1471.5 b
LSD (P < 0.10)…		2.86	5481.8	977.8	205.37

New Nematicide Evaluations with Vydate C-LV for Reniform Management in North Alabama, 2013

K.S. Lawrence, C. J. Land, R. B. Sikkens, C.H. Burmester and C. Norris

Six experimental nematicide in-furrow combinations were evaluated for reniform nematode management. The field site is located on the Tennessee Valley Research Center near Belle Mina, AL. This field has been cultivated in cotton for over 15 years and was infested with the reniform nematode in 1997. The soil is a Decatur silt loam (24 percent sand, 49 percent silt, 28 percent clay). The in furrow spray application went out at planting through two 8003 flat fan nozzles adjusted to 45 degrees over the row. Vydate C-LV and the experimental Q compound were applied as a foliar spray at the 6 to 8 leaf stage using a CO2 charged backpack sprayer. Plots were planted on May 1 with a soil temperature of 68°F at a 4-inch depth and adequate soil moisture. 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 34 days after planting (DAP) on June 4. Nematodes were collected for nematode analysis by digging up 3 random plants per plot on June 11. Nematodes were extracted from the root systems using 6 percent NaOCl and collecting the nematodes on a 25 µm sieve. Plots were harvested on October 22. Data were statistically analyzed using SAS and means compared using Fisher's protected least significant difference test ($P < 0.10$). Monthly average maximum temperatures from planting in April through harvest in October were 71.6, 78.5, 88.6, 87.0, 87.2, 86.2 and 75.6°F with average minimum temperatures of 50.5, 58.1, 67.7, 69.1, 68.3, 63.3 and 48.8°F, respectively. Rainfall accumulation for each month was 4.82, 5.90, 3.04, 10.64, 1.53, 3.75 and 0.78 in with a total of 30.46 in over the entire season. The rainfall was adequate in July but very dry in May and June. Temperatures did not reach the 100's thus this season was cooler in July and early August than our normal averages.

Reniform nematode disease pressure was high for irrigated cotton in 2013. The reniform nematode density at planting averaged 3,553 vermiform life stages per 150 centimeters3 of soil. Plant stand at 34 DAP were similar however, the single 1-quart application reduced stand compared to the 1-pint application. Although all stands were within the optimal range of one to three plants per foot of row. Reniform population densities were very high at 41 DAP. All the experimental nematicide treatments applied at 1 pint or 1 quart reduced reniform numbers compared to the untreated control. The average reduction was 62 percent. The reniform number per gram of root followed similar patterns. The 1 quart rate consistently reduced reniform numbers by 85 percent as compared to the control. Seed cotton yield varied by 746 pounds per acre between treatments although none were significantly different at the (P < 0.10) level. The 1-quart rate averaged an increase of 685 pounds per acre while the 1-pint rate increased yield 309 pounds per acre.

		Rotylenchulus reniformis		
Nematicide, Rate, and Applications	**Stand**[x]	**3 Plants**	**gm/root**	**Seed Cotton**[y] **(kg/ha)**
1. Experimental 1 pt/a in furrow	69.4 a	3362.6 b	1743.1 ab	1569.2 ab
2. Experimental 1 qt/a in furrow	56.0 b	2638.1 b	1019.1 b	1954.7 a
3. Experimental 1 pt/a in furrow + 1 pt/a foliar spray[z]	63.6 ab	3059.5 b	1164.6 b	1638.9 ab
4. Experimental 1 pt/a in furrow + Vydate C-LV 17 oz/A foliar spray[z]	61.6 ab	4854.9 a	2666.5 ab	1344.3 ab
5. Experimental 1 qt/a in furrow + Vydate C-LV 17 oz/A foliar spray[z]	62.6 ab	2613.7 b	1108.0 b	1779.4 ab
6. Vydate C-LV 17 oz/A foliar spray[z]	58.6 ab	9311.7 a	7107.5 a	1385.5 ab
7. Untreated control	59.6 ab	8474.4 a	7138.6 a	1208.1b
LSD (P < 0.10)	7.26	4004.9	5515.5	678.9

[x] Stand was the number of seedlings in 25 foot of row.
[y] Means followed by same letter do not significantly differ according to Fishers LSD test (P < 0.10).
[z] Foliar application at the 6 to 8 cotton leaf stage.

New Nematicide Evaluations with Vydate C-LV for Reniform Management in Central Alabama, 2013

K.S. Lawrence, C. J. Land and R. B. Sikkens

Six nematicide combinations were evaluated for root-knot nematode management. The field site is located on the Plant Breeding unit of the E. V. Smith Research Center near Tallassee, AL. This field has been cultivated in cotton for over 15 years and was infested with the root knot. The soil is a Kalmia loamy sand (80 percent sand, 10 percent silt, 10 percent clay). The in-furrow spray application was made at planting through two 8003 flat fan nozzles adjusted at 45 degrees over the row. Vydate C-LV and the experimental compound were applied as a foliar spray at the 6 to 8 leaf stage using a CO2 charged backpack sprayer. Plots were planted on May 8 with a soil temperature of 65F at a 4 inch depth and adequate soil moisture. Plots consisted of two rows, 25 feet long with 36-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 34 days after planting (DAP) on May 30. Nematodes were collected for nematode analysis by digging up 3 random plants per plot on June 18. Nematodes were extracted from the root systems using 6 percent NaOCl and collecting the nematodes on a 25 µm sieve. Plots were harvested on October 9. Data were statistically analyzed using SAS and means compared using Fisher's protected least significant difference test ($P < 0.10$). No interactions were observed between variety and nematicides, although all data are presented for multiple comparisons. Monthly average maximum temperatures from planting in April through harvest in October were 74.7, 79.4, 87.1, 85.4, 86.5, 85.9 and 76.5°F with average minimum temperatures of 50.6, 56.1, 67.9, 68.9, 68.3, 63.1 and 52.0°F, respectively. Rainfall accumulation for each month was 3.80, 2.02, 7.10, 6.44, 5.16, 1.79 and 0.48 in with a total of 26.79 inches over the entire season.

Root knot nematode disease pressure was high for irrigated cotton in 2013. The root knot nematode density at planting averaged 160 J2's per 150 centimeters3 of soil. Plant stand at 21 DAP were similar between all treatments and stands were within the optimal rage of 1 to 3 plants per foot of row. Root knot population densities were very high at 42 DAP. All the experimental nematicide treatments applied at 1 pint or 1 quart reduced root knot numbers 42 and 65 percent, respectively compared to the untreated control. The root knot number per gram of root followed similar patterns. The 1 quart rate consistently reduced root-knot numbers by 74 percent as compared to the control. Seed cotton yield varied by 740 pounds per acre between treatments although none were significantly different at the (P < 0.10) level. The 1 quart rate averaged an increase of 655 pounds per acre while the 1 pint rate increased yield 472 pounds per acre.

	Meloidogyne incognita			
Nematicide, Rate, and Applications	**Stand**[x]	**3 Plants**	**gm/root**	**Seed Cotton**[y] **(kg/ha)**
1. Experimental 1 pt/a in furrow	82.8	19379 c	3373 cd	2740
2. Experimental 1 qt/a in furrow	83.2	29849 bc	3893 cd	3150
3. Experimental 1 pt/a in furrow + 1 pt/a foliar spray[z]	90.6	43358 abc	6736 bcd	2935
4. Experimental 1 pt/a in furrow + Vydate C-LV 17 oz/A foliar spray[z]	84.6	60169 a	8791 ab	2973
5. Experimental 1 qt/a in furrow + Vydate C-LV 17 oz/A foliar sprayz	92.8	19627 c	2999 d	2981
6. Vydate C-LV 17 oz/A foliar sprayz	84.0	53335 ab	8354 bc	2450
7. Untreated control	89.4	70699 a	13500 a	2410
LSD (P < 0.10)	8.17	30338.0	4991.3	642.2

[x] Stand was the number of seedlings in 25 foot of row.
[y] Means followed by same letter do not significantly differ according to Fishers LSD test (P < 0.10).
[z] Foliar application at the 6 to 8 cotton leaf stage.

Experimental Biologicals Management of the Reniform Nematode in North Alabama, 2013

C.J. Land, K.S. Lawrence, C.H. Burmester and C. Norris

Four different biological experimental nematicides were evaluated for efficacy for control of the reniform nematode. The field has a history of cotton production at the Tennessee Valley Research and Extension Center and the soil is a Decatur silt loam (24 percent sand, 49 percent silt, 28 percent clay). The cotton seed was treated by Bayer CropScience. Plots were planted at a 2.5 centimeter depth and adequate soil moisture was provided from pivot irrigation. Plots consisted of two rows, 7.3 meters long with 1.0 meter row spacing and were arranged in a randomized complete block design with five replications. Blocks were separated by a 6 meter alley. Plots were uniformly maintained with herbicides, insecticides, and fertilizers upon recommendations of the Alabama Cooperative Extension System. Initial reniform nematode numbers were taken from 150 centimeters3 soil samples taken at the time of planting. The average number of reniform across the field was 8,604 vermiform per 150 centimeters3. Plant stands were recorded and vigor ratings were given on a scale of 1-5, with 1 being plants with stunting, chlorosis, and necrosis of the leaves and 5 are plants with a healthy appearance. Nematodes were collected for analysis by digging up three random plants per plot at 42 days after planting (DAP). Nematodes were extracted from the root systems using 6 percent NaOCl and collecting the nematodes on a 25 µm sieve. The trial was harvested for seed cotton on October 22. The data was analyzed with JMP Pro 10.0 (SAS Institute), means were compared using pairwise Student's T Test ($\alpha \leq .10$).

Nematode pressure was very good for the beginning of the season. Treatments had an average stand ranging from 47-55 plants per 7.3-meter row at 33 DAP. After 42 days, eggs per gram of root counts were very high and showed no statistical differences among treatments. Differences were observed between yields. Treatment 4- Gaucho 600 FS (.375) + L1946 (1) had significantly higher yields than the other six treatments. Treatment 4 had the ability to increase yields 37 percent compared to the insecticide check treatment 1 - Gaucho 600 FS (.375). All treatments significantly increased yields compared to the check, except for treatment 7- which yielded similarly to the check. Overall each of the nematicide combinations increased yield under high nematode pressure.

Treatments [y]	Dose/ Unit	42 DAP		Seed Cotton Yield (kg/ha)
		Total Reniform	Reniform Eggs per gm of Root	
1. GAUCHO 600 FS	.375 (mg A/ Seed)	3553 a [z]	3110.62 a	532.65 b
2. AERIS SEED APPLIED SYSTEM	.375 (mg A/ Seed)	2796 a	2611.06 a	602.55 ab
3. GAUCHO 600 FS L1946	.375 (mg A/ Seed) 1 (miu /seed)	4501 a	4094.26 a	562.81 ab
4. GAUCHO 600 FS L1999	.375 (mg A/ Seed) 1 (miu /seed)	5083 a	4413.58 a	733.32 a
5. GAUCHO 600 FS L1947	.375 (mg A/ Seed) 1 (miu /seed)	5289 a	4676.20 a	552.74 ab
6. GAUCHO 600 FS Votivo 240FS	.375 (mg A/ Seed) 1 (miu /seed)	5078 a	4707.12 a	577.19 ab
7. AERIS SEED APPLIED SYSTEM L1946	.375 (mg A/ Seed) 1 (miu /seed)	4661 a	4161.22 a	519.22 b

[z] Column numbers followed by the same letter are not significantly different at $\alpha = .1$ as determined by pairwise Student's T Test

[y] All seeds were treated by Bayer CropScience with additional chemical such as Votex FL, Baytan 30, and Alliance FL.

Efficacy of Experimental Biological Management of the Root Knot Nematode in Alabama, 2013

C.J. Land, K.S. Lawrence and S. Nightengale

Four different biological experimental nematicides were evaluated for efficacy against the root knot nematode. The field has a history of cotton production at the Plant Breeding Unit at the E.V. Smith research Center and the soil is a Kalmia loamy sand (80 percent sand, 10 percent silt, 10 percent clay). The cotton seed was treated by Bayer CropScience. Plots were planted at a 2.5 centimeters. depth and adequate soil moisture was provided from pivot irrigation. Plots consisted of two rows, 7.3 meters long with 1.016-meter row spacing and were arranged in a randomized complete block design with five replications. Blocks were separated by a 6 meter alley. Plots were uniformly maintained with herbicides, insecticides, and fertilizers upon recommendations of the Alabama Cooperative Extension System. . Initial root knot nematode numbers were taken from 150 cm3 soil samples taken at the time of planting. The average number of root knot across the field was 82.4 second stage juveniles per 150 centimeters3. Plant stands were recorded and vigor ratings were given on a scale of 1-5, with 1 being plants with stunting, chlorosis, and necrosis of the leaves and 5 are plants with a healthy appearance. Nematodes were collected for analysis by digging up three random plants per plot at 41 days after planting (DAP). Nematodes were extracted from the root systems using 6 percent NaOCl and collecting the nematodes on a 25 µm sieve. The trial was harvested for seed cotton on October 22. The data was analyzed with JMP Pro 10.0 (SAS Institute), means were compared using pairwise Student's T Test ($\alpha \leq .10$).

Nematode pressure was very good for the beginning of the season. Initial root knot population oat planting was J2's per 105 centimeters^3 of soil. Treatments had an average stand ranging from 74-87 plants per 7.3 meter row, 23 DAP with no differences between any treatments. After 41 days, total egg counts indicated statistical differences among treatments. All treatments significantly reduced egg numbers in comparison to the insecticide check, which had the highest egg counts. The check, treatment 1- Gaucho 600 FS (.375) had the highest number of total eggs while treatment 5- Gaucho 600 FS (.375) + L1946 (1) and treatment 7- Aeris (.375) + L1946 (1) had the lowest amount of eggs. Differences were observed between yields. Treatment 6- Gaucho 600 FS (.375) + Votivo (1) had significantly higher yields than the other six treatments. Treatment 5- Gaucho 600 FS (.375) + L1946 (1) produced the lowest amount of seed cotton in comparison to the other six treatments. Overall each of the nematicide combinations increased yield under high nematode pressure.

Treatments [y]	Dose/ Unit	41 DAP Rootknot Eggs per gm of Root	Seed Cotton Yield (kg/ha)
1. GAUCHO 600 FS	.375 (mg A/ Seed)	4372.6 a [z]	1272.46 ab
2. AERIS SEED APPLIED SYSTEM	.375 (mg A/ Seed)	2585.6 ab	1188.13 ab
3. GAUCHO 600 FS L1946	.375 (mg A/ Seed) 1 (miu /seed)	2472.2 ab	1243.47 ab
4. GAUCHO 600 FS L1999	.375 (mg A/ Seed) 1 (miu /seed)	973.5 ab	1277.72 ab
5. GAUCHO 600 FS L1947	.375 (mg A/ Seed) 1 (miu /seed)	587.4 b	1082.77 b
6. GAUCHO 600 FS Votivo 240FS	.375 (mg A/ Seed) 1 (miu /seed)	2410.4 ab	1354.1 a
7. AERIS SEED APPLIED SYSTEM L1946	.375 (mg A/ Seed) 1 (miu /seed)	376.2 b	1246.1 ab

[z] Column numbers followed by the same letter are not significantly different at α = .1 as determined by pairwise Student's T Test

[y] All seeds were treated by Bayer CropScience with additional chemical such as Votex FL, Baytan 30, and Alliance FL.

VI. Insect Management

Managing Early Season Thrips In Seedling Cotton In 2013

Ron Smith and Tim Reed

Materials and Methods: During 2013 studies were conducted at the Prattville Agricultural Research Unit (non-irrigated) and the Wiregrass Research and Extension Center at Headland (irrigated) to: (1) evaluate the impact of different seed treatments and in-furrow liquid insecticides on thrips damage to seedling cotton and yields and (2) evaluate the impact of two foliar insecticides applied at first true leaf following at- plant seed treatments on thrips damage to seedling cotton and yields. Specific treatments employed in all tests along with key measured variables are presented in Tables 1 and 2. Plant biomass was measured by cutting five random plants (from border rows) per plot at soil level and pooling the sample into a labeled paper bag. Plants were collected 43 to 49 days after planting. Samples were then air dried in a forced air oven at 60 degrees C. Plants collected in all tests except the In-Furrow test at Prattville were dried for 48 hours. The In-Furrow Prattville test was dried for 96 hours. All test plots were four rows wide and 30 feet long with four replications per treatment arranged in a RCB design. The variety Phytogen 367 was planted in all trials. The In-Furrow test and foliar test at Prattville were planted April 15 and May 9, respectively. The In-Furrow test and foliar test at Headland were both planted May 7. The first true leaf foliar sprays were applied May 29 at Prattville and May 20 at Headland.

Results of In-Furrow Insecticide Tests: The key variables measured in the In-Furrow insecticide tests are presented in Table 1. There was a significant effect with respect to damage rating among the treatments at both Headland (P>F=0.0001) on June 6 and Prattville (P>F=0.0001) on May 15. Thrips damage at both test locations was moderate ranging from 1.75 to 3.75 at Headland and from 2.1 to 3.4 at Prattville. The Fungicide alone treatment had a significantly higher visual damage rating than all the other treatments at Headland (LSD 0.1=0.546). The Aeris + Trilex Advanced + Admire Pro 7.4 ounces. treatment had the lowest damage rating at Headland and the rating for this treatment was significantly less than that of 8 other treatments. The In-Furrow Acephate 16 ounces + Fungicide treatment and the Fungicide alone treatment had damage ratings that were significantly greater (LSD 0.1 = 0.38) than the other 8 treatments at Prattville. Dried plant weights for 5 plants ranged from 14.9 to 26.2

grams and although there was no significant difference among treatments with respect to dry plant weight at Headland (P>F= 0.77) the Aeris+Trilex Advanced + Admire Pro 7.4 ounces treatment had the highest numerical plant weight and the fungicide alone treatment had the lowest dry plant weight. There was a significant difference among treatments with respect to dry plant weight at Prattville (P>F=0.011). Dried plant weight for five plants at Prattville ranged from 2.1 to 3.4 grams. Treatments with higher levels of thrips damage (like the Acephate 16 ounces + Fungicide treatment and the Fungicide alone treatment) tended to have lower dry plant weights. Yields ranged from 3,341 to 4,044 pounds of seed cotton per acre at Headland but there was not a statistically significant difference among treatments (P>F=0.88). The four treatments with the highest numerical yield at Headland also had the highest numerical yield at Prattville. There was a significant difference among treatments at Prattville with respect to yield (P>F =0.075). The Acephate 16 ounces + Fungicide treatment yielded significantly less than all the other treatments at Prattville (LSD 0.1 = 309 pounds). Numerically this treatment was the third lowest yielding trial at Headland. The Aeris + Trilex Advanced treatment had the highest numerical yield at both locations.

Results of Foliar Insecticide Tests: There was a highly significant difference among treatments with respect to damage rating at both locations (P>F = 0.000 at both locations). The Fungicide alone treatment had visual damage that was significantly greater than all the other treatments at both Headland (LSD 0.1 = 0.4) and Prattville (0.44). The Avicta Complete treatment had a damage rating that was significantly greater than four of the other treatments at Headland. The damage rating for the Avicta Complete + Radiant 3 ounces treatment at Prattville was significantly lower than three of the other insecticide treatments at Prattville. There was a significant difference among treatments with respect to dry plant weight at Headland (P>F=0.08) but not at Prattville (P>F =0.20). The Fungicide alone treatment had the lowest numerical dry plant weight at both locations and at Headland the dry plant weight in the Fungicide alone treatment was significantly less than that of three of the other treatments. There was a highly significant difference among treatments with respect to dry plant weight at both locations (P>F = 0.000 at both locations). The dry plant weights of the Fungicide alone treatment was numerically lower than all the other treatments at both locations and it was significantly lower than three of the other treatments at Headland (LSD 0.1 = 4.7) None of the first true leaf sprays in conjunction with an Avicta Complete seed treatment produced a dry plant weight that was numerically greater than the Avicta Complete seed treatment alone at Headland. There was no significant difference among treatments with respect to yield at Headland (P>F= 0.79) or Prattville (P>F=0.65). The Fungicide alone treatment had the lowest numerical yield at Headland and the highest numerical yield at Prattville. None of the first true leaf sprays in conjunction with an Avicta Complete seed treatment produced a yield that was numerically greater than the Avicta Complete seed treatment alone at Prattville.

Table 1.
Damage Ratings, Plant Weights, Stand Counts and Yields in Cotton Thrips In-Furrow Insecticide Trials at Headland and Prattville, Al In 2013.

	Visual Damage Rating*		Dry Plant Weights (gms)		Yield (lbs seed cotton/ acre)	
Treatment	**Headland**	**Prattville**	**Headland**	**Prattville**	**Headland**	**Prattville**
Avicta Complete + Radiant- 1.5 oz	1.3 C	2.5 BC	14.2 CD	16.0	2524	3075
Avicta Complete + Radiant- 3 oz	1.5 C	1.9 D	15.2 BCD	17.2	2793	3402
Avicta Complete + Acephate 97 – 6 oz	1.5 C	2.1 Cd	19.4 AB	16.3	2475	3535
Avicta Complete + Acephate 97 – 3 oz	1.6 C	2.1 CD	18.3 ABC	18.5	2610	3463
Avicta Complete	2.3 B	2.5 BC	19.9 A	17.1	2561	3626
Fungicide	3.5 A	3.9 A	12.8 D	14.3	2439	3686

*0= no damage. 5=severe damage.

Table 2.
Damage Ratings, Plant Weights and Yields in Cotton Thrips Foliar Spray Trials at Headland and Prattville, Al In 2013.

	Visual Damage Rating*		Dry Plant Weight (gms)		Stand Count (# per 60 feet)		Seed Cotton Yield (lbs/ac)	
Treatment	**Headland**	**Prattville**	**Headland**	**Prattville**	**Headland**	**Prattville**	**Headland**	**Prattville**
Aeris + Trillex Advanced + Admire Pro 7.4 oz	1.75 F	2.1 C	26.2	3.3 AB	161	214	3741	2833
Termik 15 G- 5 lbs	1.88 EF	2.1 C	22.7	3.2 AB	196	215	3426	3015
Aeris + Trilex Advanced	2.13 DEF	2.1 C	19.1	2.3CD	196	196	4044	3154
Amdro Pro 9 oz + Fungicide	2.38 CDE	2.6 B	24.6	2.9 ABC	187	207	3729	2990
Acephate 97- 16 oz + Fungicide	2.38 CDE	3.4 A	21.5	2.1 D	167	205	3487	2516
Avicta Complete +Admire Pro 7.4 oz	2.38 CDE	2.6 B	18.7	3.1 AB	181	215	3983	3057
Avicta Complete + Acephate 97 – 8 oz	2.8 CDE	2.6 B	20.2	2.9 ABC	183	198	3910	3026
Avicta Complete	2.50 BCD	2.5 BC	21.5	2.7 BC	194	203	3826	3093
Aeris + Trillex Advanced + Poncho Votivo	2.75 BC	2.4 BC	20.4	3.4 A	166	193	3693	2845
Velum Total	3.0 B	---	23.9	---	185	---	3341	---
Fungicide	3.8 A	3.2 A	14.9	2.5 CD	179	209	3535	2894

*0= no damage. 5=severe damage.