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Cotton Research Report

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

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Confidential Report

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I. Cotton Variety Trials

Enhancing Cotton Variety Selection through On-Farm Evaluations, 2016

D. Delaney, T. Cutts, D. Monks, and K. Glass

Enhancing Cotton Variety Selection in on-farm trials, was conducted in 2016. Cotton varieties were supplied by: Delta and Pine Land, Bayer, Phytogen, and Americot seed companies. On-farm trials were planted, maintained, and harvested by cooperating producers. Varieties included were either Roundup Flex or glytol-tolerant and plots were initiated from late April through late May, 2016. Trials were conducted by personnel in Alabama Cooperative Extension and Auburn University at various on-farm locations throughout Alabama. The farm locations are selected based on representative cotton acreage in the state, and the trial entries are the top performing varieties for Alabama. The 2016 On-Farm Variety trials were hugely successful this year and reflected the tremendous yields seen across Alabama. A summary of the data we collected is presented in Tables 1 - 13.

Table 1. Cotton Lint Yield Means at 9 On-Farm Locations in Alabama in 2016.

County	Environment	Lint Yield (lbs/A)
Cherokee	Dryland	1784
Macon	Irrigated	1727
Franklin	Dryland	1621
Chilton	Dryland	1610
Washington	Dryland	1562
Fayette	Dryland	1433
Escambia	Dryland	1385
Elmore	Dryland	1285
Shelby	Dryland	619

*MEANS ARE NOT SIGNIFICANTLY DIFFERENT.

Table 2. Cotton Lint Yield and Fiber Quality Means Across 9 On-Farm Locations in Alabama in 2016.							
Variety	Lint Yield (lbs/A)	Locations (#)	Lint Turn-Out (%)	Micronaire	Fiber Length (in.)	Strength (g/tex)	Uniformity (%)
DP 1639 B2XF	1707	3	46	4.9	1.14	31.3	83
DP 1614 B2XF	1686	3	46	4.6	1.17	30.4	83
DP 1646 B2XF	1632	4	45	4.6	1.24	30.7	83
PHY 312 WRF	1629	2	45	3.7	1.20	31.9	84
PHY 333 WRF	1532	8	44	4.1	1.17	30.8	83
DP 1538 B2XF	1529	5	44	4.4	1.12	28.4	83
DP 1518 B2XF	1512	2	44	4.3	1.15	29.3	83
PHY 575 WRF	1492	2	41	3.9	1.19	29.9	83
DP 1522 B2XF	1455	2	44	4.5	1.17	32.9	83
PHY 495 WRF	1439	7	44	4.3	1.11	31.6	84
DP 1555 B2RF	1435	2	47	4.7	1.18	33.0	83
NG 5007 B2XF	1408	6	44	4.2	1.14	28.7	82
PHY 444 WRF	1385	8	45	3.6	1.24	31.4	84
ST 6182 GLT	1380	8	47	4.4	1.17	29.8	83
ST 4848 GLT	1367	9	44	4.2	1.14	30.9	83
FM 1739 GLT	1343	4	46	4.7	1.19	33.5	83
NG 3406 B2XF	1324	7	43	4.4	1.14	29.6	83
DP 1553 B2XF	1301	5	45	4.3	1.17	29.9	84
PHY 552 WRF	1267	2	45	4.1	1.18	34.2	84
PHY 487 WRF	1141	3	44	4.2	1.12	31.0	83
ST 4946 GLB2	1082	2	43	4.2	1.17	33.1	84
Average	1431	5	45	4.3	1.17	31.1	83
* MEANS NOT SIGNIFICANTLY DIFFERENT.							
** LINT TURN-OUTS ON TABLE TOP GINS ARE TRADITIONALLY HIGHER THAN COMMERCIAL GINS. LINT YIELD AND LINT TURN-OUT SHOULD BE CONSIDERED ON A RELATIVE BASIS.							

Table 3. Cotton Lint Yield Rank by Variety and Location in Alabama in 2016

Variety	Avg Rank	Rank								
		Cherokee	Chilton	Elmore	Escambia	Fayette	Franklin	Macon	Shelby	Washington
DP 1646 B2XF	2	+	+	1	4	+	+	1	+	1
DP 1555 B2RF	3	+	+	4	2	+	+	+	+	+
FM 1739 GLT	4	+	2	+	3	+	+	+	7	2
DP 1639 B2XF	4	+	5	+	+	+	3	+	+	4
DP 1538 B2XF	4	+	+	2	7	2	5	+	+	6
PHY 333 WRF	5	4	1	8	+	4	16	2	9	9
NG 5007 B2XF	5	7	12	3	+	1	+	+	1	5
DP 1553 B2XF	5	+	9	5	6	+	+	5	2	+
PHY 495 WRF	6	3	3	+	10	9	2	+	5	8
PHY 444 WRF	6	5	6	6	1	6	20	3	4	+
NG 3406 B2XF	7	10	4	9	5	7	+	+	3	11
ST 6182 GLT	7	1	8	12	9	5	+	4	10	7
DP 1614 B2XF	8	2	11	+	+	+	11	+	+	+
PHY 487 WRF	8	+	+	7	+	10	+	+	8	+
ST 4848 GLT	8	9	7	10	8	8	18	6	6	3
DP 1518 B2XF	9	+	+	+	+	3	14	+	+	+
PHY 575 WRF	10	+	10	+	+	+	+	+	+	10
ST 4946 GLB2	10	+	+	+	+	+	9	+	11	+
PHY 312 WRF	11	6	+	+	+	+	15	+	+	+
DP 1522 B2XF	14	8	+	+	+	+	19	+	+	+
PHY 552 WRF	14	+	+	11	+	+	17	+	+	+
Total Entries		10	12	12	10	9	20	6	12	11

* '+' INDICATES VARIETY NOT PLANTED AT LOCATION.

** VARIETY MEANS NOT SIGNIFICANTLY DIFFERENT. VARIETIES AT SINGLE LOCATION EXCLUDED.

Table 4. Cotton Lint Yield by Percent (%) Rank Across On-Farm Locations in Alabama in 2016						
Variety	Lint Yield (lbs/A)	Locations (#)	% #1	% #2	% #3	% Top 3
DP 1646 B2XF	1632	4	75%	0%	0%	75%
FM 1739 GLT	1343	4	0%	50%	25%	75%
NG 5007 B2XF	1408	6	33%	0%	17%	50%
PHY 333 WRF	1531	8	25%	13%	0%	38%
NG 3406 B2XF	1324	7	0%	0%	14%	14%
ST 6182 GLT	1380	8	13%	0%	0%	13%
ST 4848 GLT	1367	9	0%	0%	11%	11%

*Varieties planted at 4 or more locations. Varieties at less than 4 locations excluded.

Table 5. 2016 Cotton On-Farm Variety Trial – Cherokee County, Alabama							
Variety	Rank	Lint Yield (lbs/A)	Lint Turn-Out (%)	Micronaire	Length (in.)	Strength (g/tex)	Uniformity (%)
ST 6182 GLT	1	1933	48	4.4	1.20	31.1	84
DP 1614 B2XF	2	1920	47	4.7	1.21	31.1	85
PHY 495 WRF	3	1809	46	4.3	1.13	34.1	84
PHY 333 WRF	4	1780	46	4.0	1.20	31.3	83
PHY 444 WRF	5	1774	45	3.6	1.26	33.6	87
PHY 312 WRF	6	1760	45	3.9	1.21	33.6	85
NG 5007 B2XF	7	1756	45	4.3	1.19	29.5	83
DP 1522 B2XF	8	1716	44	4.8	1.18	32.0	85
ST 4848 GLT	9	1713	46	4.3	1.20	31.6	84
NG 3406 B2XF	10	1656	44	4.6	1.16	30.6	84

* LINT TURN-OUTS ON TABLE TOP GINS ARE TRADITIONALLY HIGHER THAN COMMERCIAL GINS. LINT YIELD AND LINT TURN-OUT SHOULD BE CONSIDERED ON A RELATIVE BASIS.

Table 6. 2016 Cotton On-Farm Variety Trial – Chilton County, Alabama							
Variety	Rank	Lint Yield (lbs/A)	Lint Turn-Out (%)	Micronaire	Length (in.)	Strength (g/tex)	Uniformity (%)
PHY 333 WRF	1	1883	44	4.0	1.15	29.4	83
FM 1739 GLT	2	1708	46	4.5	1.20	32.5	84
PHY 495 WRF	3	1677	43	3.7	1.09	32.5	83
NG 3406 B2XF	4	1673	42	4.2	1.10	29.9	84
DP 1639 B2XF	5	1635	43	4.8	1.11	31.0	84
PHY 444 WRF	6	1630	44	3.5	1.20	30.0	85
ST 4848 GLT	7	1592	43	4.0	1.06	28.8	82
ST 6182 GLT	8	1537	46	4.2	1.15	28.2	83
DP 1553 B2XF	9	1518	42	4.2	1.13	29.3	84
PHY 575 WRF	10	1502	41	3.7	1.16	28.9	84
DP 1614 B2XF	11	1492	43	4.5	1.12	29.9	81

NG 5007 B2XF	12	1472	43	4.2	1.10	27.5	82
* LINT TURN-OUTS ON TABLE TOP GINS ARE TRADITIONALLY HIGHER THAN COMMERCIAL GINS. LINT YIELD AND LINT TURN-OUT SHOULD BE CONSIDERED ON A RELATIVE BASIS.							

Table 7. 2016 Cotton On-Farm Variety Trial – Elmore County, Alabama							
Variety	Rank	Lint Yield (lbs/A)	Lint Turn-Out (%)	Micronaire	Length (in.)	Strength (g/tex)	Uniformity (%)
DP 1646 B2XF	1	1537	45	4.6	1.24	30.7	83
DP 1538 B2XF	2	1457	47	4.7	1.10	31.7	83
NG 5007 B2XF	3	1390	45	4.5	1.12	29.4	80
DP 1555 B2XF	4	1365	48	4.6	1.18	33.7	83
DP 1553 B2XF	5	1279	45	4.4	1.19	30.1	84
PHY 444 WRF	6	1250	45	4.0	1.27	30.9	83
PHY 487 WRF	7	1223	44	5.1	1.11	29.1	81
PHY 333 WRF	8	1207	44	4.4	1.19	33.0	84
NG 3406 B2XF	9	1204	43	4.7	1.13	28.4	83
ST 4848 GLT	10	1190	45	4.8	1.14	30.7	82
PHY 552 WRF	11	1189	45	4.2	1.18	34.9	84
ST 6182 GLT	12	1132	48	4.3	1.16	30.7	84
* LINT TURN-OUTS ON TABLE TOP GINS ARE TRADITIONALLY HIGHER THAN COMMERCIAL GINS. LINT YIELD AND LINT TURN-OUT SHOULD BE CONSIDERED ON A RELATIVE BASIS.							

Table 8. 2016 Cotton On-Farm Variety Trial – Escambia County, Alabama							
Variety	Rank	Lint Yield (lbs/A)	Lint Turn-Out (%)	Micronaire	Length (in.)	Strength (g/tex)	Uniformity (%)
PHY 444 WRF	1	1537	43	3.8	1.25	30.7	85.2
DP 1555 B2XF	2	1504	46	4.7	1.17	32.2	84.0
FM 1739 GLT	3	1502	48	4.5	1.18	32.7	81.9
DP 1646 B2XF	4	1448	44	n/a	n/a	n/a	n/a
NG 3406 B2XF	5	1374	43	4.6	1.10	28.5	82.6
DP 1553 B2XF	6	1351	44	4.4	1.17	28.7	84.3
DP 1538 B2XF	7	1344	45	4.8	1.09	26.4	83.9
ST 4848 GLT	8	1305	44	4.6	1.15	29.8	83.6
ST 6182 GLT	9	1252	47	4.7	1.26	34.2	81.6
PHY 495 WRF	10	1236	44	4.6	1.11	30.2	84.7
* LINT TURN-OUTS ON TABLE TOP GINS ARE TRADITIONALLY HIGHER THAN COMMERCIAL GINS. LINT YIELD AND LINT TURN-OUT SHOULD BE CONSIDERED ON A RELATIVE BASIS.							

Table 9. 2016 Cotton On-Farm Variety Trial – Fayette County, Alabama							
Variety	Rank	Lint Yield (lbs/A)	Lint Turn-Out (%)	Micronaire	Length (in.)	Strength (g/tex)	Uniformity (%)
NG 5007 B2XF	1	1574	44	4.1	1.13	28.8	81.2
DP 1538 B2XF	2	1550	44	3.6	1.16	27.6	82.4
DP 1518 B2XF	3	1487	41	4.4	1.08	26.7	81.2
PHY 333 WRF	4	1470	43	3.8	1.14	29.1	81.7
ST 6182 GLT	5	1413	47	4.4	1.09	25.8	80.9
PHY 444 WRF	6	1391	43	3.5	1.24	29.8	82.9
NG 3406 B2XF	7	1360	42	4.4	1.15	28.1	82.8
ST 4848 GLT	8	1352	44	4.0	1.14	28.5	82.3
PHY 495 WRF	9	1303	45	4.5	1.10	30.1	83.9
* LINT TURN-OUTS ON TABLE TOP GINS ARE TRADITIONALLY HIGHER THAN COMMERCIAL GINS. LINT YIELD AND LINT TURN-OUT SHOULD BE CONSIDERED ON A RELATIVE BASIS.							

Table 10. 2016 Cotton On-Farm Variety Trial – Franklin County, Alabama

Variety	Rank	Lint Yield (lbs/A)	Lint Turn-Out (%)	Micronaire	Length (in.)	Strength (g/tex)	Uniformity (%)
PHY 333 WRF	1	2107	45	4.1	1.21	29.7	83
PHY 495 WRF	2	1947	43	4.6	1.21	29.3	85
DP 1639 B2XF	3	1887	46	4.6	1.13	33.2	84
DP 1538 B2XF	5	1724	45	4.6	1.14	29.2	82
ST 5115 GLT	8	1692	43	4.3	1.17	32.1	84
ST 4946 GLB2	9	1685	43	4.3	1.20	34.1	85
PHY 487 WRF	10	1660	45	3.8	1.16	34.0	85
DP 1614 B2XF	11	1646	48	4.6	1.17	30.2	82
ST 5115 GLT	12	1618	42	4.2	1.16	31.4	82
DP 1518 B2XF	14	1537	43	4.1	1.22	31.9	84
PHY 312 WRF	15	1498	44	3.4	1.19	30.1	83
PHY 552 WRF	17	1345	44	4.0	1.18	33.4	83
ST 4848 GLT	18	1308	46	3.9	1.19	34.2	85
DP 1522 B2XF	19	1194	43	4.2	1.16	33.8	82
PHY 444 WRF	20	1163	44	3.1	1.26	31.8	83
* LINT TURN-OUTS ON TABLE TOP GINS ARE TRADITIONALLY HIGHER THAN COMMERCIAL GINS. LINT YIELD AND LINT TURN-OUT SHOULD BE CONSIDERED ON A RELATIVE BASIS.							

Table 11. 2016 Cotton On-Farm Variety Trial – Macon County, Alabama							
Variety	Rank	Lint Yield (lbs/A)	Lint Turn-Out (%)	Micronaire	Length (in.)	Strength (g/tex)	Uniformity (%)
DP 1646 B2XF	1	1795	45	4.4	1.18	30.2	81
PHY 333 WRF	2	1759	46	4.4	1.16	31.1	82
PHY 444 WRF	3	1749	47	3.7	1.22	32.4	84
ST 6182 GLT	4	1699	48	4.5	1.17	30.5	84
DP 1553 B2XF	5	1696	47	4.2	1.20	30.3	83
ST 4848 GLT	6	1663	45	4.3	1.16	32.0	83
* LINT TURN-OUTS ON TABLE TOP GINS ARE TRADITIONALLY HIGHER THAN COMMERCIAL GINS. LINT YIELD AND LINT TURN-OUT SHOULD BE CONSIDERED ON A RELATIVE BASIS.							

Table 12. 2016 Cotton On-Farm Variety Trial – Shelby County, Alabama							
Variety	Rank	Lint Yield (lbs/A)	Lint Turn-Out (%)	Micronaire	Length (in.)	Strength (g/tex)	Uniformity (%)
NG 5007 B2XF	1	672	44	4.2	1.15	28.8	83
DP 1553 B2XF	2	662	45	4.3	1.15	30.9	83
NG 3406 B2XF	3	596	44	4.1	1.12	30.6	84
PHY 444 WRF	4	588	45	3.2	1.21	32.3	84
PHY 495 WRF	5	587	45	4.2	1.09	35.0	83
ST 4848 GLT	6	572	44	3.8	1.12	31.8	83
FM 1739 GLT	7	542	45	4.6	1.20	34.8	84
PHY 487 WRF	8	541	44	4.2	1.08	30.0	83
PHY 333 WRF	9	536	44	3.8	1.17	31.6	85
ST 6182 GLT	10	533	47	4.3	1.14	29.4	83
ST 4946 GLB2	11	479	42	4.0	1.13	32.0	83
* LINT TURN-OUTS ON TABLE TOP GINS ARE TRADITIONALLY HIGHER THAN COMMERCIAL GINS. LINT YIELD AND LINT TURN-OUT SHOULD BE CONSIDERED ON A RELATIVE BASIS.							

Table 13. 2016 Cotton On-Farm Variety Trial – Washington County, Alabama							
Variety	Rank	Lint Yield (lbs/A)	Lint Turn-Out (%)	Micronaire	Length (in.)	Strength (g/tex)	Uniformity (%)
DP 1646 B2XF	1	1750	44	n/a	n/a	n/a	n/a
FM 1739 GLT	2	1621	46	4.9	1.18	33.0	83.2
ST 4848 GLT	3	1611	43	4.3	1.11	30.3	83.2
DP 1639 B2XF	4	1599	44	5.2	1.19	29.8	81.6
NG 5007 B2XF	5	1586	42	4.1	1.13	28.3	82.6
DP 1538 B2XF	6	1569	43	4.5	1.13	29.8	83.9
ST 6182 GLT	7	1539	45	4.0	1.16	28.5	83.7
PHY 495 WRF	8	1516	42	4.6	1.07	30.3	82.3
PHY 333 WRF	9	1510	40	3.9	1.15	31.1	83.4
PHY 575 WRF	10	1482	40	4.1	1.21	30.9	82.9
NG 3406 B2XF	11	1403	41	4.1	1.23	30.9	82.8

* LINT TURN-OUTS ON TABLE TOP GINS ARE TRADITIONALLY HIGHER THAN COMMERCIAL GINS. LINT YIELD AND LINT TURN-OUT SHOULD BE CONSIDERED ON A RELATIVE BASIS.
**FIBER QUALITY ANALYSIS FOR THIS LOCATION PENDING.

Evaluation of Liberty Plus Dual Magnum in Liberty Link, Extend, and WideStrike Cotton Varieties

J. A. Tredaway, and A. Price

A field study was conducted at the Prattville Research Station in Prattville, AL to evaluate treatments with and without Liberty, three cotton varieties including Liberty Link (LL), WideStrike (WS), and Dicamba Tolerant cotton (DGT), and two nozzle types including a flat-fan (FF) and a turbo teejet induction (TTI). Cotton varieties planted were LL variety Stoneville 4848, WS variety Phytogen 333, and DGT variety Americot NG3406 B2XF. Liberty was applied at a rate of 29 fl. oz./A and Dual Magnum at 21 fl.oz./A were applied at the 4-leaf and 8-leaf stages of cotton. Herbicide induced injury was evaluated on a scale of 0-100% with 0 = no injury and 100% = total plant death. Cotton injury was evaluated at 7, 14, 21, and 28 days after treatment (DAT). Herbicide injury was higher, on average, for all treatments on WS cotton varieties. Injury ratings were also higher, on average, for treatments applied with TTI nozzles. Although injury ratings were also higher for certain treatments, there were no differences in cotton yield and no correlation between herbicide induced injury and cotton yield.

Breeding Cotton for Yield and Quality in Alabama

D. B. Weaver and J. Koebernick

Cotton breeding at Auburn University began in 2001 with emphasis on yield and fiber quality with an additional objective of identifying resistance to *Rotylenchulus reniformis*, reniform nematode, and incorporating resistance into adapted genotypes. In August 2016, David Weaver retired and Jenny Koebernick began as his successor.

Field experiments for 2016 included advanced and preliminary trials at the Plant Breeding Unit (PBU) in Tallassee, and the Prattville Experiment Field with cultivar development as the objective. Experimental lines developed for reniform nematode resistance were evaluated in both nematode and non-nematode infested fields at Tennessee Valley Research and Extension Center in Belle Mina. The Regional Breeders Testing Network (RBTN) was planted at Prattville, with 23 elite breeding lines evaluated for yield, agronomic traits and fiber quality traits against 5 adapted cultivars. Two elite Auburn lines were included in the test.

The results of the advanced trials gave one clear candidate to be advanced to the 2017 RBTN, AU90098. It had yield superior to the checks in both locations tested and had good fiber quality with fiber length of 1.21 inches, strength of 32 g/tex and a micronaire of 4.5. Preliminary trial results demonstrated several superior lines for advancement into the 2017 advanced trials. The nematode trial data is still being analyzed but the mean data indicate several promising lines to pursue and incorporate within the cultivar development program. These lines have good yield and quality. The yield and fiber quality means for the RBTN are in Table 1.

Table 1. Regional breeders testing network (RBTN) 2016 mean lint yield and fiber quality results from Prattville, AL.

Entry	Genotype	Lint Yield		Micronaire		Length		Uniformity		Strength		Elongation	
		lb/ac				in		%		g/tex		%	
1	TAM13Q-18	1003	b-f*	4.9	h-k	1.11	h-k	83.0	fg	30.6	f-j	5.9	g-j
2	TAM11L-24	1030	a-f	4.7	kl	1.27	a	86.2	a	34.5	a	5.2	lm
3	PD07040	764	g	5.0	g-j	1.16	cde	84.0	c-f	31.6	d-g	5.5	jkl
4	PD09084	1164	abc	5.1	f-i	1.13	e-i	84.8	bcd	32.3	cde	6.1	e-h
5	PD08028	1222	a	4.9	ijk	1.12	f-j	83.9	c-f	32.5	b-e	6.4	c-f
6	PD09046	1082	a-e	4.6	lm	1.21	BC	84.6	b-e	34.0	ab	5.0	m
7	Ark 0812-87ne	1172	abc	5.4	a-d	1.14	d-h	84.8	bcd	29.5	h-k	6.6	bcd
8	Ark 0818-23	931	d-g	5.2	c-f	1.14	d-i	84.2	c-f	31.0	d-h	6.2	d-h
9	Ark 0824-89	1028	a-f	5.5	ab	1.18	bc	85.5	ab	33.6	abc	6.1	d-h
10	Ark 0822-48	843	fg	5.6	a	1.15	c-f	84.3	b-e	30.9	e-i	6.9	ab
11	Ark 0819-89	1003	b-f	5.4	bcd	1.14	d-i	84.6	b-e	32.3	cde	6.8	abc
12	NM 13G1029	894	e	4.6	lm	1.13	e-i	83.0	fg	30.9	e-i	6.0	f-i
13	NM 13G2019	1116	a-d	4.9	ijk	1.15	d-g	84.1	c-f	31.8	def	6.5	b-e
14	AU77082	1128	a-d	5.4	a-d	1.11	h-k	83.8	c-f	30.4	f-j	5.6	i-l
15	AU82074	1104	a-e	4.8	kl	1.13	e-i	83.6	def	29.1	jk	5.8	h-k
16	GA 2011113	834	fg	5.3	c-f	1.09	jk	83.5	ef	31.9	def	6.0	f-i
17	GA 2012050	833	fg	5.1	f-j	1.14	d-i	84.9	bc	32.6	bcd	6.4	b-f
18	GA 2012082	924	d-g	5.1	e-i	1.13	d-i	84.4	b-e	30.4	f-j	6.3	d-g
19	GA 2012141	1103	a-e	5.3	c-f	1.15	def	84.7	b-e	31.1	d-h	6.2	d-h
20	MD 16-1	1186	abc	5.2	d-g	1.05	l	83.5	ef	29.1	jk	6.0	f-i
21	MD 16-2	1224	a	4.5	m	1.17	cd	84.3	c-f	34.2	a	6.1	e-h
22	MS 0152-3-11	1028	a-f	5.1	e-h	1.14	d-i	83.5	ef	29.0	jk	5.9	g-j
23	MS 0043-28-1	1137	a-d	5.3	b-e	1.08	k	83.5	ef	30.0	hij	6.0	f-i
24	DP 393 CK	1098	a-e	5.2	c-f	1.09	jk	84.2	c-f	30.5	f-j	7.2	a
25	DP 493 CK	1082	a-e	5.4	abc	1.04	l	81.9	g	28.4	k	5.4	klm
26	FM 958 CK	1083	a-e	4.9	jk	1.11	g-k	83.5	ef	30.1	g-j	5.4	klm
27	SG 105 CK	970	c-g	5.2	c-f	1.11	ijk	84.0	c-f	29.6	h-k	6.2	d-h
28	UA 222 CK	1207	ab	5.2	c-f	1.12	f-i	84.2	c-f	29.3	ijk	7.2	a
	LSD	95.4		0.22		0.035		1.25		1.62		0.45	

*Within groups, means followed by the same letter do not differ at P=0.05

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

T. Sandlin, and J. Tredaway

Fourteen varieties of cotton were evaluated in this study for tolerance to glufosinate in combination with other tank mixes. Cotton varieties were from three different companies and were comprised of Stoneville: 4747 GLB2, 4848 GLT, 4946 GLB2; Phytogen: 333 WRF, 444 WRF, 499 WRF, 495 W3RF; Deltapine: 1518 B2XF, 1522 B2XF, 1612 B2XF, 1614 B2XF, 1725 B2XF, 15R513B2XF, 16R229B2XF. Each set of these varieties were treated with one of the following combinations: (1) 29oz/A glufosinate (Liberty) + 32oz/A glyphosate (Roundup Powermax II) (2) 29oz/A glufosinate (Liberty) + 32oz/A glyphosate (Roundup Powermax II) + 16oz/A S-Metolachlor (Dual Magnum) (3) 29oz/A glufosinate (Liberty) + 32oz/A glyphosate (Roundup Powermax II) + 16oz/A s-metolachlor (Dual Magnum) + 0.5lb/A acephate (orthene). Plots were planted on May 16th and treatments were applied on June 10th at approximately third true leaf. Percent leaf burn was rated at three and seven days after application. Plots were harvested on October 13th. Percent leaf burn increased in number at seven days for all varieties versus the three-day rating. It is believed that percent leaf burn ratings were elevated for all varieties in this test due to stressful environmental conditions. All varieties recuperated quickly and new growth was unaffected. On average, percent leaf burn increased in number for all companies represented as the number of products added to the tank mix increased (Table 1). Percent leaf burn increased in number for most varieties as tank mix partners increased (Table 2). Few significant differences were noted in lint yield in this test. Differences that were present are not attributed to treatment effects (Table 3). Results from this study indicate that cotton response to glufosinate in combination with the tank mixes in this test differ not only by brand but can also differ by variety within and between brands. Extremes in environmental conditions can play a significant role in the level of crop response observed from the treatments applied in this study.

Table 1. Average percent leaf burn of brand by herbicide treatment seven days after application.			
Brand	Liberty + Roundup average % leaf burn	Liberty + Roundup + Dual Magnum average % leaf burn	Liberty + Roundup + Dual Magnum + Orthene average % leaf burn
Stoneville	14%	25%	29%
Phytogen	56%	64%	72%
Deltapine	25%	34%	46%

Table 2. Percent leaf burn of variety by herbicide treatment seven days after application.			
Variety	Liberty + Roundup % leaf burn	Liberty + Roundup + Dual Magnum % leaf burn	Liberty + Roundup + Dual Magnum + Orthene % leaf burn
Stoneville 4747 GLB2	7.5	17.5	21.3
Stoneville 4848 GLT	16.3	28.8	36.3
Stoneville 4946 GLB2	17.5	30.0	30.0
Phytogen 333 WRF	60.0	61.3	77.5
Phytogen 444 WRF	51.3	65.0	72.5
Phytogen 495 W3RF	51.3	68.8	62.5
Phytogen 499 WRF	60.0	60.0	75.0
Deltapine 1518 B2XF	26.3	40.0	53.8
Deltapine 1522 B2XF	27.5	37.5	40.0
Deltapine 1612 B2XF	27.5	33.8	47.5
Deltapine 1614 B2XF	21.3	25.0	37.5
Deltapine 1725 B2XF	26.3	38.8	46.3
Deltapine 15R513 B2XF	20.0	30.0	57.5
Deltapine 16R229 B2XF	26.3	32.5	36.3

Table 3. Cotton lint yield pounds per acre of variety by herbicide treatment.			
Variety	Liberty + Roundup Lint yield lbs/acre	Liberty + Roundup + Dual Magnum Lint yield lbs/acre	Liberty + Roundup + Dual Magnum + Orthene Lint yield lbs/acre
Stoneville 4747 GLB2	1630.2	1789.9	1892.2
Stoneville 4848 GLT	1845.8	1774.6	1766.5
Stoneville 4946 GLB2	1895.3	1963.3	1759.5
Phytogen 333 WRF	1942.7	1800.0	2009.4
Phytogen 444 WRF	1630.6	1710.5	1726.2
Phytogen 495 W3RF	1810.1	1902.2	1890.3
Phytogen 499 WRF	1783.1	1792.3	1868.8
Deltapine 1518 B2XF	1803.8	1819.5	1930.8
Deltapine 1522 B2XF	1758.1	1837.5	1899.0
Deltapine 1612 B2XF	1708.5	1735.4	1679.4
Deltapine 1614 B2XF	1809.5	1693.1	1935.0
Deltapine 1725 B2XF	1897.5	1817.7	1995.9

Deltapine 15R513 B2XF	1711.9	1662.6	1898.1
Deltapine 16R229 B2XF	1886.8	1813.6	2103.9

Develop a Customized CRISPR-Cas9 System for Cotton and Generate Transgenic Cotton Varieties with Enhanced Drought Tolerance

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

1. Accomplishments to date

1.1. Develop a customized CRISPR-Cas9 genome engineering system for cotton.

a. Analysis of drought-resistance related genes

The mitogen-activated protein kinase (MAPK) cascades are conserved pathways through which extracellular stimuli are transduced into intracellular responses in all eukaryotes [1, 2]. In plants, MAPK cascades have been shown to regulate a number of essential biological processes, including stress responses such as drought [3]. Based on the sequence homology and conserved phosphorylation motifs, MAPKs are classified into four major groups (A-D). A novel stress-responsive group D MAPK from cotton, *GhMPK16*, is reported to be involved in disease resistance and drought sensitivity through induction of chemical and biological signals [4]. Ectopic expression of *GhMPK16* in *Arabidopsis* led to obvious more drought-sensitive plants. Therefore, inactivation or a decrease in the expression of this gene is speculated to decrease the drought-sensitivity and thus improve the drought resistance in different environments.

As reported by Guo et al. [4], *GhMPK16* is also related with pathogen resistance against fungi and bacteria, and thus the knockout of this gene is undesirable from this sense. Fortunately, sequence analysis revealed that the promoter region (785 bp) contains several motifs probably related to pathogen and drought tolerance separately. Among these motifs, the Box-W1 element is a fungal elicitor responsive element (Fig. 1), and the MBS element is responsible for MYB binding site involved in drought-inducibility. To decrease drought sensitivity while reserving its pathogen sensitivity, the MBS box is a rational choice as the target sequence to be knocked out.

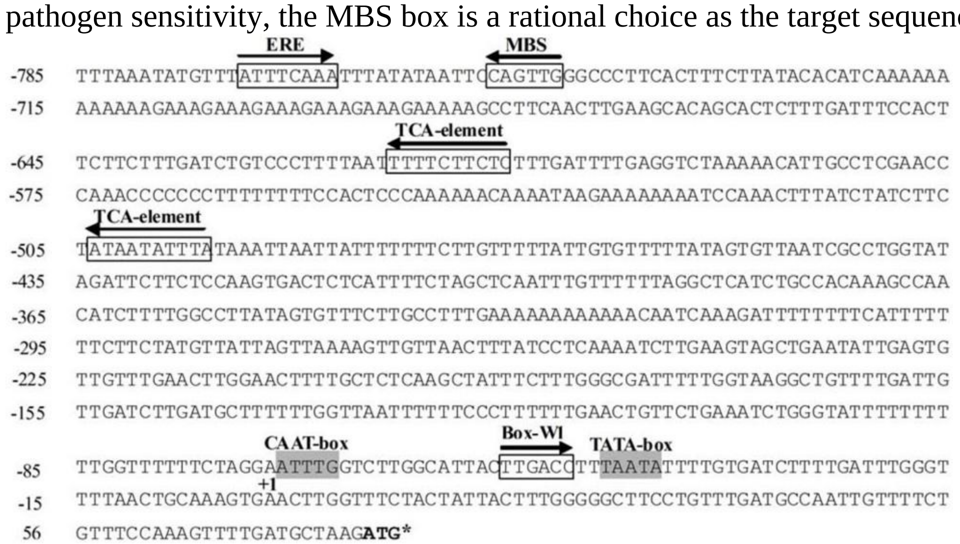


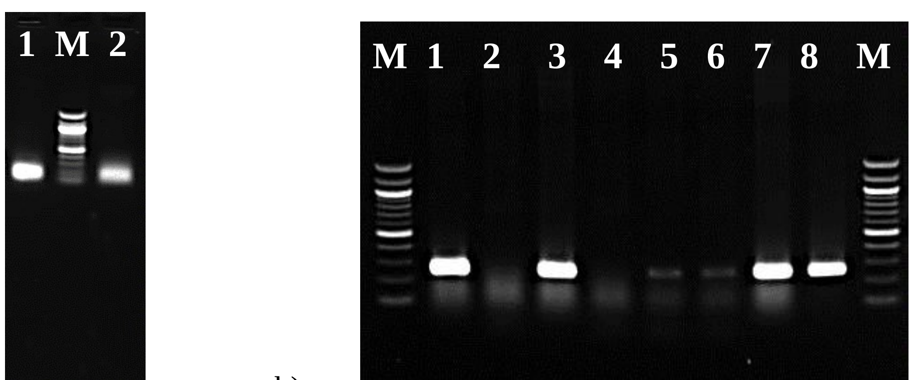
Fig. 1. Taken from Figure 5 in Shi et al. [4]. Nucleotide sequence of the promoter region of *GhMPK16*. The predicted transcription initiation site is indicated (+1, A). The start codon is marked with an asterisk, and the putative core promoter consensus sequences (TATA-box and CAAT-box) are highlighted in grey. The putative *cis*-acting elements are indicated by boxes and their corresponding names are given above each element. Arrows indicate the direction of the *cis*-element. Box-W1 is a fungal elicitor responsive element, ERE is an ethylene-responsive element, the MBS binding site is involved in gene induction in response to drought-inducibility and the TCA-element is a *cis*-acting element involved in SA-responsive.

b. Development of CRISPR-Cas9 system for cotton

To construct the CRISPR-Cas9 system to delete the MBS box in *Gossypium hirsutum*, the plasmid HBT-pcoCas9 which harbors the plant codon–optimized Cas9 gene under the hybrid constitutive 35SPPDK promoter was used as the mother vector [5]. The 352 bp fragment containing the U6 polymerase III promoter and 20 nt sequence (5'CAATTTATATAATTCCAGTT-3') targeting on the MBS box region, was amplified from pUC119-gRNA using primers YW1759 and YW1760 (Table 1; Lane 1, Fig. 2a). Primers YW1761 and YW1762 were used to amplify the 175 bp fragment (Lane 2, Fig. 2a) containing the 20 nt targeting sequence with the terminator. Then the whole sequence, including the promoter, 20nt sequence, and the terminator was amplified using YW1759 and YW1762 through SOE (Splicing by Overlap Extension), and was inserted into the *Eco*RI site of HBT-pcoCas9 through Gibson Assembly. Positive plasmid was verified through colony PCR (cPCR) and named as pCotton1 (Lanes 1, 3, 7 and 8, Fig. 2b).

Table 1 Primers used in this study.

Primers	Sequence (5'-3')
YW1759	GATGATAAGCTGTCAAACATGAGAATTCAGAAATCTCAAAATTCCG
YW1760	AACTGGAATTATATAAATTGAATCACTACTTCGTCTCT
YW1761	CAATTTATATAATTCCAGTTGTTTTAGAGCTAGAAATAGC
YW1762	GAAACAGCTATGACCATGATTACGAATTCTAATGCCAACTTTGTACA

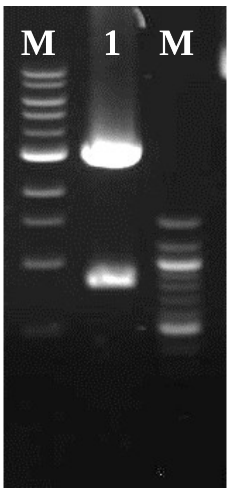


a) b)

Fig. 2. Construction of plasmid pCotton1. a) Amplification of fragment containing the promoter and the 20 nt targeting sequence (Lane 1) and the fragment containing the 20 nt sequence with the terminator (Lane 2); b) Positive plasmid verification through colony PCR.

Genetic mutations in plants can be introduced through the non-homologous end-joining (NHEJ) or homology directed repair (HDR) by providing a DNA editing template [6]. Higher repair efficiency was observed with NHEJ than HDR in *Arabidopsis* [5]. pCotton1 was designed as the system to obtain mutants through NHEJ. To compare the efficiency between NHEJ and HDR in cotton, another plasmid pCotton2 was also constructed with the insertion of a repairing template into the plasmid. The upstream and downstream homology sequences flanking the targeting sequence were synthesized by Genscript (Piscataway, NJ) in pUC57. The 790 bp homology sequence (Fig. 3a) was amplified from pUC57, and inserted into the *Pst*I site of pCotton1, generating pCotton2. The construct of pCotton2 was further verified with digestion using *Pst*I (Fig. 3b).

a)



b)

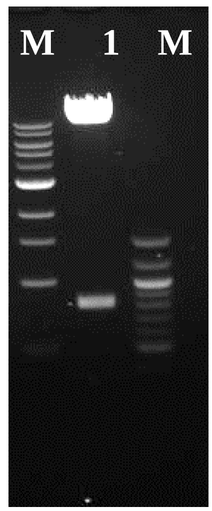


Fig. 3. Construction of plasmid pCotton2. a) Digestion of pUC57 using *Pst*I (Lane 1); b) Digestion of pCotton2 using *Pst*I (Lane 1).

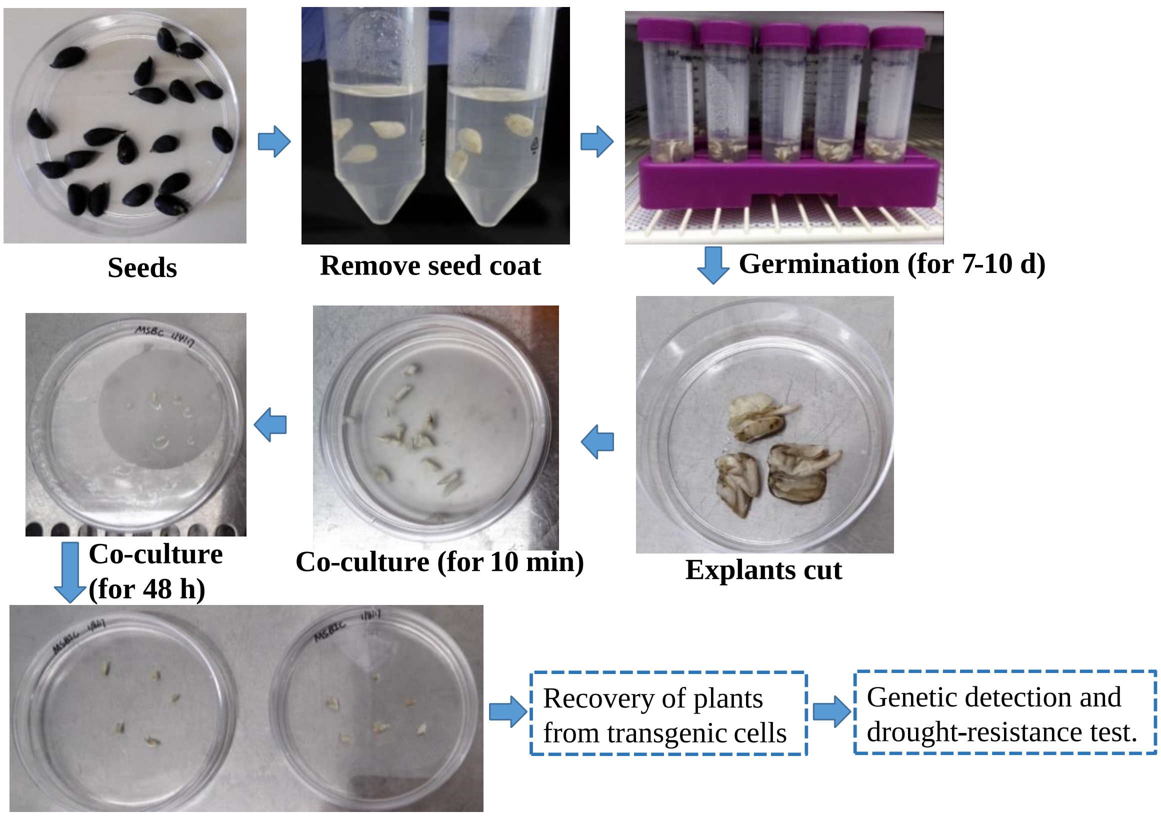
1.2. Develop transgenic cotton varieties with enhanced drought tolerance using the developed CRISPR-Cas9 system.

The developed CRISPR-Cas9 system was transformed into cotton through *Agrobacterium*mediated transformation as described by Zhang [7]. Before co-culturing of cotton explants with *Agrobacterium*, seed coats were manually removed. Then the seeds were sterilized and cultured for germination for 7-10 days under a '14-h day/10-h night' cycle at 28 ^{o}C. After that, the cotyledons and hypocotyls were cut into small segments of 5-7 mm for co-culturing with *Agrobacterium*. While waiting for the seed germination, the plasmid pCotton1 and pCotton2 were respectively transformed into *Agrobacterium* EHA105 through electrophoresis (2,500 V, 400 Ω, 25 uF, within a 0.2 cm cuvette). Single colonies from Luria broth (LB) plates containing rifampicin and ampicillin were picked and cultivated in liquid medium for 24 h.

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

2. Plan for the next step

Now, we developed the CRISPR-Cas9 system for cotton, and we carried out the transformation with *Agrobacterium* to obtain the transgenic cell lines. Next, we will continue the work as proposed to recover the plants from transgenic cells and characterize the genotype of the transgenic plants. Furthermore, we will characterize the transgenic variety for their drought resistance.



Induction and selection of stable transgenic cell lines

Fig. 4. Development of transgenic cotton varieties through co-culturing with *Agrobacterium* harboring the developed CRISPR-Cas9 system.

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8.

II. Cultural Management

Continued Support of Long-term Crops Research

D. P. Delaney, K. Balkcom, and T. Cutts

The “Old Rotation” experiment (circa 1896) is the oldest, continuous cotton study in the world and the third oldest field crops experiment in the U.S. on the same site. With the renewed interest in cover crops, we believe that this is the oldest “cover crop” study in the U.S. and it is beginning to get more international attention. Many students at Auburn are using this study for special-problems research, as well as graduate students from other Universities in Alabama, while soils from the Old Rotation have been shared with researchers in Ohio, Louisiana and Texas.

Corn and cotton yields reflect soil moisture and N availability more than any other factors. There was a response to irrigation in 2016 by cotton, corn and soybean. Wheat always follows corn and soybean is double-cropped behind wheat. Wet spring weather contributed to delayed planting of summer crops, while extremely hot and dry late summer weather contributed to lower yields for later planted crops, esp. double-cropped soybeans.

Six soil moisture monitors were installed and monitored again in 2016 to optimize irrigation amounts and timing. A camera overlooking the Old Rotation allows visitors to the Old Rotation web site to view a live image of crops growing on the Old Rotation.
http://cses.auburn.edu/old-rotation/live-cam/

Crop yields on the OLD ROTATION in 2016.											
Plot No.	Description	Clover dry matter* (lb/a)		Wheat (bu/a)	Corn (bu/acre)		Cotton lint (lb/acre)		Soybean (bu/acre)	
		Irrigated	Non-irrigated		Irrigated	Non-irrigated	Irrigated	Non-irrigated	Irrigated	Non-irrigated
1	no N/no legume	0	0				723	334		
2	winter legume	1764	3900				1389	798		
3	winter legume	1232	2549				1389	854		
4	cotton-corn	2066	2967				1690	1014		
5	cotton-corn + N	1388	3203				1342	1023		
6	no N/no legume	0	0				685	404		
7	cotton-corn	1271	2901		44.3	65.5				
8	winter legume	1140	2665				1333	967		
9	cotton-corn + N	1597	2370		178.8	74.6				
10	3-year rotation	-	-	45.6*					50.3	25.9
11	3-year rotation	0	0				1183	835		
12	3-year rotation	3039	3217		188.7	73.5				
13	cont. cotton/no legume, +N	0	0				798	826		
	Mean	1687	2971		137.3	71.2	1170	784		
*Winter legume and wheat ares not irrigated. Average total N fixed by legume is 60 lb. N/acre.										

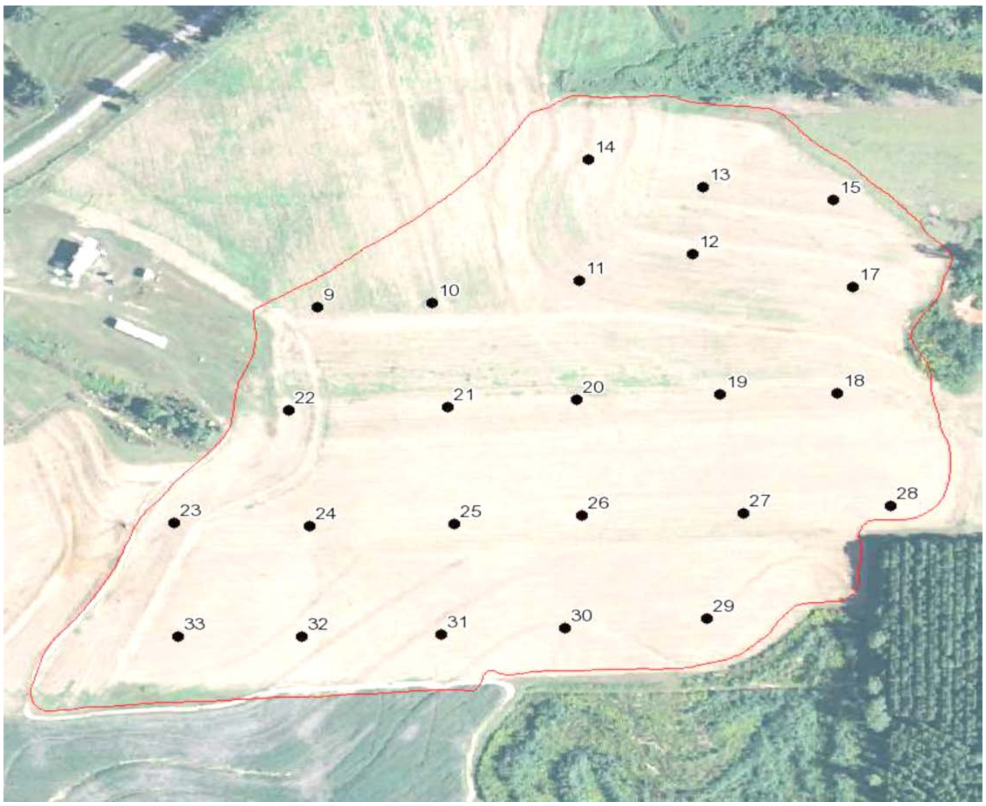
On-Farm Grid Soil Sampling Demonstration for Variable Rate Nutrient Applications in Cotton Systems

B. A. Dillard, J. Kelton, R. Yates, C. Hicks, T. Sandlin, K. Wilkins

Variable-rate (VR) fertilizer and lime applications in cotton production are being utilized throughout Alabama due to the economic benefits for growers using this technology. VR applications can increase yield uniformity across a field, reduce total amounts of material being applied, and, ultimately, lead to higher profit returns. To implement variable-rate applications on-farm, it is necessary to know in-field soil variabilities that traditional soil sampling techniques cannot provide. Grid soil sampling within a field can allow for the development of a prescription map to tailor nutrient applications to site-specific needs rather than uniform applications across a field. Most growers that adopted some type of VR applications have relied on a third party to sample fields; however, the added costs of this service can make it impractical for some producers, particularly smaller operations. With easier technology and grid soil analysis offered through the Auburn University Soils Lab, growers now have the ability to sample their own fields which can reduce costs for adopting VR applications. The objective of this project is to demonstrate to growers effective sampling methods for implementing grid soil sampling to allow for site-specific nutrient applications.

There is a need for reduced input costs for Alabama cotton production in order for the state's growers to continue to be profitable. Using variable rates for fertilizer and lime applications within a field can reduce overall production costs while maximizing yield potentials. Use of grid soil sampling can be an expensive initial investment but with net savings in inputs during the season. Growers who choose to grid soil sample themselves can reduce some of these upfront costs while still being able to utilize VR applications. By demonstrating to producers how they can implement grid sampling, we expect to see an increase in VR adoption, increase in cotton yield, and reduced inputs of fertilizer and lime for those fields using variable-rate applications.

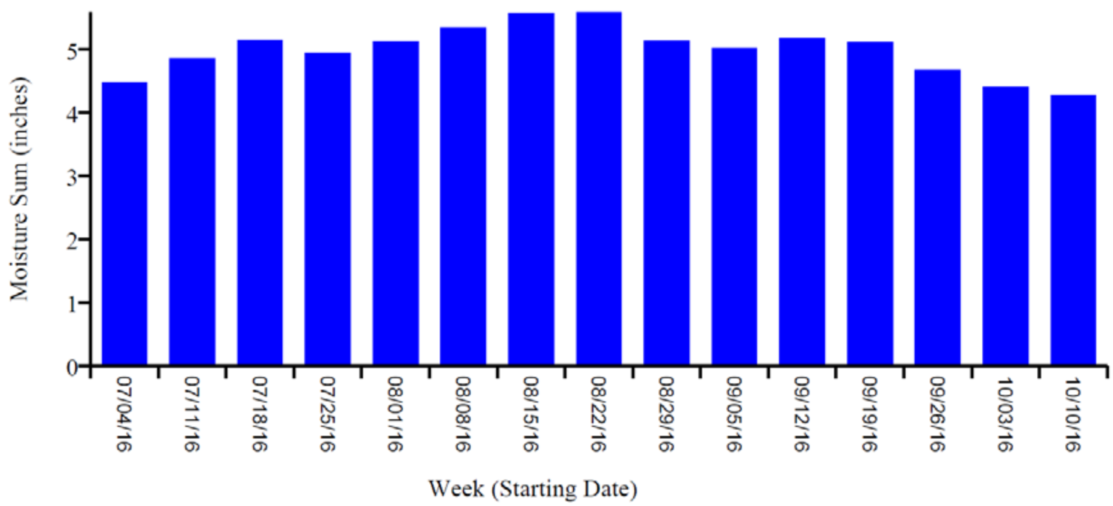
In 2016, we were able to conduct one demonstration of grid soil sampling through the Auburn University Soils Lab. With the money provided by the Alabama Cotton Commission, we were able to pay the MapShots set up fee with the AU Soils Lab. This paid fee saves each farmer $300 that submits precision soil samples. In 2017, Dr. Ortiz is conducting 2 demonstrations, one at E.V. Smith and one at the Wiregrass Research and Extension Center. Also in 2017, we plan on having 2 on farm demonstrations. In the state.

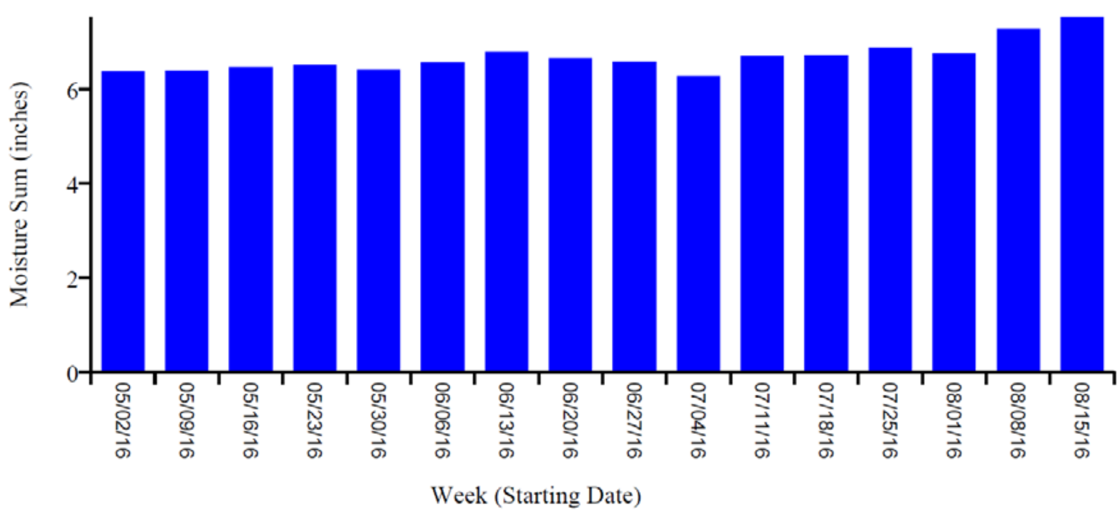


Comparison of On-Farm Irrigation Scheduling Practices in Southeast Alabama Crop Production

B. A. Dillard, J. Kelton, and A. Bouselm

The objective for the first year was to "blind fold" the farmers and evaluate their irrigation practices by the data from the soil moisture probes. In 2017, we will be conducting research at the Wiregrass Research & Extension Center to compare different irrigation scheduling methods while monitoring them with soil moisture probes. We will also be back onto the farms with these probes to compare farmers from last year to this year with using the moisture probes.





III. Disease Management

Potassium Rate and Source Effect on Target Leaf Spot

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

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

Methods

As part of a regional effort, an experiment was conducted at the EV Smith Field Crops Unit under irrigation with varying application methods and rates of potassium applied pre-plant. The 10 treatments in the trial included factorial combinations of five rates of K (0, 40, 80, 120, or 160 lb/A) and two application methods (liquid K injected 6-8 inches deep and 4 inches away from the seed furrow, or dry K surface broadcast) applied 3 weeks before planting. Soil samples were taken in increments from 0-6, 6-12, and 12-24 inches before K application and sent to a central lab for testing.

PHY 499WRF was planted in 36-inch rows in mid-May and managed under irrigation for high yields with lush growth conducive to Target Spot infestation. Stand counts and early season vigor measurements were taken. Leaf samples were taken at First Bloom + 2 weeks and sent to a central lab for analysis. Ratings were taken of Target Spot when severe enough to rate. At maturity, measurements were taken of first fruiting branch, total nodes, plant height and nodes above cracked boll. After defoliation, cotton was harvested and weighed, followed by ginning of samples, with turnout and seed weights recorded. Lint samples were sent for Cotton Incorporated for quality analysis.

Results

Although pre-application soil samples showed K levels rated in the Low to Very Low Ranges, there were no differences in yield ($p < 0.10$) noted between the different K application rates or methods, with lint yields averaging 1135 lb/A for the trial.

Significant differences were noted for seedling Vigor, with the 120 lb/A K treatment slightly less vigorous than the 40 lb rate. There was a small but statistically significant interaction of K rates and placement with no clear trend (0.42 – 0.44) for lint turnout. Broadcast dry K applications increased micronaire vs deep liquid (4.41 vs 4.26), while increasing rates also increased micronaire (40 lb K = 4.20 vs 160 lb K = 4.43).

There were also no significant differences noted for Target Spot ratings, early defoliation, or lint length, strength or uniformity, but there were small but significant differences for lint color noted.

Potassium Rate Effects on Leaf Spots and Yield

C. Hicks, B. Dillard, K. Wilkins, W. Birdsong, M. Runge, G. Harris

The objective of this study was to determine the best potassium rates for two new cotton cultivars, DeltaPine 1646 B2XF and Phytogen 444 WRF. Fiber quality data, petiole potassium percentage and leaf spot ratings were also taken. The study was conducted at the following Auburn University Research Stations: Tallassee, Prattville, Brewton, Headland and Fairhope. Soil samples were taken at each location before planting. Tests were replicated four times in randomized complete blocks. Potassium source was 0-0-60 and the foliar potassium source was KNO_3. Foliar potassium applications were made the first and third weeks of bloom at 5 lbs K/acre. Petiole samples were taken one week after the last foliar application.

Table 1. Lint Yields lb/acre by Treatment

Location	1/2 Soil Test Rate		Soil Test Rate		Soil Test Rate plus two foliar app		2X soil test rate		2X soil test rate split	
Brewton	1305	a	1348	a	1350	a	1322	a	1233	a
Fairhope	1341	b	1492	ab	1459	ab	1691	a	1667	a
Prattville	1001	a	1006	a	1044	a	1021	a	960	a
Headland	1685	a	1643	a	1701	a	1740	a	1569	a

**Numbers in the same row with the same letter are not significantly different.*

Table 2. Fiber Quality by Treatment

Treatment	MIC	LEN	STR	UNIF
½ Soil Test Rate	4.10667 a	1.193333 a	30.4567 b	83.7967 ab
Soil Test Rate	4.15667 a	1.197000 a	30.9100 ab	83.6433 b
Soil Test Rate + 2 Foliar App	4.06667 a	1.197667 a	30.7300 ab	84.1500 ab
2X Soil Test Rate	4.19000 a	1.197667 a	31.1467 a	84.3433 a
2X Soil Test Rate in Split App	4.18667 a	1.192333 a	31.0667 ab	83.9800 ab

**Numbers in the same row with the same letter are not significantly different.*

Table 3. Fiber Quality by Variety

Variety	MIC	LEN	STR	UNIF
PHY 444	3.81200 b	1.201600 a	32.0240 a	84.5960 a
DP 1646	4.47067 a	1.189600 b	29.7000 b	83.3693 b

**Numbers in the same column with the same letters are not significantly different.*

Figure 1. Petiole percent by variety.

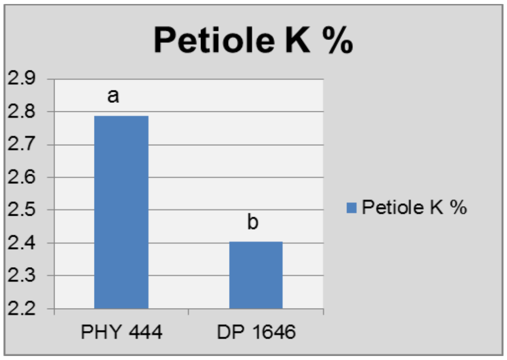
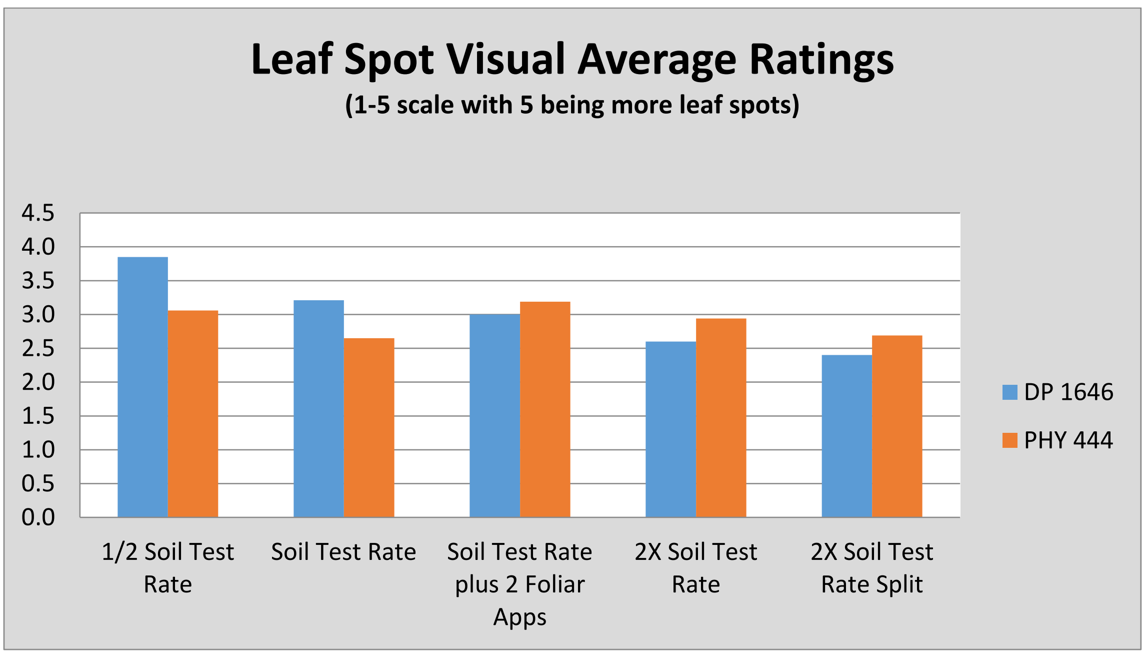


Table 4. Plant, Harvest Date and K rates used.

Location	Plant Date 2016	Harvest Date 2016	Soil Test Recommended K Rate used
Brewton	May 5	Oct 5	120 lbs
Fairhope	May 9	Sept 29	120 lbs
Prattville	May 10	Nov 7	40 lbs
Headland	May 6	Oct 20	140 lbs
Tallassee	May 13	Sept 23	100 lbs

Figure 2. Visual Leaf Spot Ratings.



Summary

Fairhope was the only location with a significant lint yield difference. The 2X soil test rate and 2X soil test rate in split applications resulted in significantly higher lint yields than the ½ soil test rate at Fairhope. No other differences for lint yield were seen among treatments or variety. Percent petiole K was not significant by treatment, but Phytogen 444 WRF had significantly higher percent of petiole potassium than DeltaPine 1646 B2XF. Further investigation is needed to detect any yield response by treatment across environment.

Evaluation of Commercial Cotton Cultivars for Resistance to Fusarium Wilt and Root-knot Nematode, 2016

K. S. Lawrence, K. Glass, D. Monks

Fourteen cotton cultivars were evaluated for resistance to Fusarium wilt and Root-knot nematodes at the Plant Breeding Unit near Tallassee, AL on a Kalmia loamy sand (80% sand, 10% silt, 10% clay). The field has a history of continuous cotton production and natural infestations of the causal agents of Fusarium wilt (*Fusarium oxysporum* f. sp. *vasinfectum*) and root-knot nematode (*Meloidogyne incognita*). Plots consisted of one row with 1m row spacing, four replications, and rows were 6 m long with 3 m alleys. Sixteen commercially available cotton varieties commonly grown in the region were tested for resistance or tolerance to Fusarium wilt and the root-knot nematode and compared to a susceptible check Rowden and a resistant check M-315. Fertilizer and pesticide management practices were applied as necessary according to the Alabama Cooperative Extension System recommendations. The trial was planted 1 June. Four disease incidence evaluations were made throughout the growing season on July 13, July 27, August 17, and Sept. 1. Root-knot egg counts were obtained from three whole root systems per plot at 63 DAP. Plots were harvested 11 Nov. Data were analyzed by ANOVA using PROC GLIMMIX with SAS 9.4 (SAS Institute, Inc., Cary, NC) and means compared with Tukey's HSD test at the alpha ≤ 0.05 level.

Fusarium wilt incidence ranged from 0.9 to 56 % for the two control M-315 resistant and the susceptible check Rowden, respectively. All varieties were statistically similar to the resistant check, M-315, although ST 6182 GLT did support the most Fusarium wilt of the commercial varieties available to producers. Root-knot nematode eggs ranged from 345 on the resistant check to 2758 eggs on the Americot NG 3522 B2XF which was a larger population than the susceptible check Rowden supported. Although no statistically significant differences were identified between varieties, there is a broad range of egg reproduction factors. Root-knot nematode eggs per gram of root fresh weight ranged from 23.7 per gram in the resistant check to 159.5 eggs per gram in Americot NG 3522 B2XF with the greatest eggs/g root. Seed cotton yields among varieties were very low in the non-irrigated field. Ranking the cotton yields indicted PHY 495 W3RF produced the highest yield followed by ST 6182 GLT, DP 1614 B2XF, Americot NG 3522 B2XF, PHY 552 WRF, and ST 4848 GLT.

Table 1. Commercial cotton variety response to Fusarium wilt and *Meloidogyne incognita* nematode in central Alabama, 2016.

	Meloidogyne incognita[y]		Fusarium wilt		Seed cotton yield
Variety	Eggs total	Eggs/ g root	% incidence		lb/A
DP 1553 B2XF	623	35	6.3	b	1002
DP 1614 B2XF	1355	82	9.2	b	1394
DP 1639 B2XF	1480	59	7.9	b	327
DP 1646 B2XF	732	44	4.2	b	1002
ST 4848 GLT	1030	80	9.9	b	1242
ST 6182 GLT	868	67	17.3	b	1634
DynaGro DG 3526 B2XF	1001	61	9.2	b	1212
Americot NG 3522 B2XF	2758	160	7.2	b	1300
PHY 312 WRF	737	35	2.3	b	951
PHY 444 WRF	1005	35	5.2	b	1176
PHY 552 WRF	704	48	8.2	b	1242
PHY 495 W3RF	650	60	7.1	b	1822
Rowden	1409	113	56.5	a	755
M-315	435	24	0.9	b	276

[z]Observations followed by the same letters within a column are not significantly different.

[y]Data were analyzed by ANOVA using PROC GLIMMIX with SAS 9.4 (SAS Institute, Inc., Cary, NC) and means compared with Tukey’s HSD test at the α≤0.10 level.

Verticillium Wilt On-farm Cotton Cultivar Evaluations, 2016

K. S. Lawrence, B. Meyer, T. Raper, T. Cutts, T. Sandlin, and C. Burmester

Twenty-four cotton cultivars were planted and evaluated for resistance to *Verticillium dahliae*. The trial was planted on the Tate farm in northern Alabama. Plots were one row each, approximately 500 feet long and replicated 4 times. The field was irrigated with a drip tape irrigation system. Disease ratings were taken September 16. In 10 ft sections of in each plot, total number of plants were determined, and stems were cut longitudinally to assess disease incidence. Disease severity ratings of foliar symptoms were evaluated on a scale from 1 to 5 with 1= no foliar wilting, 3= interveinal chlorosis and necrosis of the leaves, and 5=completely defoliated plants. The trial was harvested on 11 Nov. Analysis of variance was conducted using SAS 9.4 (SAS Institute), and means were compared using Tukey-Kramer Honest Significant Difference (HSD) ($\alpha \leq .10$).

Verticillium wilt pressure was moderate to high during the 2016 season with 37 to 81% Verticillium wilt present in each plot. The cultivars with the lowest incidence of Verticillium wilt were PHY 243 WRF and ST 4747 GLB2 with the 5 and 11% of the plants infected with Verticillium. ST 4747 GLB2 was the cultivar with the lowest disease severity (<2) rating in the last three years of testing. This year PHY 243 WRF, PHY 223 WRF, and PHY 308 WRF, were the three cultivars with severity ratings significantly less than and ST 6182 GLT and similar to our standard resistant cultivar ST 4747 GLB2. These three PHY cultivars and the ST 4747GLB2 yielded up to 35% higher than the most susceptible ST 6182 GLT low yielding cultivar. ST 4747 GLB2, PHY 312 WRF, PHY 333 WRF, and PHY 499 WRF all produced yields over 3400 lb/A.

Table 1. Commercial cotton variety response to *Verticillium dahliae* on the Tate farm in northern Alabama, 2016.					
Cultivar	Disease incidence[x]		Disease severity[y]		Seed cotton lb/A
CROPLAN X1516 B2XF	41	a-d [z]	2.3	ab	2773
CROPLAN 3885 B2XF	69	a	2.8	ab	2087
DP 1612 B2XF	50	abc	2.8	ab	3375
DP 1614 B2XF	38	a-d	2.9	ab	2999
DP 1518 B2XF	26	a-d	1.9	ab	3368
DP 1522 B2XF	33	a-d	2.3	ab	3409
DPLX 15R513 B2XF	21	a-d	2.5	ab	3360
DPLX 15R535 B2XF	28	a-d	2.0	ab	3327
DPLX 16R225 NRB2XF	30	a-d	2.1	ab	2779
PHY 223 WRF	25	a-d	1.8	b	3169
PHY 243 WRF	5	d	1.7	b	3408
PHY 308 WRF	16	bcd	1.8	b	2882
PHY 312 WRF	17	a-d	2.6	ab	3537
PHY 333 WRF	18	a-d	2.5	ab	3452
PHY 339 WRF	26	a-d	2.0	ab	3328
PHY 444 WRF	32	a-d	2.6	ab	3520
ST 4747 GLB2	11	cd	2.0	ab	3594
ST 4946 GLB2	22	a-d	2.6	ab	3372
ST 4848 GLT	18	a-d	2.4	ab	2901
ST 4949 GLT	27	a-d	2.4	ab	2995
ST 5032 GLT	22	a-d	2.5	ab	3192
ST 5115 GLT	35	a-d	2.7	ab	3093
ST 6182 GLT	59	ab	3.7	a	2308
ST 1776 GLT	41	a-d	3.0	ab	2826
[x] Disease incidence is the percent number of plants with vascular discoloration in a 10 ft of row.					
[y] Disease severity ratings ranged from 1-5 with 1 = no disease or foliar wilting, 3 = interveinal chlorosis and necrosis of the leaves with 40-60 % defoliation and 5 = 70 -100 % defoliation.					
[z] Column numbers followed by the same letter are not significantly different at *P*=0.1 as determined by the Tukey-Kramer method.					

Fungicide Treatments to Combat Seedling Disease in North Alabama, 2016

D. Dyer, K. S. Lawrence, S. Till, D. Dodge, W. Groover, N. Xiang, and M. Hall

Six fungicides treatments were tested for their ability to control seedling disease on cotton caused by *R. solani*. This test was conducted at Auburn University's Tennessee Valley Research and Education Center, which is located near Belle Mina, AL. This field has been planted to cotton for over 16 years. The field contains a Decatur silt loam soil type with consist of 24% sand, 49% silt, and 28% clay. All treatments were applied to the cotton as seed treatments and the cotton variety used during the test was NexGen 3406 B2XF. Base fungicide treatments consisted of Metalaxyl, Fludioxonil, and Myclobutanil. Premium fungicide treatments consisted of Metalaxyl, Difenoconazole, Myclobutanil, and Azoxystrobin. Metalaxyl, Difenoconazole, Myclobutanil and Fludioxonil are products of Albaugh LLC, Ankeny, Iowa. This test was planted on the 19th of April, planting depth was 2.5 cm and the soil temperature at the time of planting was 25°C. *R. solani* inoculum was applied to the test at the time of planting. Each test plot consisted of 4 rows that were 7 m long with a row spacing of 1-meter, the test replicated 5 time and arranged in a randomized complete block design. The test was maintained throughout the season with standard insecticide, herbicide, and fertilizer practices recommended by the Alabama Cooperative Extension System. Test plots were watered as needed through the use of a lateral irrigation system. Plant stands were determined by counting the total number of seedlings in the 7 meters of row. These counts were conducted at 15 and again at 30 days after planting (DAP). The test was harvested and yield data was collected on the 28 of September. Data was analyzed with SAS 9.4 using PROC GLIMMIX and LS-means were compared using Tukey's method ($P \leq 0.1$). Average monthly high temperatures for the area from the time of planting until harvest were 24, 27, 34, 34, 33, and 33°C and average monthly low temperatures were 11, 15, 21, 22, 22, and 18°C. The average high temperature through the growing season was 31°C which is normal for area. Rainfall accumulation for each month during the growing season was 8.43, 3.45, 4.06, 6.93, 12.73, and 0.30 centimeters with a total rainfall amount of 35.91 cm.

The average plant stand 15 DAP for the non-inoculated plots was 73 and average stand for plots inoculated with *R. solani* was 64. Both the inoculated and non-inoculated plots were within the optimal range of 8-12 plants per meter of row at 15 DAP. The average plant stand counts at 30

DAP were 69 for the non-inoculated plots and 62 for the plots inoculated with *R. solani*. Both the inoculated and non-inoculated plots were within the optimal range of 8-12 plants per meter of row at 30 DAP. The highest stand counts occurred in the treatment of base fungicide + premium fungicide + Biost Nematicide for both inoculated and non-inoculated plots. This three-way combination treatment supported a greater stand than the untreated control and base fungicide in the natural disease incidence plots and, the base fungicide + premium fungicide + SAR, and the Base fungicide + Vibrance CST in the inoculated plots. In the non-inoculated plots, the treatment of base fungicide + premium fungicide and the base fungicide + premium fungicide + SAR supported the highest yield producing 584 and 581 kg per ha more than the control. In the inoculated plots the highest yield was shown in the base fungicide and the base fungicide + premium fungicide + SAR treatment which produced 37 and 54 kg per ha more than the control.

	Stand 15 DAP [x]				Stand 30 DAP				Seed cotton yield kg/ha			
Treatment	Non-inoculated		Inoculated		Non-inoculated		Inoculated		Non-inoculated		Inoculated	
Untreated	73	ab [w]	60	a	66	b	61	bc	4508	ab	4234	ab
Base fungicide [z]	74	ab	68	a	66	b	66	ab	4718	ab	4271	a
Base fungicide Bio ST VPH	78	a	65	a	71	ab	63	abc	4396	b	4197	ab
Base Fungicide Premium Fungicide [y]	75	a	65	a	71	ab	68	ab	5092	a	4237	ab
Base Fungicide Premium Fungicide SAR	66	b	62	a	70	ab	54	c	5089	a	4288	a
Base Fungicide Vibrance CST	73	ab	64	a	68	ab	54	c	4284	b	4101	a
Base Fungicide Premium Fungicide BioST Nematicide	73	ab	66	a	74	a	71	a	4624	ab	3898	b

[z] Base fungicide treatments consisted of Metalaxyl, Fludioxonil, and Myclobutanil.
[y] Premium fungicide treatments consisted of Metalaxyl, Difenoconazole, Myclobutanil, and Azoxystrobin
[x] Total number of plants in a 7-meter row.
[w] Means followed by the same letter do not significantly differ according to Tukey's method ($P \leq 0.1$)

An Evaluation of Fungicide Combinations for Cotton Seedling Disease Management in North Alabama, 2016

M. Foshee, K.S. Lawrence, N. Xiang, W. Groover, S. Till, D. Dodge, D. Dyer, M. Hall

Seed treatment fungicides were evaluated for the management of cotton seedling disease at the Tennessee Valley Research and Education Center in Belle Mina, AL. The field had a history of cotton seedling disease and was naturally infested with *Rhizoctonia solani*, *Pythium* spp., and *Thielaviopsis basicola*. The soil type was a Decatur silt loam (24% sand, 49% silt, 28% clay). Plots were planted on 19 Apr with a soil temperature of 64°F at a 10 cm depth and adequate soil moisture. Plots consisted of 2 rows, 7.6 m long with 1.0 m 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. Plots were irrigated with a sprinkler system as needed. Seedling stand was determined 29 days after planting (DAP). Plots were harvested on 10 Oct. Data was analyzed using the SAS 9.4 program and means compared using Fisher's protected least significant difference test ($P \leq 0.10$). Monthly average maximum temperatures from planting in Apr through harvest in Oct were 72, 80, 88, 91, 91, 85, and 75°F with average minimum temperatures of 45, 55, 63, 66, 64, 57, and 46°F, respectively. Rainfall accumulation for each month was 4.4, 4.8, 4.3, 3.9, 3.3, 3.9, and 3.4 cm with a total of 28 cm over the entire season. The rainfall was adequate in July and Sept. but very dry in August.

Seedling disease pressure was moderate in 2016 due to precipitation and moisture being normally distributed. Plant stand at 29 DAP was highest for the RTU-Baytan-Thiram + Allegiance FL + Gaucho 600 when compared to the industry standard Allegiance FL + Gaucho 600 and the untreated control, but did not differ from treatments 1, 2, 3, 5, 6, 7, 8, 10, and 11. Plant stands were good ranging from 3.5 to 2.3 plants per foot of row. *Rhizoctonia solani*, *P. ultimum*, and *Fusarium* spp. were isolated from the diseased seedlings. Seed cotton yields were very good and similar between all fungicides. Eight of the twelve treatment plots had higher yield than the nontreated plots. Yields varied by 716 lb/ac at harvest with an average of 464 lb/ac increase of seed cotton produced over all the fungicide treatments as compared to the nontreated control.

Fungicide seed treatment	Rate (oz/cwt)	Stand/ 25 ft row[z,y]	Seed cotton (lb/ac) [y]
1. Apron XL + Maxim 4 FS + Systhane WSP + A21606B + Gaucho 600	0.31 + 0.08 + 0.84 + 3.33 + 12.8 oz/cwt	60a	3803
2. Apron XL + Maxim 4 FS + Systhane WSP + A21606B + Gaucho 600	0.31+ 0.08 + 0.84 + 4.08 + 12.8 oz/cwt	52ab	4173
3. Allegiance FL + EverGol Prime + Spera + Vortex + Gaucho 600	0.75 + 0.33 + 1.8 + 0.08 + 12.8 oz/cwt	58ab	3463
4. Allegiance FL + EverGol Prime+ Spera 240 FS + L1979-A + Gaucho 600	0.75 + 0.33 + 1.8 + 0.15 + 12.8 oz/cwt	40b	3684
5. Allegiance FL + EverGol Prime + Spera 240 FS + L1979-A + Gaucho 600	0.75 + 0.33 + 1.8 + 0.3 + 12.8 oz/cwt	54ab	3552
6. Allegiance FL + EverGol Prime + Spera 240 FS + L1979-A + EverGol Energy + Gaucho 600	0.75 + 0.33 + 1.8 + 0.3 + 1.0 + 12.8 oz/cwt	52ab	3752
7. Albaugh Premium Fungicide Nematicide Overtreatment + Gaucho 600	1.9 + 11.3 + 12.8 oz/cwt	58ab	3909
8. Albaugh Premium Fungicide Overtreatment + Gaucho 600	1.9 + 5.25 + 12.8 oz/cwt	51ab	4179
9. RTU-Baytan-Thiram + Allegiance FL + Gaucho 600	3.0 + 0.75 + 12.8 oz/cwt	62a	4050
10. Vitavax-PCNB + Allegiance FL + Gaucho 600	6.0 + 0.75 + 12.8 oz/cwt	50ab	3868
11. EverGol Prime + Gaucho 600	0.64 + 12.8 oz/cwt	48ab	4011
12. Allegiance FL + Gaucho 600	1.5 + 12.8 oz/cwt	44b	3493
13. Nontreated	--	50ab	3715
14. Range Trial Averages	--	52	3819

[z]Stand was the number of seedlings in 25 feet of row at 29 days after planting.
[y]Means followed by same letter do not significantly differ according to Fishers LSD test ($P \leq 0.10$).

IV. Weed Management

Evaluation of Cotton Tolerance on Early Postemergence (EPOST) Applied Chloroacetamide Herbicides

J. A. Tredaway, and A. Price

A field study was conducted at the Prattville Research Station in Prattville, AL to evaluate EPOST applications of Dual Magnum, Outlook, and Warrant. Liberty Link (LL) Stoneville 4848 variety was planted. Dual Magnum was applied at a rate of 21 fl. oz./A, Outlook at 12 fl. oz./A and Warrant at 48 fl. oz./A to cotton in the 4-leaf stage. Herbicide induced cotton injury was evaluated on a scale of 0-100% with 0 = no injury and 100% = total plant death. Herbicide injury evaluations were conducted on 7, 14, 21, and 28 days after treatment (DAT). Cotton injury was highest with Warrant at 7 and 14 dat. Injury was less than 10% with all three herbicides at the 28 DAT evaluation. Although injury ratings were higher for certain treatments, there were no differences in cotton yield across treatments. There was also no correlation between herbicide induced injury and cotton yield which suggests that injury caused by treatments was strictly visual and not affecting the growth of the cotton plant.

Cotton Growth Responses to Various Soil Herbicides Containing Fomesafen and Fluridone

S. Li

Fomesafen (Reflex 2SL) is a widely-used soil herbicide in cotton and soybean with excellent pigweed control efficacy. Despite of the occurrence of PPO resistance pigweed in several southern states, fomesafen is still recommended by many extension specialists and crop consultants for pre-emgernce (PRE) pigweed control. However, fomesafen injury on cotton has been a long-time concern being it is difficult to predict. Fluridone and fluridone-based products (Brake herbicides) are developed by SePro and have obtained registration in several cotton-growing states. They provide an alternative mode-of-action to control herbicide resistant pigweed and have shown promising results. However, the injury potential of fluridone-based products on cotton requires further evaluation in Alabama due to lack of data. Field trials were conducted at three (Shorter AL, Fairhope AL and Hawkinsville GA) in 2016 to evaluate cotton tolerance to 13 treatments containing different rates of fomesafen and fluridone-based products. Experimental design was RCBD with 4 replications. Thirteen treatments were evaluated and all of them were applied PRE within 3 days after planting.

Cotton stand was not significantly affected by herbicide treatments at Shorter and Fairhope at 20-26 days after planting (DAP), but this was not the case at Hawkinsville where 4X and 8X rates of fomesafen (64 and 128 oz/A Reflex), fomesafen + acetochlor (16 oz/A Reflex + 48 oz/A Warrant) and fomesafen + diuron (16 oz/A Reflex + 20 oz/A Direx) significantly reduced cotton stand as compared to non-treated control (NTC). Also, these four treatments reduced cotton seedling height at 20-26 DAP with most of the height reduction observed at Hawkinsville. Cotton injury varied from less than 10% to over 90% (figure 1), with 100% being completely dead; fomesafen at 2X, 4X and 8X rates produced more injury than other treatments. Fomesafen + acetochlor and fomesafen + diuron also caused unacceptable injury at Hawkinsville. At the end of the season, 4X and 8X rates of fomesafen reduced over 50% of cotton yield at Hawkinsville as compared to NTC, while 8X rate fomesafen reduced 40% yield at Shorter (Figure 2). These data suggested more cotton injury, stand count, height and yield reduction were found in

Hawkinsville where sand fraction was the highest among all locations. Higher rates of fomesafen tend to cause greater negative impact on cotton growth and yield. Meanwhile, fluridone-based products (Brake FX and F16) did not show any negative effect on cotton growth at any location in this study. Although results regarding fluridone-based products (Brake herbicides) are mostly positive and both Brake FX and F16 have been registered in Alabama, the high purchasing cost ($25/A for Brake F16 and $32/A for Brake FX) is the major obstacle for Alabama cotton farmers to use these herbicides in their production. More research will be conducted to evaluate variety tolerance to various soil herbicide treatments.

Figure 1. Cotton injury at 20-22 days after planting (100% being completely dead)

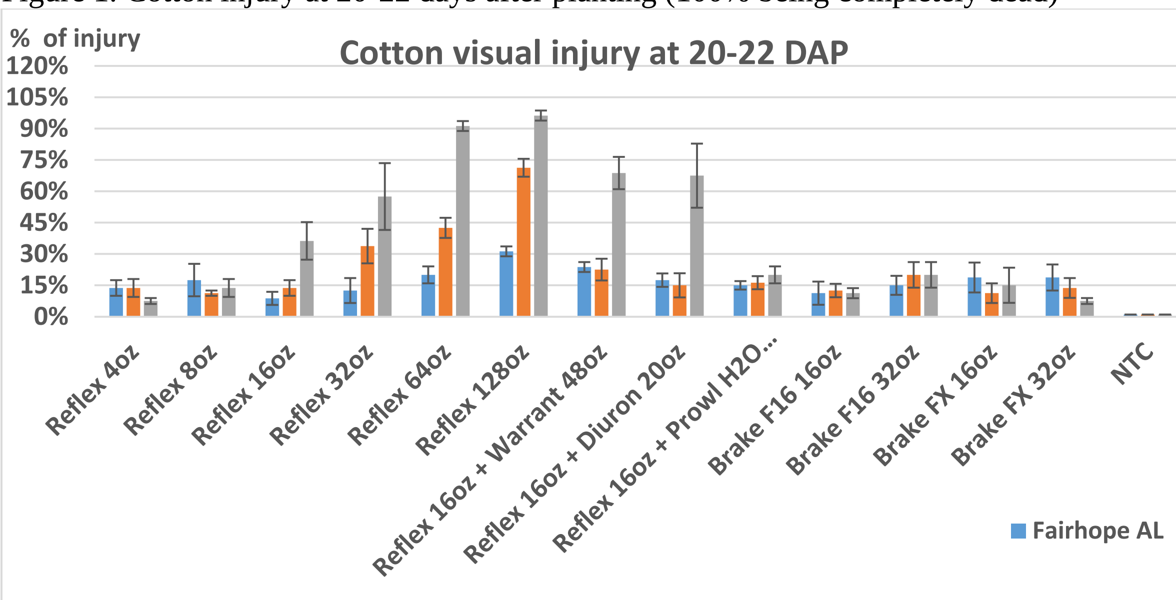
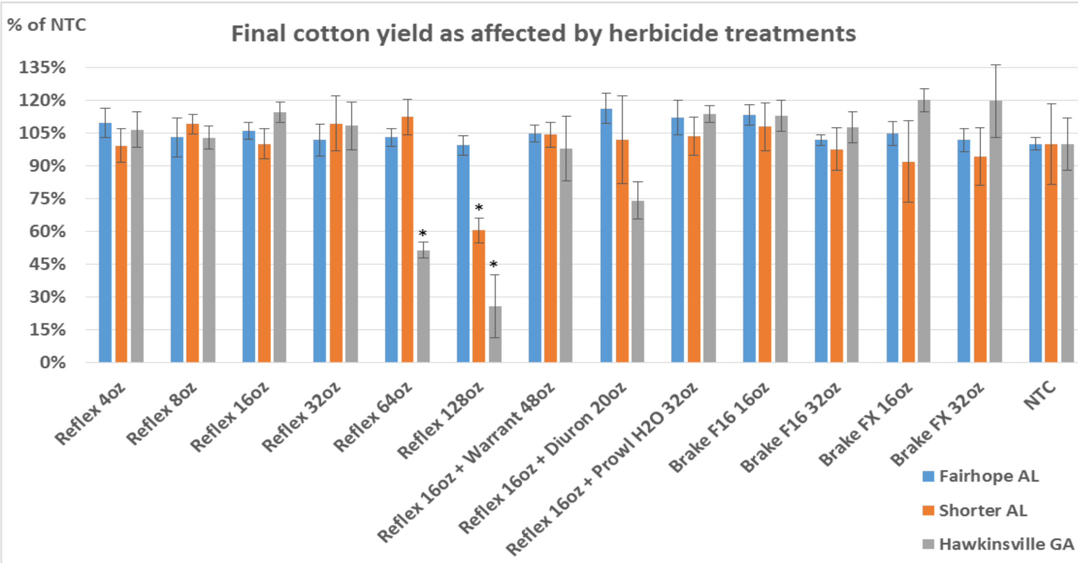


Figure 2. Cotton yield as affected by treatments containing fomesafen (Reflex) and fluridone. Asterrisk * indicates significant reduction as compared to non-treated control.


% of NTC
Final cotton yield as affected by herbicide treatments
135%
120%
105%
90%
75%
60%
45%
30%
15%
0%
*
*
*
Reflex 4oz
Reflex 8oz
Reflex 16oz
Reflex 32oz
Reflex 64oz
Reflex 128oz
Reflex 16oz + Warrant 48oz
Reflex 16oz + Diuron 20oz
Reflex 16oz + Prowl H2O 32oz
Brake F16 16oz
Brake F16 32oz
Brake FX 16oz
Brake FX 32oz
NTC
Fairhope AL
Shorter AL
Hawkinsville GA

Cotton Responses to 2, 4-D and Dicamba Applie Preemergence

S. Li

As of Jan 17, 2017, Xtendimax with vaporgrip (Monsanto), Enlist duo (Dow agrosciences) and Engenia (BASF) have been registered by EPA in US cotton and soybean. These new technologies will bring better options for Alabama farmers to control resistant and problematic weeds, such as pigweed, morningglory, sicklepod, horseweed, cuttleaf evening primose and groundcherry, etc. Field trials and demonstrations conducted by Steve Li's team haven shown 2,4-D and dicamba combined with glufosinate showed excellent growth suppression on very large pigweeds than current options. However, herbicide drift and off-target injury have been the greatest concern regarding using 2,4-D and dicamba in row crops. One specific risk farmers have to deal with is applying 2,4-D or dicamba very close to planting cotton to burndown existing weeds such as horseweed or marestail, then plant a wrong cotton variety that are not tolerant to 2,4-D or dicamba by error. This is likely to happen since only selected varieties in Deltapine and Phytogen product line are tolerant to these auxin herbicides. Moreover, if one used 2,4-D or dicamba to burndown existing weeds at planting, then crop stand is not acceptable, replanting variety with the same tolerance is required. If such tolerant variety is unavailable due to seed shortage, he may have to plant sensitive variety which may cause negative impact on crop growth. Therefore, experiment was conducted at Shorter, Fairhope and Jay FL to evaluate sensitive cotton responses to 2,4-D and dicamba residues in soil. Treatments included 2,4-D 1 pt/A and 2 pt/A applied 3-4 weeks before planting, 2,4-D 0.1 pt/A, 0.3 pt/A, 0.5 pt/A and 1 pt/A applied immediately after planting. All treatments were sprayed over soil surface and irrigated within 3 days of application.

Cotton stand at Fairhope was not affected by any of these treatments at 24 DAP, but in Shorter, 2,4-D 1pt/A applied at planting, dicamba 0.5 and 1 pt/A applied at planting reduced cotton stand as compared to NTC. Dicamba 1pt/A applied at planting reduced seedling height at Shorter 21 DAP. At 51 DAP, this treatment still reduced cotton height at Shorter when compared to NTC. Fairhope cotton height was not affected by herbicide treatments at 50 DAP. At the end of season, only dicamba 1 pt/A applied at planting reduced cotton yield at Shorter (Figure 3). No other treatment reduced cotton yield at Fairhope and Jay FL. The results of this study indicated high rates of dicamba have higher potential to injury cotton and cause yield reduction than 2,4-D, due to longer soil persistence (Figure 4). Therefore, more attention is needed after dicamba is applied to the soil immediately prior to or at planting to prevent cotton injury caused by planting error.

Figure 3. Cotton yield as affected by 2,4-D and dicamba residues in soil at three locations. Asterisk * indicated significant lower than NTC.

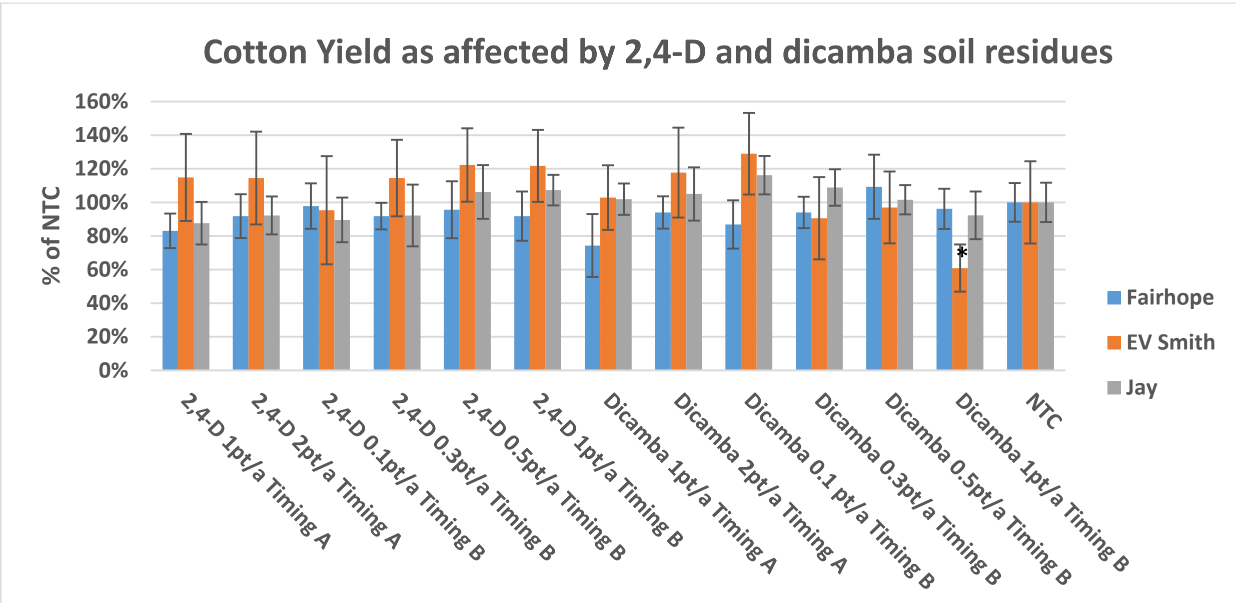
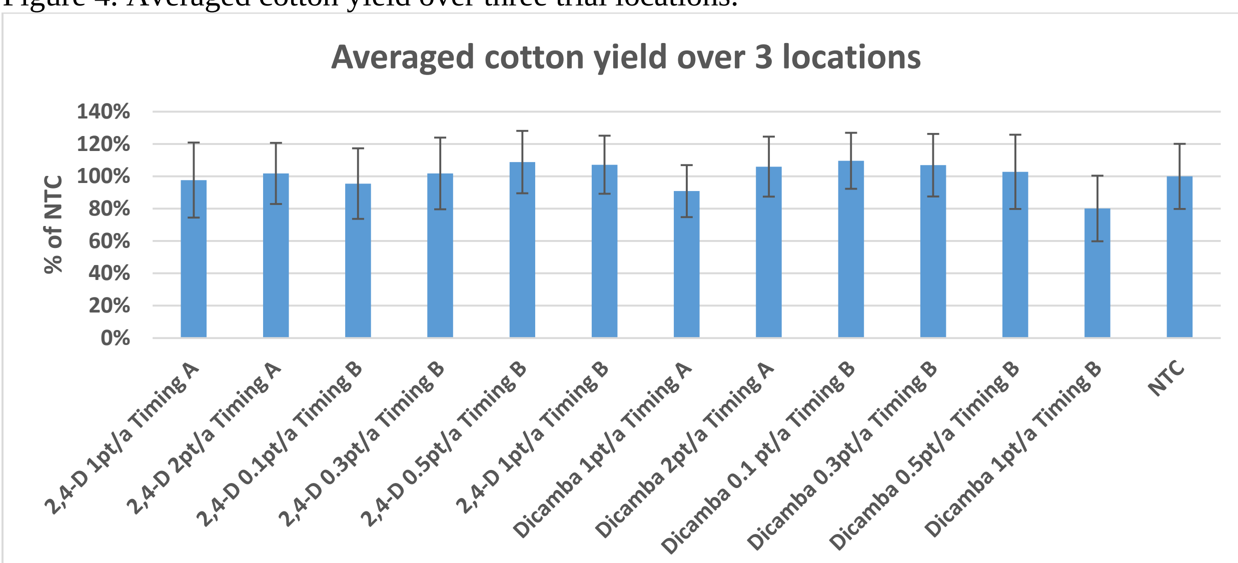


Figure 4. Averaged cotton yield over three trial locations.



Pigweed Resistance Screening in Alabama

S. Li

Palmer Amaranth has gained resistance to multiple mode of action (MOA) of herbicides. In the last three years, PPO-resistant palmer has been identified in multiple southern states, seriously threatening cotton production. Therefore, a statewide survey of Palmer Amaranth was conducted in 2015 and 2016 to quantify the level of herbicide resistant Palmer infestation in Alabama cotton. A total of 59 seed samples of Palmer amaranth or spiny amaranth were collected from 59 fields in multiple counties. Screening work on 2015 collected populations has been completed while 2016 collected populations are still under screening. Palmer Amaranth seeds collected from fields were cleaned and planted in 4 inch cups with organic medium in greenhouse, and sprayed in spray chamber when these seedlings were 1 inch tall. NIS @ 0.25% v/v was included in all treatments. Data collection was conducted 14-21 days after treatment.

Data from this herbicide screening study indicated that herbicide resistant Palmer Amaranth is widely presented in Alabama in many counties. EPSPS inhibitor (Roundup) and ALS inhibitor (Staple, Cadre, Envoke, etc.) resistances are most common resistances found in this screen study, with 2X rates of Roundup, Staple LX, Cadre and Envoke failed to kill more than 25% of pigweed seeds collected from all locations. Cobra (PPO inhibitor) and Liberty (GS inhibitor) are still working on most of the Palmer populations. However, these two MOA have taken too much pressure and resistance are likely to develop in Palamer Amaranth against these two MOA. The population from Limestone county survived 4X rates of Cobra, Goal and Reflex (Picture 1-3). Since PPO resistance pigweed has started to spread out in TN, AR, MO, MS and possible NC and SC, we need to prepare for managing this new resistance in field and minimize its impact in Alabama cotton production.

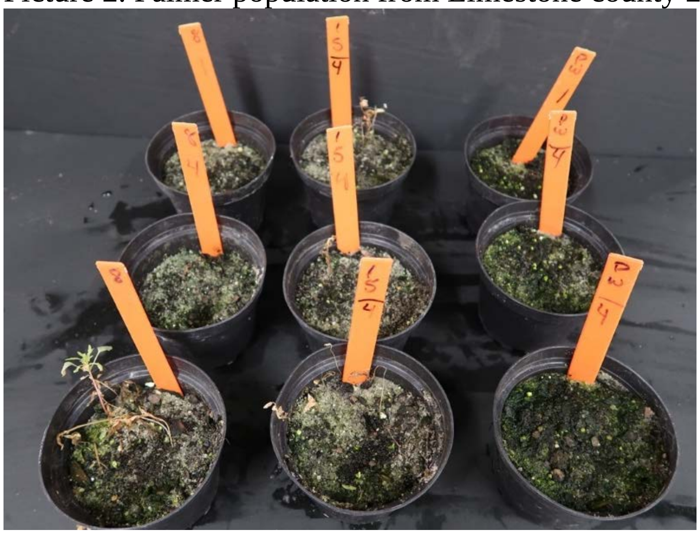
Table 1. 2015 Palmer Amaranth resistance screening results. Number shown in this table represents seedling mortality (number killed/total number germinated)							
		Roundup		Staple LX		Cadre	
#	County	64 oz/A	128 oz/A	8 oz/A	16 oz/A	8 oz/A	16 oz/A
1	Elmore County	0%	0%	0%	0%	33%	20%
3	Henry County	0%	17%	0%	10%	0%	11%
4	Henry County	0%	50%	0%	11%	0%	27%
5	Henry County	0%	38%	0%	11%	25%	22%
6	Dallas County	0%	25%	7%	27%	0%	0%
7	Russell County	8%	88%	0%	22%	0%	20%
8	Limestone County	4%	33%	2%	0%	7%	8%
9	Chilton County	0%	0%	0%	0%	0%	0%
10	Talladega County	0%	79%	0%	15%	67%	20%
11	Autauga County	0%	33%	0%	0%	0%	0%
12	Autauga County	17%	67%	8%	18%	0%	0%
13	Henry County	0%	18%	0%	6%	5%	11%
14	Talladega County	15%	25%	7%	14%	0%	14%
15	Talladega County	5%	8%	5%	14%	6%	3%
16	Shelby County	0%	5%	0%	5%	6%	9%
17	Henry County	5%	21%	0%	7%	0%	5%
18	Shelby County	18%	9%	0%	30%	0%	14%
19	Madison County	21%	8%	6%	18%	59%	50%
Overall mortality		**5%**	**29%**	**2%**	**12%**	**12%**	**13%**

* Liberty 32 and 64 oz/A killed all pigweed seedlings in 2015 resistance screening (100% overall mortality). Cobra 32 and 64 oz/A killed all 2015 populations except for one from Limestone county (90% overall mortality). This population of pigweed will be further evaluated in 2017 in field.

Table 2. 2016 Palmer Amaranth resistance screening results. Number shown in this table represents Palmer Amaranth seedling mortality (number of killed/total number germinated)							
		Roundup	Envoke	Staple LX	Cobra	Cadre	Liberty
#	County	64 oz/A	0.3 oz/A	8 oz/A	32 oz/A	8 oz/A	64 oz/A
1	Henry	0%	60%	0%	100%	17%	0%
2	Henry	6%	43%	0%	100%	20%	100%
3	Houston	42%	17%	0%	67%	100%	100%
4	Baldwin	0%	33%	10%	100%	50%	100%
5	Baldwin	52%	42%	86%	100%	100%	4%
6	Henry	0%	0%	3%	100%	71%	53%
7	Henry	50%	0%	50%	100%	11%	63%
8	Geneva	0%	0%	14%	100%	0%	83%
9	Elmore	0%	0%	0%	100%	0%	78%
11	Henry	0%	0%	60%	75%	15%	33%
12	Geneva	8%	0%	15%	40%	0%	89%
13	Geneva	0%	0%	9%	67%	0%	33%
15	Geneva	0%	5%	33%	100%	0%	92%
16	Henry	22%	0%	0%	0%	8%	100%
17	Baldwin	11%	71%	100%	100%	100%	10%
18	Henry	0%	40%	0%	33%	0%	80%

19	Henry	0%	0%	0%	100%	0%	75%
20	Barbour	7%	0%	42%	100%	0%	100%
21	Henry	0%	0%	0%	100%	50%	83%
22	Escambia	0%	0%	6%	100%	0%	100%
23	Houston	0%	17%	67%	100%	20%	no data
24	Houston	0%	20%	14%	75%	0%	69%
25	Baldwin	0%	0%	14%	100%	60%	50%
27	Baldwin	0%	14%	40%	100%	60%	100%
28	Geneva	0%	0%	0%	100%	0%	20%
32	Henry	0%	0%	0%	100%	80%	67%
33	Henry	0%	33%	92%	100%	100%	100%
34	Henry	0%	10%	100%	100%	0%	40%
35	Henry	0%	33%	0%	100%	0%	no data
36	Henry	0%	0%	0%	100%	0%	33%
38	Limestone	38%	0%	0%	100%	0%	100%
Overall mortality		**8%**	**14%**	**24%**	**89%**	**28%**	**67%**

Picture 1. Palmer population from Limestone county 21 days after 4X rate of Cobra (64 oz/A)

Picture 2. Palmer population from Limestone county 21 days after 4X rate of Goal (96 oz/A)


Picture 3. Palmer population from Limestone county 21 days after 4X rate of Reflex (96 oz/A)

This population from Limestone county will be further evaluated in field for PPO resistance confirmation.

Evaluation of Sprayer Cleaning Procedures Following Application of 2, 4-D and Dicamba

S. Li

The objective of this project is to compare sprayer cleaning efficacy using common cleaning practices, such as household ammonium and tank cleaners. And develop sprayer cleaning recommendation for 2,4-D and dicamba to be used in future resistant crops. Treatments to be evaluated include:

1. Water (triple rinse)
2. 3% ammonium (1st rinse) + Roundup PM @ 2 pt/A (2nd rinse) + Water (3rd rinse)
3. 3% ammonium (1st rinse) + Ag spray tank cleaner (2nd rinse) + Water (3rd rinse)
4. 3% ammonium (1st rinse) + Another common tank cleaner (2nd rinse) + Water (3rd rinse)

This project will be conducted from Jan-Apr 2017 at EV Smith REC at Shorter AL, on three commercial ag sprayers. Rinsate from each cleaning step will be collected and analyzed by analytical instruments on Auburn campus. Quantitative data from laboratory will be used to determine best cleaning protocol. Meanwhile, collected rinsate from each rinse and treatment will be sprayed on top of sensitive plants, such as tomatoes, to determine the effect of remaining herbicide (2,4-D and dicamba) on these sensitive bioassays. Visual injury, bioassay height and dry weight will be collected 1 month after application. If any cleaning method tested in this project shows promising results, they may be furthered tested on farmer’s sprayer for efficacy as compared to regular procedures.

V. Insect Management

Determining Which Insecticide Provides the Most Cost-effective Control of Plant Bugs Infesting Cotton

T. Reed

This study was conducted at the Tennessee Valley Research and Extension Center at Belle Mina and at the Prattville Agricultural Research Unit. Plots at Belle Mina were planted April 23rd using the variety ST 4747 GLB2. Plots were 8 rows wide and 25 feet long with a 40 inch row spacing. Treatments were arranged in a RCB design with 4 replications of each insecticide treatment and 12 replications of the unsprayed treatment. Insecticide treatments and rates at Belle Mina and Prattville are shown in Tables 1 and 2. Treatments were applied July 22 using TX6 conejet nozzles and a spray volume of 9.5 gallons per acre. Tarnished plant bugs (TPB's) were sampled August 1 by placing a 3-foot-long drop cloth between two rows and shaking both rows vigorously. Two drop cloth samples were taken in each plot. Plots at Prattville were planted April 18 using the variety ST 6182 GLT. Plots were 4 rows wide and 30 feet long with a 36 inch row spacing. Treatments were arranged in a RCB design with 4 reps for each treatment. Treatments were applied July 6 using a CO_2 backpack sprayer that delivered 10 gallon spray/acre at 40 PSI using TX6 conejet nozzles. Plots were sampled using a 3-foot-long drop-cloth on July 8 and July 13.

Results: Total numbers of TPB's per 12 row feet and seed cotton yields at Belle Mina are presented in Table 1.

Table 1. Number of plant bugs recovered per 12 row feet 10 days following application of different cotton insecticides and yields. Belle Mina, AL, 2016

Trt #	Treatment Insecticide	Rate/Acre	Plant bugs/12 feet	Lbs seed cotton/acre
1	Orthene 97	0.55 lb	4.0 CD	4314 B
2	Bidrin 8	3.2 oz	4.5 CD	4490 AB
3	Bidrin 8 + Bifenthrin 4	6.4 oz	5.8 CD	4442 AB
4	Bifenthrin 4	6.4 oz	22.0 A	3881 C
5	Transform 50 WG	1.5 oz	3.5 CD	4369 B
6	Transform 50 WG + Diamond 4	6 oz	0.0 D	4402 B
7	Diamond 4	6 oz	2.3 CD	4685 A
8	Centric 40 WG	2 oz	5.8 CD	4400 B
9	Untreated	-	13.1 B	3803 C
		P>F =	0.0007	0.0001
		LSD 0.1 =	7.04	251.6

There was a statistically significant treatment effect with respect to the total number of TPB's 10 DAA (P>F=0.0007) and yields (P>F=0.0001). All insecticide treatments except bifenthrin had significantly fewer TPB's than the untreated plots. The number of TPB's in the bifenthrin treatment was significantly greater than that in the unsprayed plots. The most expensive treatment, Transform + Diamond, had no TPB's on the sampling date. All insecticide treatments except bifenthrin had a significantly greater yield than that in the unsprayed plots. The yield in the Diamond 6 oz/acre treatment (4685 lbs/ac) was significantly greater than that in 5 of the other insecticide treatments, but not significantly greater than that in the Bidrin and Bidrin + bifenthrin treatment.

Total numbers of TPB immatures per 12 row feet at Prattville 48 hours post-application are presented in Table 2.

Table 2. Number of Plant bug nymphs recovered per 12 row feet 48 hours post-application of different cotton insecticides, Prattville, AL, 2016			
Trt #	Treatment Insecticide	Rate/Acre	Plant bugs/12 feet
1	Centric 40 WG	2 oz	2.0 B
2	Transform 50 WG	1.5 oz	0.5 B
3	Diamond 4	6 oz	6.0 A
4	Transform 50 WG + Diamond 4	1.5 oz + 6.0 oz	0.8 B
5	Orthene 97	0.55 lb	2.8 B
6	Untreated	-	5.5 A
		P>F =	0.0019
		LSD 0.1 =	2.74

There were very few TPB's present on the second sampling date and numbers for this date are not presented. There was a statistically significant treatment effect with respect to the number of TPB's at Prattville (P>F= 0.0019). Diamond is an insect growth regulator which did not have sufficient time to reduce TPB numbers and the TPB count for this treatment was statistically similar to that in the unsprayed plots. The mean number of TPB nymphs in the Centric, Transform, Transform + Diamond and Orthene treatments all had significantly fewer TPB's than the Diamond and the unsprayed treatments but they were not significantly different from each other.

State Pheromone Trapping Program for Cotton Bollworm, Tobacco Budworm, and Heliothis Armigera (The Old Boll Worm)

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

A statewide pheromone trapping program was conducted in 2016 to assess the moth activity level for 3 species of lepidoptera which can be pests of cotton. Species monitored were, cotton bollworm (CBW), tobacco budworm (TBW) and the potentially invasive species *Heliothis armigera (HA),* the African or Old World bollworm. All moths collected in HA traps and many moths caught in CBW traps were tested using a DNA based technique to confirm the species present. The trapping program was conducted from the 3rd week of June through the 2nd week of September. Counties in which traps were placed are presented in the results section.

Results: Cotton bollworm (CBW) moth trap catch numbers were much higher in Baldwin, Elmore and Autauga counties than at the other 4 trapping sites. Baldwin county CBW moth numbers began increasing the 4th week of June (132) and ranged from 282 to 347/week for the next 4 weeks. CBW moth numbers at the Baldwin county site then declined the 1st week of August (136), peaked at 549 the 3rd week of Aug. then declined to 158 or less for the remainder of the year. CBW moth trap catches at the Elmore county site jumped the 1st week of July (419) and except for the 2nd week of Aug (6 caught) the CBW moth catch ranged from 200 to 612 through the 4th week of Sept. The CBW trap catch numbers in Autauga county (Prattville Research unit) peaked the 1st two weeks of Sept. The CBW moth catch at the Macon county site peaked the 1st week of Aug. at 229. The CBW trap catch in Limestone County (Belle Mina Station) began increasing the 4th week of June (78 caught) and peaked the 1st week of Aug. at 181. The only reported economic infestation of cotton bollworms on soybeans in AL in 2016 was in a few fields in north AL in the Hillsboro area within 25 miles of the Belle Mina trapping site. These larvae were in the 6th instar stage on Aug. 6 indicating that eggs were deposited by moths about July 25 when the CBW moth trap catch at Belle Mina was 83 for the week. The Henry county trapping site at the Wiregrass Research Station caught very few CBW moths all season (total of 70). However, there were reports of CBW damage to Phytogen cotton near the Headland trapping site. Numbers of CBW moths trapped at the Escambia county site at the Brewton

Research station were also low all season and numbers ranged from 40 the 2nd week of Aug. to 2 the 3rd week of Sept.

<u>The Tobacco budworm</u> (TBW) moth trap catch was highest in Elmore county with the largest numbers collected the 3rd week of June (227), the 3rd week of July (236) and the 1st and 2nd weeks of Aug. (ca. 150/week). The TBW moth catch in Baldwin county reached 121 the 2nd week of July then declined for 3 weeks and rebounded to 143 the 2nd week of Aug. before declining again. The Henry county TBW moth catch was highest the 3rd week of June (58), the 1st and 2nd weeks of July (45) and the 3rd week of Aug. (42). The Limestone county TBW catches showed peaks at 38 the 1st week of July, 70 the 4th week of July and 55 the first week of Sept. The Macon county site peaked the 1st week of August at 66. The next highest sampling period was the 3rd week of Aug with 19 collected. The highest number of TBW moths were collected at the Autauga county site the 4th week of July (53), the 2nd week of Aug. (41) and the 2nd week of Sept. (67).

Heliothis armigera (HA) moths were trapped in Baldwin, Escambia and Henry counties. All moths collected in traps baited with Heliothis armigera as well as numerous moths caught in Helicoverpa zea traps were tested and no moths were found to be HA moths.

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

T. Reed, R. Smith and C. Hicks

This study was conducted at the Belle Mina station and the Prattville Research Unit. Plots were planted at Belle Mina on April 23, 2016 and were arranged in a RCB design with 4 reps/treatment. (Exception: The untreated plots planted into a wheat residue were replicated 8 times). The variety used was Phytogen 339 WRF. Plots were 4 rows wide (38 inch row spacing) and 25 feet long. Treatments are provided in Table 1. All treatments except 8, 9 and 11 were planted into a wheat cover-crop residue. Treatments 8, 9 and 11 were tilled prior to planting. Velum Total and Admire Pro were applied in-furrow on top of the seed using 6502 flat fan nozzles that applied 12 gallons of water per acre. Nozzles were turned to line up parallel with the furrow and all the water went into the furrow. Thrips damage ratings were made on May 13, 18 and 25 when plants were at the 1 to 2, 2 to 3 and 4^{th} true leaf stage, respectively. Damage ratings were made on a scale of 0 to 5 with 0 being no damage and 5 being severe damage. A foliar overspray of Orthene 97 at a rate of 6 oz/acre was applied May 11 at the 1 to 2 true leaf stage using TX 6 conejet nozzles and 20 gallons water/acre. Plots received 4 inches of supplemental irrigation. Plots were harvested on October 7, 2016.

Plots were planted at Prattville April 20. Experimental design was similar to that at Belle Mina with 4 reps of all treatments. Plots were 4 rows wide and 25 feet long with a 36 inch row spacing. Foliar Orthene Treatments were applied May 5 and 10 using a CO_2 back pack sprayer, 7.9 gallon water/acre, 40 psi and TX6 conejet nozzles.

Results: Thrips damage ratings and yields at Belle Mina are presented in Table 1. Thrips damage ratings did not reach the economic threshold in any plots until May 25 (42 days after planting). The no insecticide-no crop residue treatment had a significantly lower yield than all the insecticide treatments. There was no significant difference with respect to yield among the insecticide treatments (LSD test at 90% level of confidence). Thrips damage ratings and yields at Prattville are presented in Table 2.

Five insecticide treatments at Prattville had significantly less thrips damage than all the other treatments on both sampling dates. These treatments were Avicta+ Crop Residue, Aeris+Crop Residue, Untreated Seed+ Foliar Orthene, Avicta +Foliar Orthene, and Aeris+Foliar Orthene. The untreated seed+ conventional tillage had the greatest level of damage on both sampling dates. The two treatments with the numerically highest number of blooms/25 feet of row on both 6/20 and 6/24 were Avicta+Foliar Orthene and Aeris+ Foliar Orthene. The 4 treatments with less than one bloom/25 feet on 6/20 were Avicta+ Crop Residue, Aeris+ Crop Residue, Untreated Seed+Crop Residue, and Untreated seed+ Conventional Tillage. Residue treatments had fewer blooms initially due to the thick residue preventing seedling plants from receiving sunlight. When the residue was pulled back from the plants the seedlings were yellow. Plant heights were statistically similar with one exception; Plant height for the Aeris+Foliar Orthene treatment was significantly greater than Untreated Seed+ Conventional Tillage treatment. Treatment yields were confounded by stink bug damage. The presence of crop residue enhanced yields probably due to enhanced moisture retention.

Table 1. Thrips Damage Ratings and Cotton Yields with Different Seed, In-Furrow and Seedling Foliar Sprays at Belle Mina, AL. 2016

Treatment	Mean 5/13	Damage 5/18	Rating 5/25	Yield-Lbs Seed Cotton/acre
1. Avicta	0.38 C	1.5 BCD	2.50 CD	4094 AB
2. Aeris	0.25 C	0.63 EF	1.31 E	4058 AB
3. Avicta + Foliar Orthene 97 (6oz)	0.50 BC	0.75 EF	1.31 E	4017 ABC
4. Avicta Elite	0.25 C	0.88 EF	1.31 E	4136 AB
5. Avicta + IFS[1] Admire Pro (9.2oz)	0.38 C	1.19 CDE	2.00 DE	4009 ABC
6. Untreated Seed + IFS Orthene 97 (16oz)	0.50 BC	1.0 DEF	1.63 E	3979 ABC
7. Velum Total IFS (14oz)	0.75 AB	0.88 EF	2.56 CD	3938 ABC
8. Avicta with no crop residue	0.38 C	1.81 B	3.50 AB	4174 AB
9. Aeris with no crop residue	0.50 BC	1.06 DEF	3.00 BC	4017 ABC
10. Temik IF[2] 5 lbs	0.25 C	0.50 F	1.44 E	4164 AB
11. Untreated with no crop residue	0.25 C	2.44 A	4.06 A	3525 D
12. Untreated with foliar	0.56 ABC	0.88 EF	2.56 CD	4236 A

Orthene 97 (6oz)				
13. untreated	0.88 A	1.98 AB	4.06 A	3725 CD
P>F =	0.066	0.000	0.000	0.039
LSD 0.1 =	0.36	0.56	0.87	314
1 IFS = In-Furrow Spray				
2 IF = In-Furrow Granules				

Table 2. Thrips Damage Ratings and Cotton Yields with Different Seed, In-Furrow and Seedling Foliar Sprays at Prattville, AL. 2016

Treatment	Mean Damage Rating 5/17/16	Mean Damage Rating 5/24/16	Bloom count 6/20/16	Bloom Count 6/22/16	Plant Height (cm) 6/24/16	Seed Cotton Yield Lb/acre
1. Avicta	3.25 b	3.13 bc	2.1 a-d	13.8 ab	14.5 ab	2583.3 abc
2. Aeris	3.50 b	3.38 b	2.7 a-d	13.5 ab	14.7 ab	2925.0 abc
3. Avicta + Admire Pro (7.2 oz)	3.38 b	3.13 bc	4.7 ab	14.5 ab	15.5 ab	2116.7 c
4. Aeris + Admire Pro (7.2 oz)	3.25 b	3.25 b	3.3 abc	11.3 abc	15.7 ab	2158.3 c
5. Avicta + Orthene IF (8 oz)	3.63 b	3.50 b	2.1 a-d	8.5 bcd	16.0 ab	3008.3 abc
6. Aeris + Orthene IF (8 oz)	3.38 b	3.38 b	4.0 abc	15.3 ab	15.2 ab	2658.3 abc
7. Avicta + Crop Residue	2.25 c	2.00 d	.7 cd	4.8 cd	15.2 ab	3275.0 a
8. Aeris + Crop Residue	1.75 c	1.38 d	.7 cd	3.8 cd	16.4 ab	3158.3 ab
9. Aeris + Velum IF (14 oz)	3.13 b	3.00 bc	4.2 abc	12.0 ab	15.5 ab	2308.3 bc
10. Untreated Seed + Velum IF (14 oz)	3.75 b	4.13 ab	3.1 abc	11.3 abc	14.5 ab	2883.3 abc
11. Untreated Seed + Crop Residue	3.88 b	4.25 ab	.3 d	2.5 d	14.0 ab	2725.0 abc
12. Untreated Seed + Conv Till	4.50 a	4.88 a	.7 cd	4.3 cd	13.5 b	2525.0 abc
13. Untreated Seed + Orthene Foliar (6 oz)	2.25 c	1.63 d	1.4 bcd	13.5 ab	16.4 ab	2391.7 abc
14. Avicta + Orthene Foliar (6 oz)	2.25 c	2.13 cd	6.0 ab	15.8 ab	15.5 ab	2933.3 abc
15. Aeris + Orthene Foliar (6 oz)	1.88 c	1.25 d	6.8 a	17.8 a	16.7 a	2891.7 abc
LSD P = .10	.490	.741	1.14-3.61	4.74	481.65	1.53-1.69
Standard Deviation	.412	.623	.23t	3.98	346.77	.04t
2 IF = In-Furrow Granules						

Controlling the Stink Bug Complex on Cotton in the Absence of Phosphate Chemistry

R. Smith

The objective of this study was to determine if and how stink bugs can best be managed or controlled with only pyrethroid chemistry.

A stink bug trial was conducted at the Wiregrass Research Center, Headland, AL to measure control using only the pyrethroid chemistry under various intervals, thresholds and timing. This test was conducted in a design consisting of 8 rows of PHY-499 cotton planted April 25, adjacent to a peanut field.

The various treatments (intervals, timing, and thresholds) were applied in a random manner to replicate plots (8 rows x 50 feet). Four replicates were utilized for each treatment. Weekly damaged bolls counts were made during boll production season and yields were taken. Sweep net samples were taken as needed to determine the number and species of stink bugs present.

Controlling The Stink Bug Complex On Cotton In the Absence of Phosphate Chemistry WREC - 2016							
		Spray Interval					
		Week of Bloom					
Flag Color	Trt	**Treatment/Rate**	3	4	5	6	7
Orange	1	Bidrin 6oz. (0.375lbs)	(7/14)	-	(7/27)	-	(8/11)
White	2	Bifenthrin 6.4oz. (0.08lbs)	(7/14)	-	(7/27)	-	(8/11)
Yellow	3	Bifenthrin 6.4oz. (0.08lbs)	(7/14)	(7/20)	(7/27)	(8/3)	(8/11)
Green	4	Bifenthrin 6.4oz. (0.08lbs)	(7/14)	(7/20)	-	(8/3)	(8/11)
Red	5	Untreated	-	-	-	-	-

Summary **% S.B. Damaged Bolls (Row 1)** **5 Observation Dates** **Survey Date**							
Trt#	**20-Jul**	**27-Jul**	**3-Aug**	**11-Aug**	**17-Aug**		**Mean (Row 1)**
					Row 1	**Row 7**	
1	30	55	30	55	60	30	46
2	20	28	38	53	58	15	39
3	28	32	18	20	48	20	29
4	28	22	32	38	55	28	35
5	40	65	80	90	58	52	67

SB/20 Sweeps (Row 2 and 3)					
Trt#	**20-Jul**	**27-Jul**	**3-Aug**	**11-Aug**	**Mean**
1	0.0	2.0	0.5	2.0	1.2
2	0.5	2.8	0.2	2.5	1.5
3	0.2	0.8	0	0.2	0.3
4	0.5	0.2	2.4	0.2	0.8
5	2.5	9.0	7.0	3.7	5.6

Stink Bugs/80 Sweeps (Life Stage and Species)				
	BSB		SGSB	
Date	N	A	N	A
July 20	0	8	0	7
July 27	0	30	0	23
Aug 3	0	9	0	27
Aug 11	0	6	0	30

All adults
BSB peaked on July 27
SGSB peaked between July 27 and Aug 11

S.B. Trial - WREC - 2016							
Yields (lbs seed cotton/plot)							lbs. Seed Cotton Per Acre
		Rows 1 and 2					
		Replicates					
Trt #		1	2	3	4	Mean	
1	Bidrin x 3 app	15.8	11.0	13.4	14.2	13.6	1972
2	Bifenthrin x 3 app	12.8	13.6	11.4	15.8	13.4	1943
3	Bifenthrin x 5 app	18.5	14.8	17.2	16.0	16.6	2407
4	Bifenthrin x 4 app	13.6	16.2	17.2	14.8	15.5	2248
5	Untreated	5.8	7.6	9.2	6.4	5.8	841
		Rows 7 and 8					lbs. Seed Cotton Per Acre
		Replicates					
Trt #		1	2	3	4	Mean	
1	Bidrin x 3 app	17.4	11.8	17.2	15.0	15.4	2233
2	Bifenthrin x 3 app	14.6	13.2	13.6	17.6	14.8	2146
3	Bifenthrin x 5 app	16.4	14.8	16.2	15.4	15.7	2276
4	Bifenthrin x 4 app	17.0	16.2	15.2	8.6	16.8	2436
5	Untreated	8.8	11.8	14.2	16.0	12.7	1842

This trial was conducted under extremely high stink bug pressure due to the proximity of the trial to an adjacent host crop (peanuts). The trial was initiated on July 14th, about the third week of bloom, when the stink bug damaged boll count was 20% internal injury. On that date, 1.3 stink bugs, consisting of both the brown and southern green species, were found per 20 sweeps. The number of stink bugs increased to 2.4, 7.5, and 8.2 per 20 sweeps in the untreated plots during the following three weeks. All stink bugs captured by sweep net were in the adult stage. The brown species increased through July and then declined in number. The southern green species continued to increase weekly, peaking in early August. The brown species made up 67% of the population on July 27, but decreased to only 15% of the population on August 3 and remained at that level for the duration of trial.

Insecticide treatments used in this trial were Bidrin applied three times on weeks 3, 5, and 7 of bloom; bifenthrin applied three times on weeks 3, 5, and 7 of bloom; bifenthrin applied five times on weeks 3, 4, 5, 6, and 7 of bloom; bifenthrin applied four times based on thresholds (applied on weeks 3, 4, 6, and 7 of bloom); and, an untreated. A stink bug survey and damage boll count was made weekly between July 20 and August 17.

A final survey was conducted on Aug 17, by sampling bolls on rows 7 and 8 from the field border. All previous surveys were made by collecting bolls from rows 1 and 2 adjacent to the edge of field adjoining peanuts. The distance from the cotton to the peanuts was approximately 15 feet of mowed grass field border. Bolls collected from rows 7 and 8 ranged from 15 to 30% internal damage compared to 52% in the untreated. Damaged bolls from rows 7 and 8 in all treatments were less than one half the level found in rows 1 and 2 on Aug 17.

The damage in the untreated plots were 52% in rows 7 and 8 compared to 80% in rows 1 and 2. This supports previous observations and data that have indicated that stink bugs cause much more damage on field borders than farther into fields. This data suggests that when controls are applied for stink bugs based on thresholds, most of the damage is limited to the first 6 to 10 rows around the edges of fields. It also suggests that border sprays to cotton planted adjacent to other stink bug hosts crops could greatly reduce inter field damage and/or the need for field wide applications.

When combining the boll damage by treatment across all five observation dates, all treatments (29 to 46 %) reduced boll damage compared to the untreated at 67%. However, no treatment (phosphate or pyrethroid) held damage on field borders below suggested threshold levels. The lowest damage was when bifenthrin was applied on a weekly interval. Bifenthrin (39%) compared favorably with Bidrin (46%) on a season long basis when both were applied on weeks 3, 5, and 7 of bloom.

Stink bug numbers, as captured by sweep net, were lower season long in all treated plots when compared to the untreated. The means recorded from the four-weekly survey made between July 20 and Aug 11 range from 0.3 to 1.5 stink bugs per 20 sweeps compared to 5.6 in the untreated. The mean from Bidrin treated plots was 1.2/20 sweeps compared to 1.5 in the bifenthrin when both were applied on the same schedule (week 3, 5, and 7 of bloom). One additional application of bifenthrin reduced the mean to 0.8/20 sweeps while the weekly application of bifenthrin (total of 5 applications) only left 0.3 stink bugs per 20 sweeps.

Yields from this trial coincide closely with the level of damaged bolls and the number of stink bugs captured by sweep net. Yields were taken by harvesting rows 1 and 2 on the border and rows 7 and 8 in each plot. Cotton harvested from rows 1 and 2 had 1972 lbs. of seed cotton in the Bidrin treated plots, compared to 1943 in the bifenthrin plots. The untreated only yielded 841 lbs. Four applications of bifenthrin yielded 2248 and five applications yielded 2407. The fourth application of bifenthrin increased yields by 305 lbs. of seed cotton over three applications. The fifth application of bifenthrin increased yields by 464 lbs. over three applications and 159 lbs. over the four applications.

Yields from rows 7 and 8 of each plot were higher in all plots than yields from rows 1 and 2. However, the treatment/application effect on yields from rows 7 and 8 were not as closely related to boll damage or numbers of stink bugs as found in rows 1 and 2. All sprayed plots out yielded the untreated in rows 7 and 8. However, the yields did not correlate with the numbers of applications. Yields from the untreated plots in rows 7 and 8 was 1842 lbs. of seed cotton while the treated plots varied from 2146 (3 app bifenthrin) to 2436 (4 app of bifenthrin). Plots receiving Bidrin (3 app) yielded 2233lbs and those treated with bifenthrin (5 app) yielded 2276 lbs.

Conclusions

1. Stink bugs are a major economic pest of cotton in the coastal plains region of Southern Alabama.

2. Cotton fields planted adjacent to alternative stink bug host crops such as peanuts are susceptible to high levels of injury.

3. Borders of cotton fields adjacent to crops such as peanuts are at the greatest risk of economic damage.

4. The heaviest injury to cotton field borders is usually confined to the first 10 to 15 rows (30 to 45 feet)

5. Treatments applied to field borders may reduce the damage and the number of treatments required over entire fields.

6. In this trial, bifenthrin pyrethroid was as effective as Bidrin when applied on the same schedules.

7. Additional applications regardless of the chemical selected, may be required to protect field borders from stink bug injury when cotton fields are located near other host crops or overwintering sites.

Cotton Production with Reduced Inputs for 2016

R. Smith

The objective of this study was to evaluate variables in a reduced input cotton production system such as the economic importance of managing the bug complex (plant and stink bugs) and caterpillars (bollworm and budworm).

Trials were conducted in a replicated small plot (8 rows x 35 feet) reduced input cotton trial at the Prattville Ag Research Unit. We compared a conventional variety (UA 222) to a full season variety (DP 1555 B2RF) with weed and insect technology. Input costs were recorded and yields taken.

Cotton Economic Study Prattville Agricultural Research Unit 2016

Trt. No.	Variety	Target Pest
1	UA 222	None
2	UA 222	Bugs Only
3	UA 222	Worms Only
4	UA 222	Bugs and Worms
5	DP 1555 B2RF	None
6	DP 1555 B2RF	Bugs Only
7	DP 1555 B2RF	Worms Only
8	DP 1555 B2RF	Bugs and Worms

Plant date: April 29

Replant Skips May 16

Vigor and Thrips Damage Rating Made: May 23

1. UA 222 had slightly less vigor than DP 1555 B2RF (may be due to 2 year old seed)

2. Thrips damage was below threshold in all plots when a rating was made on May 23 when plants were at the 2 – 3 true leaf stage.

Plant Bug Survey Made: July 8

A drop cloth sample was made on random plots in both UA 222 and DP 1555 B2RF. About 3 immature plant bugs were found per 5 row feet. Populations were similar in both UA 222 and DP 1555 B2RF. An application of Diamond at 9oz.ac.was made on July 11 to all plots receiving bug treatments.

Weed Pressure:

Coffee weeds were heavy in the UA 222 plots and presented much competition for the cotton plants in early to mid-July. Weeds were hand pulled from rows 2 and 3 in all UA 222 plots on July 13. Yields were taken from these same rows.

Stink Bugs Surveys Made:

July 25th and Aug 8 sweep net samples were made and an economic level of adult southern green stink bugs were recorded. Application was made to all bug treated plots on July 25 and Aug 12.

Insecticides Applied and Costs Cotton Economic Study PARU - 2016						
Variety	Trt #	Insecticide/Rate	Date	Target	Cost/ac. Including Application	Total
UA 222	1	None				0
UA 222	2	Diamond/9oz Bidrin/ 8oz Bifenthrin/6.4oz	July 11 July 25 Aug 12	Plant Bugs Stink Bugs Stink Bugs	$13.00 $10.45 $7.25	$30.70
UA 222	3	None				0
UA 222	4	Diamond/9oz Bidrin/ 8oz (0.5lb) Bifenthrin/6.4oz	July 11 July 25 Aug 12	Plant Bugs Stink Bugs Stink Bugs	$13.00 $10.45 $7.25	$30.70
DP 1555 B2RF	5	None				0
DP 1555 B2RF	6	Diamond/9oz Bidrin/ 8oz Bifenthrin/6.4oz	July 11 July 25 Aug 12	Plant Bugs Stink Bugs Stink Bugs	$13.00 $10.45 $7.25	$30.70
DP 1555 B2RF	7	None				
DP 1555 B2RF	8	Diamond/9oz Bidrin/ 8oz Bifenthrin/6.4oz	July 11 July 25 Aug 12	Plant Bugs Stink Bugs Stink Bugs	$13.00 $10.45 $7.25	$30.70

Cotton Economic Study PARU 2016					
			Worm Damaged Bolls/30ft	**Lbs. Lint Cotton/Acre**	**$ Return/ac ***
Trt #	**Variety**	**Pest Controlled**	**Mean**		
1	UA 222	None	3.8	1015	$690
2	UA 222	Bugs Only	10.3	1328	$872
3	UA 222	None	3.5	1152	$783
4	UA 222	Bugs Only	9.8	1185	$775
5	DP 1555 B2RF	None	0.8	942	$641
6	DP 1555 B2RF	Bugs Only	0	1260	$826
7	DP 1555 B2RF	None	0.8	1136	$772
8	DP 1555 B2RF	Bugs Only	0.2	1206	$789

* Assume 68 cents/lb. cotton
* Assume 44% turn out for UA 222 and 45% for DP 1555 B2RF.

Yield/Returns – Cotton Economic Study Insect Control Versus Variety			
Variety	**Insect Control**	**Yield (lbs. lint/ac)**	**Return (above insect costs)**
UA 222	Bugs	1256	$827
UA 222	None	1083	$738
DP 1555 B2RF	Bugs	1233	$808
DP 1555 B2RF	None	1039	$707

Across Varieties	lbs. lint/ac.	
Bug Sprayed	1245	Difference +184
No insect control	1061	

Variety Difference	lbs. lint/ac.	
UA 222	1170	Difference +34
DP 1555 B2RF	1136	

Insecticide applications for control of plant bugs and stink bugs were applied to the designated plots in this trial.

No economic level of worm infestations was detected therefore no controls specifically for worm control were made. An end of season worm damage boll count was made. Very low numbers of worm damaged bolls were found in any of the DP 1555 B2RF Plots. The highest number of worm damaged bolls were found in the UA 222 conventional variety plots that had been sprayed for bugs. Insecticides targeted for bug control, especially stink bugs, generally suppress beneficial insect numbers that assist in controlling bollworms.

Since no worm controls were applied, treatments number 2 and 4 (UA 222) and 6 and 8 (DP 1555 B2RF) were identical in treatment for bugs only. In all treatments, the plots treated for bugs had higher yields and returns than those that did not. The returns on the bug treatments were greater than the cost of bug control ($30.70).

When calculating across varieties the bug treated plots out yielded the untreated by 184 lbs. of lint. When looking at the varietal comparison, regardless of direct control, the UA 222 yielded 34 more lbs. of lint than did the DP 1555 B2RF. Both varieties yielded above 1100 lbs. of lint per acre.

There were two major factors at play in the yield results from this trial. One was whether the plot was sprayed for bugs or not. The second was the location of these replicated plots within the trial area. Plots on the perimeter of the trial encountered much heavier stink bug pressure and damage than plots located nearer the center of the trial. This is due to the nature of stinkbug infestations. Stink bugs do not randomly distribute across fields such as plant bugs. Stink bugs are weak or “lazy” flyers and therefore settle into the perimeter rows of cotton or other host crops.

Observations indicate that the heaviest stink bug injury occurs first and heaviest within the first 12-15 feet of a field border.

Therefore, under heavy stink bug pressure such as experienced at the Prattville research farm in both 2015 and 2016, it is very difficult to do replicated small plot research with cotton. Furthermore, the Prattville research station may be the only cotton research farm in the U.S. cotton Belt that is heavily infested with the brown marmolated stink bug in addition to our native brown and southern green species.

Validating Treatment Thresholds and Determining Border Effect of Brown Marmorated Stink Bugs in Cotton

R. Smith, and S. Duke

The objective of this study was twofold. First to define the width of the cotton field border that was susceptible to BMSB injury. Second was to determine if a new stink bug threshold is needed since older more mature bolls are at risk of damage from this species.

Brown Marmorated Stink Bug Prattville Agricultural Research Unit

Trt #	Rows From Edge	Control Regime	Rep I	Rep II	Rep III	Rep IV
1	0 – 8	Untreated	101	207	304	401
2	9 – 16	Untreated	105	202	308	402
3	17- 24	Untreated	109	209	303	406
4	0 – 8	Threshold	104	201	307	404
5	9 – 16	Threshold	108	205	305	405
6	17- 24	Threshold	103	203	309	409
7	0 – 8	Maximum Control	107	204	301	407
8	9 – 16	Maximum Control	102	208	302	408
9	17- 24	Maximum Control	106	206	306	403

Hedgerow and BARNS/SHEDS

New Home Const. (left side)

Tree Line (left side)

Cotton Disease Trial (right side)

407 M	408 M	409 T
404 T	405 T	406 U
401 U	402 U	403 M
307 T	308 U	309 T
304 U	305 T	306 M
301 M	302 M	303 U
207 U	208 M	209 U
204 M	205 T	206 M
201 T	202 U	203 T
107 M	108 T	109 U
104 T	105 U	106 M
101 U	102 M	103 T
U = Untreated T = Threshold M = Maximum Control		
Planted May 4		
Variety DP 1555		
Plot Size 8 Rows x 50 Ft.		

Corn

Collected 10 bolls per plot weekly beginning the third week of bloom. Boll were examined for internal stink bug injury. Insecticide controls were applied based on predetermined thresholds or schedules.

Spray Dates for Brown Marmorated Stink Bug – Cotton Prattville

7/28 – M & T

8/2 – M & T

8/12 – M Only

8/17 – M & T

8/24 – M & T

9/6 – M Only

Sprays were bifenthrin @ 6.4 oz. /A

M = Maximum Control = 6 Applications

T = Established Threshold of 10% internal boll damage = 4 Applications

U = Untreated

BMSB Trial							
% Boll Damage							
	7/25	8/1	8/8	8/15	8/22	9/6	Mean
Untreated	14 a	40 a	33 a	54 a	27 a	21 a	32 a
Threshold	8 a	35 a	8 b	33 b	17 a	11 ab	19 b
Maximum	15 a	31 a	13 b	37 ab	22 a	7 b	21 b
Application Dates:							
Threshold: 7/28, 8/2, 8/17, 8/24 (4 Total)							
Maximum 7/28, 8/2, 8/12, 8/17, 8/24, 9/6 (6 Total)							

BMSB Trial		
Yield by Treatment and Location (lbs. Seed Cotton/AC)		
Border	Middle	Interior
	Untreated	
2465	3698	3422
	Threshold (4 App)	
3074	4379	3944
	Maximum (6 App)	
3089	3959	4684

BMSB Trial						
No. Stink Bugs/ 20 Sweeps						
(Samples Taken From Untreated Plots)						
	Brown		SGSB		BMSB	
Date	I	A	I	A	I	A
July 19	0	.5	.5	.2	0	0.1
Aug 1	0	.1	.6	1.2	.2	1.1
Aug 8	0	.1	0	1.4	.3	.4
Aug 10 *	0	0	0	.3	.3	.9
Aug 15 *	0	0	0	0	0	.3
* Counts made by walking slowly and observing						

BMSB Trial

Factors Affecting Damage and Yields

1. Proximity of plot to border and/or end of trial area
2. Treatments made to adjacent plots (untreated with 4 sides treated) (Example plot 202 UT)
3. Location of plot in relation to other host crops (cotton/corn)
4. Treated or untreated (# of applications)

BMSB Trial

Conclusions

1. Trial was conducted under heavy stink bug pressure by both BMSM and SGSB.

2. Pyrethroids (bifenthrin) gave good control of both BMSB and SGSB when used on tight schedule (weekly on borders).
3. We may need additional late season applications to control BMSB.
4. No good scouting method for quantifying number of BMSB's.
5. Cotton borders adjacent to overwintering habitat not the only factor to consider when other early season hosts (corn) are present.
6. A high percent of bolls with external feeding signs had internal damage, even in a dry season.
7. Stink bug damaged bolls do not open as rapidly as do undamaged bolls (likely due to delayed fiber development).
8. As population of BMSB's spread they will likely be a major economic pest of cotton on field borders or adjacent to other host crops.

VI. Nematode Management

Varietal and Nematicidal Application Responses in North Alabama soils, 2016

K.S. Lawrence, M. Hall, D. Dodge, D. Dyer, W. Groover, S. Till, N. Xiang

Velum Total in-furrow spray applications combined with seed treatments were evaluated for reniform nematode management. Applications were applied to two Stoneville cotton varieties, ST 4946GLB2 and ST 4747GLB2. The field site is located on the Tennessee Valley Research Center near Belle Mina, AL. This field has been cultivated in cotton for over 16 years and was artificially infested with the reniform nematode in 1997. The soil is a Decatur silt loam. Gaucho, Aeris, and Fluopyram were applied as seed treatments prior to planting, and Velum Total was applied as an in-furrow spray with 8002 flat-fan nozzles angled diagonally across the seed furrow immediately preceding the seed. Plots were planted on 5 May with a soil temperature of 69°F at 4-in depth and adequate soil moisture. Plots consisted of 4 rows measuring 25-ft long with 40-in row spacing and were arranged in a randomized complete block design with five replications. A 15-ft wide alley separated blocks. 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 and vigor were determined at 33 days after planting (DAP) on 7 Jun. Samples were collected for nematode analysis by digging up 4 random plants per plot on 7 Jun. Nematodes were extracted from the root systems using 6% NaOCl and collecting the nematodes on a 25 µm sieve. Plots were harvested on 23 Oct. Data were statistically analyzed using SAS 9.4 PROC GLIMMIX and means compared using Tukey-Kramer ($P \leq 0.10$). Monthly average maximum temperatures from planting in May through harvest in Oct were and 82.3, 90.1, 91.6, 88.1, 84.8, and 75.5°F with average minimum temperatures of 60.1, 69.2, 71.7, 67.6, 63.1, and 51.6°F, respectively. Rainfall accumulation for each month was 4.62, 3.48, 4.18, 2.16, 0.98, and 2.2 in with a total of 17.62 in over the entire season. The rainfall was adequate in Jul but very dry in Aug and Sep.

Reniform nematode disease pressure was moderate for irrigated cotton in 2016. No significant variety by treatment interactions were revealed by data analysis, indicating both varieties responded similarly to nematicide treatments across replications. Plant stand at 33 DAP was similar for all nematicide applications, and all stand counts with the exception of the untreated control (1) fell within the acceptable range of 2-4 plants per foot of row. All treatments demonstrated improved vigor compared to the untreated control (1). Both Velum Total applications at 14 oz/A (3) and 18 oz/A (4), Velum Total + Aeris combination (5), and the Gaucho + Fluopyram combination (7) reduced reniform eggs per gram of root compared to the Gaucho treatment (2) alone. Seed cotton yields ranged from a low of 2143 to 2910 lb/A; however, yields were statistically similar across all nematicide treatments as well as both varieties.

Treatment and Rate	Stand[x]		Vigor[y]		Root-knot eggs/g root		Seed cotton lbs/A	
1. Untreated Control	49	a[z]	4.9	a	3528	abc	2143	a
2. Gaucho 12.8 oz/cwt seed	53	a	3.1	b	8163	a	2797	a
3. Velum Total 14 fl oz/A	52	a	2.5	b	2628	bc	2586	a
4. Velum Total 18 fl oz/A	54	a	2.7	b	1171	c	2821	a
5. Velum Total 14 fl oz/A + Aeris 25.6 oz/ cwt seed	59	a	2.5	b	931	c	2840	a
6. Aeris 25.6 oz/ cwt seed	56	a	2.6	b	6595	ab	2607	a
7. Gaucho 12.8 oz/cwt seed + Fluopyram 8.5 oz/cwt seed	59	a	2.8	b	1465	c	2901	a
Varieties								
'ST 4946' (tolerant)	56	A	3.1	A	2956	A	2740	A
'ST 4747' (susceptible)	53	A	2.9	A	4039	A	2602	A

[x]Stand indicates the number of seedlings in 25 ft of row 33 days after planting (DAP).
[y]Plant vigor ratings ranged from 1-6 with 1 indicating strong proliferation and 6 representing extremely poor vitality.
[z]Column numbers followed by the same letter are not significantly different within nematicide or variety treatments at $P \leq 0.1$ as determined by the Tukey-Kramer method.

Cotton Variety Selection with and without Velum Total for Root-knot Nematode Management in Central Alabama, 2016

W. Groover, K. S. Lawrence, N. Xiang, S. Till, D. Dodge, D. Dyer, and M. Hall

Five cotton varieties were evaluated along with Velum Total for control of the root-knot nematode. This test was conducted at the Plant Breeding Unit Research Station near Tallassee, Alabama. The field has a substantial population of the root-knot nematode (*Meloidogyne incognita* race 3). The soil type is Kalmia loamy sand, which contains 80% sand, 10% silt, and 10% clay. Seed varieties received standard seed treatment as sold based upon variety, and Velum Total was applied in-furrow with 8002 flat fan nozzles angled diagonally across the seed furrow after seed at a rate of 14 oz/acre on right two rows of each plot. Plots were planted on 16 May, and consisted of 4 rows that were 25 feet long with 36-inch row spacing. Seed was planted at 1-inch depth. The plots were arranged in a randomized complete block design with five replications of each treatment and a 20-feet-wide alley. All plots were maintained as recommended via the Alabama Cooperative Extension System with typical pesticide and fertility production practices, and an overhead irrigation system was used for watering as needed. Nematode densities and stand measurements were taken in the root-knot nematode infested field at 28 DAP (days after planting). Nematodes were extracted from the cotton roots using 6% NaCl and collected on a 25 um sieve. Harvest took place on 4 October at 141 DAP. Data was statistically analyzed by SAS 9.4 (SAS Institute Inc.) using ANOVA and means were compared using Tukey-Kramer with $P \leq 0.1$. Monthly average maximum temperatures from planting in May through harvest in October were 82.3, 90.9, 93.5, 92, 92.1, and 85°F with average minimum temperatures of 57.5, 66.3, 69.9, 70.5, 64.9, and 51.2°F, respectively. Average temperatures from May to October was 69.9, 78.6, 81.7, 81.3, 78.5, and 68.1°F. Rainfall accumulation for each month was 1.76, 2.82, 2.94, 4.12, 0.95, and 0.23 in., respectively.

Deltapine 1646 B2XF with Velum Total (VT) stand was statistically higher than Deltapine 1538 B2XF untreated, Stoneville 6182 GLT untreated, and Stoneville 4848 GLT with VT. Root-knot nematode eggs per gram of root were statistically lower with the addition of Velum Total in varieties Deltapine 1538 B2XF and Deltapine 1646 B2XF when compared to the untreated varieties. Deltapine 1646 B2XFwith VT yield was statistically higher than four other treatments, which were untreated Deltapine 1538 B2XF, Phytogen 333 WRF, Stoneville 4848 GLT, and Stoneville 6182. Of the five varieties screened, both Stoneville 4848 and Stoneville 6182 GLT yields were statistically higher with the addition of Velum Total.

Cotton Variety[y]	Stand	Eggs/g root	lb/A seed cotton
Deltapine 1538 B2XF Velum Total	80 abc[x]	1030 bc	4598 ab
Deltapine 1538 B2XF Untreated	73 bcd	2091 a	4069 bcd
Deltapine 1646 B2XF Velum Total	87 a	558 c	4725 a
Deltapine 1646 B2XF Untreated	81 abc	1514 ab	4373 abc
Phytogen 333 WRF Velum Total	84 ab	1200 bc	4365 abc
Phytogen 333 WRF Untreated	77 abc	650 b	4048 bcd
Stoneville 4848 GLT Velum Total	63 d	830 bc	4451 ab
Stoneville 4848 GLT Untreated	76 abc	1382 abc	3956 cd
Stoneville 6182 GLT Velum Total	80 abc	855 bc	4191 abc
Stoneville 6182 GLT Untreated	72 cd	1039 bc	3500 d

[y]Velum Total was added to all varieties at a rate of 14 oz/acre in-furrow spray.
[x]Column numbers followed by the same letter are not significantly different at $P \leq 0.1$ as determined by Tukey's multiple-range test.

Cotton Variety Selection with and without Velum Total for Reniform Management in North Alabama, 2016

W. Groover, K.S. Lawrence, N. Xiang, S. Till, D. Dodge, D. Dyer, and M. Hall

Twelve cotton varieties were evaluated along with Velum Total for control of the reniform nematode. This test was conducted in the field at the Tennessee Valley Research and Extension Center near Belle Mina, Alabama. The field was infested with the reniform nematode in 1997 and has been cultivated in cotton for over 17 years. The soil type is Decatur silt loam, which contains 24% sand, 49% silt, 11% clay and 1% organic matter. Seed varieties contained a standard seed treatment as sold based upon variety. Velum Total was applied in-furrow with 8002 flat fan nozzles angled diagonally across the seed furrow after seed at a rate of 14 oz/acre on right two rows of each plot. Plots were planted on 4 May, and consisted of 4 rows that were 25 feet long with 36-inch row spacing. Seeds were planted at 1-inch depth. The plots were arranged in a randomized complete block design with five replications of each treatment and a 20-feet-wide alley. All plots were maintained as recommended via the Alabama Cooperative Extension System with typical pesticide and fertility production practices, and an overhead irrigation system was used for watering as needed. Nematode densities were measured in the reniform infested field at 34 days after planting (DAP). Nematodes were extracted from the cotton roots using 6% NaCl and collected on a 25-um sieve. Harvest occurred on 5 October at 154 DAP. Data was statistically analyzed by ANOVA using SAS 9.4 (SAS Institute Inc.) and means were compared using Tukey-Kramer with $P \leq 0.1$. Monthly average maximum temperatures from planting in May through harvest in October were 81.14, 92.84, 93.92, 88.16, 92.48, and 83.84°F with average minimum temperatures of 58.82, 68.54, 72.32, 71.96, 65.3, and 53.78°F, respectively. Average temperatures from May to October were 69.98, 80.78, 83.12, 81.86, 78.98, and 68.72°F. Rainfall accumulation for each month were 3.45, 4.06, 6.93, 12.73, 0.3, and 1.09 in., respectively.

Velum Total significantly reduced reniform eggs per gram of root compared to untreated in eight of the twelve cotton varieties tested. When looking at yield, seven of the twelve varieties tested saw a statistically significant increase in yield with the addition of Velum Total compared to the untreated cotton. These varieties were Phytogen 312 WRF, Phytogen 444 WRF, Phytogen 495W3RF, Phytogen 552 WRF, Deltapine 1614 B2XF, Nexgen 3522 B2XF, and Stoneville 6182 GLT.

Cotton Variety[y]	Eggs/g root	lb/A Seed Cotton
Phytogen 312 WRF Velum Total	1310 c[x]	3364 a
Phytogen 312 WRF Untreated	1 0318 b	2750 bcdef
Phytogen 444 WRF Velum Total	2446 bc	3077 abc
Phytogen 444 WRF Untreated	7306 b	2236 fgh
Phytogen 495 W3RF Velum Total	154 c	2649 cdefg
Phytogen 495 W3RF Untreated	20182 a	1969 h
Phytogen 552 WRF Velum Total	222 c	2905 abcde
Phytogen 552 WRF Untreated	4873 b	2104 gh
Deltapine 1553 B2XF Velum Total	244 c	2755 bcdef
Deltapine 1553 B2XF Untreated	5391 b	2271 fgh
Deltapine 1614 B2XF Velum Total	288 c	2919 abc
Deltapine 1614 B2XF Untreated	5800 b	1996 h
Deltapine 1639 B2XF Velum Total	735 c	2742 cdef
Deltapine 1639 B2XF Untreated	5929 b	2273 fgh
Deltapine 1646 B2XF Velum Total	418 c	3051 abcde
Deltapine 1646 B2XF Untreated	7875 b	2344 efgh
Dynagrow 3526 B2XF Velum Total	201 c	2521 defgh
Dynagrow 3526 B2XF Untreated	2682 bc	2245 fgh
Nexgen 3522 B2XF Velum Total	298 c	3316 ab
Nexgen 3522 B2XF Untreated	3202 bc	2530 cdefg
Stoneville 4848 GLT Velum Total	1055 c	2695 cdefg
Stoneville 4848 GLT Untreated	5438 b	2135 gh
Stoneville 6182 GLT Velum Total	407 c	2981 abcd
Stoneville 6182 GLT Untreated	3303 bc	2175 fgh

[y]Velum Total was added to all varieties at a rate of 14 oz/acre in-furrow spray.
[x]Column numbers followed by the same letter are not significantly different at $P \leq 0.1$ as determined by Tukey's multiple-range test.

Cotton Seed Treatment Combinations for *Rotylenchulus reniformis* Control and Yield Increase in North Alabama, 2016

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Allegiance FL, Fluopyram 600 FS, Poncho/Votivo 2nd Gen., Avicta 500FS and Velum Total were evaluated for combinations in *Rotylenchulus reniformis* (reniform nematode) control and yield increase on cotton. This test was planted in the field at the Tennessee Valley Research and Extension Center near Belle Mina, Alabama. This field was infested with the reniform nematode in 1997 and has been cultivated in cotton for over 17 years. The soil type is Decatur silt loam, which contains 24% sand, 49% silt, 11% clay and 1% organic matter. Seed treatments were applied by Bayer Crop Science to variety ST 4747 GLB2. All treatments were put on as a seed treatment, except for Velum Total, which was applied as an in-furrow spray at planting. Seed treatments were applied pre-planting, and planting occurred on 4 May. Plots consisted of 4 rows that were 7 meters long with 1-meter row spacing. Seed was planted at 2.54 cm depth. The plots were arranged in a randomized complete block design with five replications of each treatment and a 6-meter-wide alley. All plots were maintained as recommended via the Alabama Cooperative Extension System with typical pesticide and fertility production practices, and an overhead irrigation system was used for watering as needed. Plant stand, vigor, and nematode population data was collected at 34 days after planting (DAP). Only living plants were included in stand counts for data collection. Nematodes were extracted from the cotton roots using 6% NaCl and collected on a 25 um sieve. Harvest occurred on 5 October at 154 DAP. Data was statistically analyzed by ANOVA in SAS 9.4 (SAS Institute Inc.), and means were compared using Tukey-Kramer with $P \leq 0.05$. Monthly average maximum temperatures from planting in May through harvest in October were 27.3, 33.8, 34.4, 31.2, 33.6, and 28.8°C with average minimum temperatures of 14.9, 20.3, 22.4, 22.2, 18.5, and 12.1°C, respectively. Average temperatures from May to October was 21.1, 27.1, 28.4, 27.7, 26.1, and 20.4°C. Rainfall accumulation for each month was 3.5, 4.1, 6.9, 12.7, 0.3, and 1.1 cm, respectively.

Plant stands ranged from 41 to 52 plants per 7 meters of row, which is slightly below the optimal range of 8 to 12 plants per meter of row. Stand was statistically higher for the untreated control (1) stand than Poncho/Votivo + Fluopyram 600 FS (2). Plant vigor ranged from 3 to 4.4, with Poncho/Votivo + Velum Total (6) at 3.0 statistically higher than Poncho/Votivo + Fluopyram 600 FS (2), at 4.4. Reniform egg densities were substantial at 34 DAP. Reniform egg densities were statistically greater for the untreated control (1) than the Poncho/Votivo + Velum Total treatment (6). Yield was greater for the Poncho/Votivo + Velum Total treatment (6) than all other treatments in yield, at 3,052 kilograms per hectare.

No.	Treatment[z]	Rate	34 DAP Stand[y]	34 DAP Vigor[x]	Reniform Eggs/g Root	154 DAP kg/hectare
1	Untreated Control		52 a[w]	3.8 ab	9327 a	2136 bc
2	Poncho Votivo 2nd Gen.	0.424 mg ai/seed				
	Fluopyram 600 FS	0.25 mg ai/seed	41 b	4.4 b	6398 ab	2079 c
3	Poncho Votivo 2nd Gen.	0.424 mg ai/seed				
	Fluopyram 600 FS	0.2 mg ai/seed	50 ab	3.8 ab	2795 ab	2570 b
4	Fluopyram 600 FS	0.2 mg ai/seed	44 ab	4.6 b	2150 ab	2030 c
5	Avicta 500 FS	0.15 mg ai/seed	45 ab	3.8 ab	8521 ab	1934 c
6	Poncho Votivo 2nd Gen.	0.424 mg ai/seed				
	Velum Total	450 g ai/ha	47 ab	3.0 a	227 b	3052 a

[z]All treatments include Gaucho at 0.375 mg ai/seed, Spera at 54.8 mL/100kg, Proline 480 SC at 5 g ai/100 kg, Evergol Prime at 5 g ai/100 kg, and Allegiance FL at 48.9 mL/100 kg.
[y]Stand was the number of seedlings in 7 meters of row.
[x]Vigor ratings ranged from 1 to 6 with 1 being the best and 6 being the worst.
[w]Column numbers followed by the same letter are not significantly different at $P \leq 0.05$ as determined by Tukey's multiple-range test.

Nematicide Combinations for *Rotylenchulus reniformis* Management in North Alabama, 2016

W. Groover, K.S. Lawrence, N. Xiang, S. Till, D. Dodge, D. Dyer, and M. Hall

Gaucho, Fluopyram 600 FS, Aeris Seed Applied System, Trilex Advanced FS300, and Velum Total combinations were evaluated in *Rotylenchulus reniformis* (reniform nematode) control and yield increase on cotton. This test was planted in the field at the Tennessee Valley Research and Extension Center near Belle Mina, Alabama. This field was infested with the reniform nematode in 1997 and has been cultivated in cotton for over 17 years. The soil type is Decatur silt loam, which contains 24% sand, 49% silt, 11% clay and 1% organic matter. Seed treatments were applied by Bayer Crop Science to variety ST 4747 GLB2. All treatments were put on as a as a seed treatment, except for Velum Total, which was applied as an in-furrow spray at planting. Seed treatments were applied pre-planting, and planting occurred on 4 May. Plots consisted of 4 rows that were 7 meters long with 1-meter row spacing, and seeds planted at 2.54 cm depth. The plots were arranged in a randomized complete block design with five replications of each treatment and 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, and an overhead irrigation system was used for watering as needed. Plant stand, vigor, and nematode population data were collected at 34 days after planting (DAP). Only living plants were included in stand counts for data collection. Nematodes were extracted from the cotton roots using 6% NaCl and collected on a 25-um sieve. Harvest occurred on 5 October at 154 DAP. Data was statistically analyzed by ANOVA in SAS 9.4 (SAS Institute Inc.) and means were compared using Tukey-Kramer with $P \leq 0.05$. Monthly average maximum temperatures from planting in May through harvest in October were 27.3, 33.8, 34.4, 31.2, 33.6, and 28.8°C with average minimum temperatures of 14.9, 20.3, 22.4, 22.2, 18.5, and 12.1°C, respectively. Average temperatures from May to October was 21.1, 27.1, 28.4, 27.7, 26.1, and 20.4°C. Rainfall accumulation for each month was 3.5, 4.1, 6.9, 12.7, 0.3, and 1.1 cm, respectively.

Plant stands ranged from 34 to 55 plants per 7 meters of row, which is slightly below the optimal range of 8 to 12 plants per meter of row. Plant vigor ranged from 3.6 to 5.6, with all seed treatments significantly increasing plant vigor over the untreated control (1). In contrast, stand was statistically lower for the untreated control (1) treatment than all other treatments. Reniform nematode egg densities were substantial at 34 DAP. Reniform egg numbers were statistically higher with the Gaucho treatment (2) at 4,545 eggs per gram of root than the Aeris Seed Applied System + Trilex Advanced FS300 + Fluopyram 600 FS + Velum Total treatment (6) at 263 eggs per gram of root, but there were no significance differences between other treatments. Yield was significantly lower for the untreated control (1), which was 340 kg/hectare, than any other treatment. This yield is surprisingly low as there was no other disease pressure in the field besides the reniform nematode, so it is unclear why the low yield occurred for this treatment. There were no statistical differences between the other five treatments.

No	Treatment[z]	Rate	34 DAP Stand[y]	34 DAP Vigor[x]	Reniform Eggs/g root	154 DAP kg/hectare
1	Untreated Control		34 b[w]	5.6 a	3863 ab	340 b
2	Gaucho	0.375 mg ai/seed	53 a	4.2 b	4545 a	1979 a
3	Gaucho	0.375 mg ai/seed				
	Fluopyram 600 FS	0.25 mg ai/seed	55 a	3.6 b	1030 ab	2632 a
4	Aeres Seed Applied System	0.75 mg ai/seed				
	Trilex Advanced FS300	47.3 mL/cwt	50 a	4.0 b	3863 ab	2053 a
5	Aeris Seed Applied System	0.75 mg ai/seed				
	Trilex Advanced FS300	47.3 mL/cwt				
	Fluopyram 600 FS	0.2 mg ai/seed	53 a	4.0 b	2016 ab	2164 a
6	Aeris Seed Applied System	0.75 mg ai/seed				
	Trilex Advanced FS300	47.3 mL/cwt				
	Fluopyram 600 FS	0.2 mg ai/seed				
	Velum Total	335.3 mL ai/ha	55 a	3.8 b	263 b	2869 a

[z]All treatments include Spera 24.9 mL/cwt, Proline 480 SC at 2.37 mL ai/cwt, Evergol Prime at 2.37 mL ai/cwt, and Allegiance FL at 22.2 mL ai/cwt.
[y]Stand was the number of seedlings in 7 meters of row.
[x]Vigor ratings ranged from 1 to 6 with 1 being the best and 6 being the worst.
[w]Column numbers followed by the same letter are not significantly different at $P \leq 0.05$ as determined by Tukey's multiple-range test.

Evaluation of Velum Total on Cotton for Root-knot Management in Central Alabama, 2016

N. Xiang, K.S. Lawrence, W. Groover, D. Dodge, D. Dyer, S. Till, and M. Hall

Velum Total was evaluated for the management of root-knot nematode on cotton in a naturally infested field in the Plant Breeding Unit of the E V Smith Research Center near Tallassee, AL. The soil is Kalmia loamy sand with 80% sand, 10% silt, and 10% clay. All nematicides except Velum Total were seed treatments and applied by Bayer Crop Science. Plots consisted of 2 rows, 7 m long with 0.9 m spacing and were arranged in a randomized complete block design with five replications. Blocks were separated by a 6-m-wide alley. All plots were maintained with standard herbicide, insecticide, and fertility production practices throughout the season as recommended by the Alabama Cooperative Extension System. Seedling stand was determined at 27 days after planting (DAP) on 24 May. Shoot and root fresh weights of 4 root systems from each plot were determined at 36 DAP. Nematode population densities were determined by extracting eggs from 4 root systems per plot at 36 DAP. Plots were harvested on 3 Oct. Data were analyzed in SAS 9.4 by Proc Glimmix procedure using Tukey-Kramer method with significant level $P \leq 0.05$. Monthly average maximum temperatures from planting in May through harvest in October were 27.9, 32.7, 34.2, 33.3, 33.4, and 29.4°C with average minimum temperatures of 14.2, 19.1, 21.1, 21.4, 18.3, and 10.7°C, respectively. Temperature was normal based on heat units. Rainfall accumulation for each month was 1.76, 2.82, 2.94, 4.12, 0.95, and 0.23 cm with a total of 12.82 cm over the entire season. The rainfall was limited and dry throughout the growing season.

Nematode disease pressure was severe for conducting nematode research on early-planted cotton in 2016. Aeris + Fluopyram 600 FS + Velum Total (10) significantly increased plant stand as compared to Aeris (2) at 27 DAP. Shoot fresh weight, ranging from 14.0 g to 24.9 g, and root fresh weight, ranging from 1.3 g to 2.6 g, were statistically similar among all the treatments at 36 DAP. Root-knot nematode eggs per gram of root were statistically similar among all the treatments. All Velum Total treatments numerically reduced root-knot nematode numbers compared to Gaucho and that average was 66%. Cotton yield varied by 986 kg/ha. The treatments Aeris + Fluopyram (8) and Aeris + Velum Total 385.8 g ai/ha (5) significantly increased seed cotton yield as compared to Aeris + Velum Total (7).

		27 DAP	36 DAP	36 DAP	*Meloidogyne incognita* (36 DAP)	Seed Cotton
No.	Nematicide[z]	Stand[y]/ row	SFW[x]	RFW[w]	Eggs/g root[v]	kg/ha
1	Gaucho 0 .03 mg ai/seed	74 ab[u]	16.3	1.7	11248	2706 ab
2	Aeris seed applied system 0.75 mg ai/seed	69 b	18.9	1.8	10634	2568 ab
3	Aeris seed applied system 0.75 mg ai/seed	76 ab	17.7	1.8	7311	2949 ab
	Velum Total 257.2 g ai/ha					
4	Aeris seed applied system 0.75 mg ai/seed	77 ab	19.2	1.7	1969	2977 ab
	Velum Total 321.5 g ai/ha					
5	Aeris seed applied system 0.75 mg ai/seed	82 ab	14.4	1.5	2010	3371 a
	Velum Total 385.8 g ai/ha					
6	Aeris seed applied system 0.75 mg ai/seed	82 ab	24.9	2.1	4246	2754 ab
	Velum Total 450 g ai/ha					
7	Aeris seed applied system 0.75 mg ai/seed	83 ab	24.6	2.6	1831	2400 b
	Velum Total 578.7 g ai/ha					
8	Aeris seed applied system 0.75 mg ai/seed	77 ab	14.0	1.3	11063	3386 a
	Fluopyram 600 FS 0.2 mg ai/seed					
9	Aeris seed applied system 0.75 mg ai/seed	82 ab	16.3	1.7	8543	2765 ab
	Fluopyram 600 FS 0.2 mg ai/seed					
	Velum Total 321.5 g ai/ha					
10	Aeris seed applied system 0.75 mg ai/seed	89 a	17.6	1.9	1034	2630 ab
	Fluopyram 600 FS 0.2 mg ai/seed					
	Velum Total 385.8 g ai/ha					

[z]Nematicide treatments included a base fungicide-insecticide application of 54.8 ml/100kg of Spera, 5g ai/100kg of Proline 480 SC, 652 ml/100kg of Secure plus seed gloss 661, 5 g ai/100kg of Evergol prime, 48.9 ml/100kg of Allegiance FL, and 0.03 mg ai/seed of Gaucho.
[y]Stand was the number of seedlings per row.
[x]SFW means shoot fresh weight (g) per 4 cotton plants.
[w]RFW means root fresh weight (g) per 4 root systems.
[v]Eggs/g root means root-knot nematode eggs per gram of root.
[u]Means followed by same letter do not significantly differ according to Tukey-Kramer test ($P \leq 0.05$).

Evaluation of Velum Total on Cotton for Reniform Nematode Management in North Alabama, 2016

N. Xiang, K.S. Lawrence, W. Groover, D. Dodge, D. Dyer, S. Till, and M. Hall

Velum Total was evaluated for the management of reniform nematode on cotton in a naturally infested field at Tennessee Valley Research and Education Center in Belle Mina, AL. The soil is a Decatur silt loam (24% sand, 28% clay, and 49% silt). All nematicides except Velum Total were seed treatments and applied to Stoneville 4747 GLT by Bayer Crop Science. Plots consisted of 2 rows that were 7-m long with 0.9-m spacing and were arranged in a randomized complete block design with five replications. Blocks were separated by a 6-m-wide alley. All plots were maintained with standard herbicide, insecticide, and fertility production practices throughout the season as recommended by the Alabama Cooperative Extension System. Seedling stand, vigor, plant height, biomass including shoot and root fresh weights of 4 cotton plants per plot, and nematode population densities were determined at 33 days after planting (DAP) on 7 June. Plots were harvested on 6 Oct. Data were analyzed in SAS 9.4 by Proc Glimmix procedure with significant level $P \leq 0.05$. Means were separated by Tukey-Kramer test. Monthly average maximum temperatures from planting in May through harvest in October were 26.7, 31.1, 32.8, 32.8, 29.4, and 23.4°C with average minimum temperatures of 12.8, 17.2, 18.9, 17.8, 13.9, and 7.8 °C, respectively. Rainfall accumulation for each month was 4.8, 3.9, 3.3, 3.9, and 3.4 cm with a total of 23.7 cm over the entire season. The rainfall was adequate in May but became limited through the remainder of the season.

Nematode disease pressure was severe for conducting nematode research on early-planted cotton in 2016. Plant stand, vigor, and plant height, were statistically similar among all the treatments at 33 DAP. Plant biomass was significantly increased by Aeris + Velum Total (7) as compared to Gaucho control (1). Reniform nematode eggs per gram of root was significantly reduced by

Velum Total (5) and Aeris + Fluopyram + Velum Total (8) as compared to Aeris (2). Difference in cotton yield varied by 1575 kg/ha numerically from Gaucho being the lowest and Velum Total 578.7 g ai/ha the highest. All the Velum Total treatments, Velum Total (5), Velum Total (6), Aeris + Velum Total (7), and Aeris + Fluopyram 600 FS + Velum Total (8), significantly increased seed cotton yield compared to Gaucho control ($P \leq 0.10$) and that average increase was 47%. Two of the seed treatments, Aeris (2) and Aeris + Admire pro (3), also significantly increased seed cotton yield compared to Gaucho control ($P \leq 0.10$) and that average increase was 37%.

			33 DAP				*Reniform nematode*	Seed Cotton
No.	Nematicide[z]		Stand[y]/ row	Vigor[x]	Height[w]	Bio[v]	Eggs/g root[u]	kg/ha
1	Gaucho	0.03 mg ai/seed	44	4.4	11.6	9.4 b	3415ab	1442 b[t]
2	Aeris seed applied system	0.75 mg ai/seed	47	4.2	12.9	13.8 ab	5580 a	2294 a
3	Aeris seed applied system	0.75 mg ai/seed	46	3.4	13.8	14.8 ab	1899 ab	2266 a
	Admire pro systemic pro	361.7 mg ai/ha						
4	Aeris seed applied system	0.75 mg ai/seed	52	3.8	12.6	12.3 ab	2888 ab	1918 ab
	Fluopyram 600 FS	0.2 mg ai/seed						
5	Velum Total	450 g ai/ha	48	3.8	14.4	17.3 ab	954 b	2506 a
6	Velum Total	578.7 g ai/ha	47	3.8	13.1	14.6 ab	1364 ab	3017 a
7	Aeris seed applied system	0.75 mg ai/seed	47	3.8	14.4	18.4 a	1367 ab	2819 a
	Velum Total	450 g ai/ha						
8	Aeris seed applied system	0.75 mg ai/seed	53	3.2	12.9	17.4 ab	333 b	2638 a
	Fluopyram 600 FS	0.2 mg ai/seed						
	Velum Total	450 g ai/ha						

[z]Nematicide treatments included a base insecticide application of 54.8 ml/100kg of Spera, 5g ai/100kg of Proline 480 SC, 652 ml/100kg of Secure plus seed gloss 661, 5g ai/100kg of Evergol prime, 48.9 ml/100kg of Allegiance FL, and 0.03 mg ai/seed of Gaucho.
[y]Stand was the number of seedlings per row.
[x]Vigor ratings from 1 to 6 with 6 being the best and 1 the worst.
[w]Height means plant height (cm).
[v]Bio means plant biomass including shoot fresh weight (g) and root fresh weight (g).
[u]Eggs/g root means reniform nematode eggs per gram of root at 33 DAP.
[t]Means followed by same letter do not significantly differ according to Tukey-Kramer test ($P \leq 0.10$).

A Potential New Biological Nematicide for Reniform Management in North Alabama, 2016

D. Dyer, K. S. Lawrence, S. Till, D. Dodge, W. Groover, N. Xiang, and M. Hall

Five rates and combinations of a biological nematicide were tested for their control of the reniform nematode on cotton. The field site where this test was conducted is located at Auburn University's Tennessee Valley Research and Education Center, Belle Mina, AL. This field has been cultivated in cotton for over 16 years and was infested with the reniform nematode in 1997. The field contains a Decatur silt loam soil type, which consists of 24% sand, 49% silt, and 28% clay. All nematicides were applied to the crop as seed treatments. BioST nematicide and experimental treatments are products of Albaugh LLC, and the BioST nematicide is part of a seed treatment platform being launched by Albaugh in 2017. Seed treatment rate designations were assigned by the manufacturer, but quantitative application rates were not specified. The cotton variety used during this test was NexGen 3406 B2XF. The test was planted on 4 May, planting depth was 2.5 centimeters and the soil temperature at the time of planting was 24°C. Each test plot consisted of two rows that were 7 meters long with a 1-meter row spacing. The test was replicated 5 times and arranged in a randomized complete block design. The test was maintained throughout the season with standard insecticide, herbicide, and fertilizer practices as recommended by the Alabama Cooperative Extension System. Average monthly high temperatures for the area from the time of planting until harvest were 27, 34, 34, 33, 33, and 29°C and average monthly low temperatures were 15, 21, 22, 22, 18, and 12°C. Rainfall accumulation for each month during the growing season was 3.45, 4.06, 6.93, 12.73, 0.30 and 1.09 centimeters with a total rainfall amount of 28.58 centimeters. Test was watered throughout the season as needed by a lateral irrigation system. Seedling stands were counted 30 days after planting (DAP). Nematode samples were taken 45 DAP by digging up four plants at random for each plot. Nematodes were extracted by soaking the roots in a 6% NaOCl solution on a shaker table for four minutes, and the nematodes were collected on a 25-µm sieve. The test was harvested and the yield data was collected on 5 October. Data was analyzed with SAS 9.4 using PROC GLIMMIX and LS-means were compared using Tukey-Kramer's method ($P \leq 0.1$).

In this test, plant stands were similar for all treatments and ranged from 7.6 to 8.9 plants per meter of row. Forty-five days after planting, the total reniform nematode egg numbers ranged from 1,450 to 7,330 with the Fluopyram and BioST Nematicide Concentrate + Experimental 2 treatments showing significantly lower numbers as compared to the untreated control. Biomass in this test ranged from 8.42 grams to 15.87 grams with the high rate treatment of BioST nematicide showing significantly higher biomass than the control. Biomass was decreased in this study, compared to the control, by treatments of the BioST Nematicide concentrate and the BioST Nematicide concentrate + Experimental product 2. Yield ranged from 2091 to 2754 kg/ha. Yield was 663 kg/ha greater for the high rate of the BioST nematicide than the untreated control.

		Reniform nematode eggs			
Seed treatment	Stand [z] 30 DAP	total eggs [y]	per g of root	Biomass [x]	Seed cotton yield kg./ ha
Control	63 a	7330 a	7176 a	11.46 b	2091 b
Fluopyram	59 a	1450 b	1831 b	10.23 bc	2251 b
Abamectin	55 a	3588 ab	3824 ab	10.55 bc	2130 b
BioST Nematicide low	60 a	6591 ab	7617 a	10.72 bc	2159 b
BioST Nematicide High	60 a	7161 a	5293 ab	15.87 a	2754 a
BioST Nematicide Concentrate	59 a	3080 ab	4720 ab	8.42 c	2147 b
BioST Nematicide Concentrate + Experimental product 1	59 a	5652 ab	7195 a	8.56 c	2251 b
BioST Nematicide Concentrate + Experimental product 2	53 a	1719 b	2517 ab	9.47 bc	2351 ab

[z]Stand is the total number of plants in 7 meters of row. Means followed by the same letter do not significantly differ according to Tukey-Kramer's method ($P \leq 0.1$)
[y]Total number of eggs that were found on the four plants that were sampled at 45 DAP.
[x]Biomass is the total weight of the plant in grams.

A Potential New Biological Nematicide for Root-knot Management in North Alabama, 2016

D. Dyer, K. S. Lawrence, S. Till, D. Dodge, W. Groover, N. Xiang, and M. Hall

Five rates and combinations of a biological nematicide were tested for their control of the root-knot nematode on cotton. The field site where this test was conducted is located on Auburn University's Plant Breeding Unit in Tallassee, AL. This field contains a Kalmia loamy sand soil type made up of 80% sand, 10% silt, and 10% clay. All nematicides tested were applied to the crop as seed treatments. BioST nematicide and Experimental products 1 and 2 are products of Albaugh LLC. Seed treatment rate designations were assigned by the manufacturer, but quantitative application rates were not specified. The cotton variety used during this test was NexGen 3406. The test was planted on 26 April at a planting depth of 2.5 centimeters. The soil temperature at the time of planting was 21.7°C. Each test plot consisted of two rows measuring 7 meters long with 1-meter row spacing. The test was replicated five times and arranged in a randomized complete block design. The test was maintained throughout the season with standard insecticide, herbicide, and fertilizer practices as recommended by the Alabama Cooperative Extension System. The average monthly high temperatures for the area from the time of planting until harvest were 24.2, 27.9, 32.7, 34.2, 33.3, 33.4, 29.4°C and the average monthly low temperatures for the area were 10, 14.2, 19.1, 21.1, 21.4, 18.3, and 10.7°C. Rainfall accumulation for each month during the growing season was 20.62, 4.47, 7.16, 7.47, 10.46, 2.41, and 0.58 centimeters with a total rainfall amount of 53.44 centimeters. The test was watered throughout the season as needed by a center-pivot irrigation system. Seedling stand counts were taken 30 days after planting (DAP). Nematode samples were taken 45 DAP by digging up four plants at random from each plot. Nematodes were extracted from cotton roots by soaking the roots in a 6% NaOCl solution on a shaker table for 4 minutes, and the nematodes were collected on a 25-µm sieve. Nematode population density is demonstrated below as both total eggs extracted from the root systems of the four plants as well as nematode eggs per gram of root. The test was harvested and yield data collected on 4 October. Data was analyzed with SAS 9.4 using PROC GLIMMIX and LS-means were compared using Tukey-Kramer's method ($P \leq 0.1$).

Root-knot nematode disease pressure on cotton was high in this field during 2016. Plant stands were similar for all treatments in this test, ranging from 10.5 to 11.7 plants per meter of row. When samples were taken 45 DAP, total root-knot nematode egg densities ranged from 38,378 to 75,056, and the root-knot nematode eggs per gram of root ranged from 16,214 to 26,930. Total nematode egg densities were significantly higher for BioST Nematicide concentrate + Experimental treatment 1 than the control, Fluopyram, Abamectin, and BioST Nematicide concentrate + Experimental product 2 treatments. The control, Abamectin, and BioST Nematicide concentrate + Experimental product 2 treatments supported lower nematode egg population density per gram of root when compared to the BioST Nematicide concentrate + Experimental product 1 treatment. In this study, plant biomass ranged from 19.1 to 27.8 grams. Treatments of BioST nematicide in a concentrated form increased biomass compared with Fluopyram or the high rate of BioST nematicide. Yields were statistically greater than the control for Fluopyram, BioST high rate, and Abamectin treatments by 466, 462, and 633 kg/ha respectively.

			Root-knot nematode eggs							
Treatment	Stand [z] 30 DAP		total [y]		per g of root		Biomass [x]		Seed cotton yield kg/ha	
Control	74	a	41823	b	16908	b	21.5	ab	3168	c
Fluopyram	79	a	37389	b	19525	ab	19.1	b	3634	ab
Abamectin	81	a	38378	b	17463	b	22.4	ab	3801	a
BioST Nematicide Low rate	77	a	48899	ab	20105	ab	21.3	ab	3377	bc
BioST Nematicide High rate	76	a	47586	ab	23057	ab	19.5	b	3630	ab
BioST Nematicide Concentrate	82	a	58339	ab	20631	ab	27.8	a	3190	c
BioST Nematicide Concentrate + Experimental product 1	77	a	75056	a	26930	a	23.9	ab	3152	c
BioST Nematicide Concentrate + Experimental product 2	80	a	41561	b	16214	b	22.3	ab	3462	abc

[z]Stand is the total number of plants in 7 meters of row. Means followed by the same letter are not significantly different according to Tukey-Kramer's method ($P \leq 0.1$) [y]Total number of eggs that were found on the four plants that were sampled at 45 DAP. [x]Biomass is the total weight of the plant in grams.

Varietal and Nematicidal Application Responses in Central Alabama Soils, 2016

K.S. Lawrence, M. Hall, D. Dodge, D. Dyer, W. Groover, S. Till, N. Xiang

Nematicidal applications were evaluated on two varieties of cotton for southern root-knot nematode management. Treatments were applied to two Stoneville cotton varieties, ST 4946GLB2 and ST 4747GLB2; ST 4946GLB2 typically exhibits good tolerance in the presence of the root-knot nematode, whereas ST4747GLB2 demonstrates only fair tolerance to the root-knot nematode. The field site is located at the Plant Breeding Unit in Tallassee, Alabama. The soil type is a Kalmia loamy sand. Gaucho, Aeris, and Fluopyram were applied as seed treatments prior to planting, and Velum Total was applied as an in-furrow spray with 8002 flat-fan nozzles angled diagonally across the seed furrow immediately preceding the seed. Plots were planted on 26 Apr 2016 with a soil temperature of 67 °F at 1-in depth and adequate soil moisture. Plots consisted of 4 rows measuring 25-ft long with 36-in row spacing and were arranged in a randomized complete block design with five replications. A 10-ft wide alley separated blocks. 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 center pivot sprinkler system as needed. Seedling stand and vigor were determined at 28 days after planting (DAP) on 24 May. Samples were collected for nematode analysis by digging up 4 random plants per plot on 2 Jun. Nematodes were extracted from the root systems using 6% NaOCl and collected on a 25 µm sieve. Plots were harvested on 3 Oct.

Data were statistically analyzed using SAS 9.4 PROC GLIMMIX and means compared using Tukey-Kramer ($P \leq 0.10$). Monthly average maximum temperatures from planting in Apr through harvest in Oct were and 83.4, 82.3, 90.9, 93.5 92.0, 92.1, and 82.7°F with average minimum temperatures of 59, 57.5, 66.3, 69.9, 70.5, 64.9, and 51°F, respectively. Rainfall accumulation for each month was 1.5, 1.76, 2.82, 2.94, 4.12, 0.95, and 0 in with a total of 14.09 in over the entire season. The rainfall was adequate in Jul but very dry in Aug, Sep, and Oct.

Root-knot nematode disease pressure was intense for cotton in 2016. No significant variety by treatment interactions were revealed by data analysis, indicating both varieties responded similarly to nematicide treatments. Plant stand at 28 DAP was similar for all nematicide applications, and all stand counts fell within the acceptable range of 2-4 plants per foot of row. The untreated control (1) and Velum Total 14 fl oz/A (3) treatments demonstrated increased vigor compared to the Velum Total + Aeris (5) and Gaucho + Fluopyram (7) treatments. Both 'ST 4946' and 'ST 4747' vigor ratings were similar across all nematicide treatments. Nematode population densities per gram of root were similar for both the tolerant 'ST4946' and susceptible 'ST 4747' varieties. The Velum Total 18 fl. oz./A treatment (4) significantly reduced nematode eggs per gram of root compared to the untreated control (1). Seed cotton yields varied by 798 lb/A; however, yields were not significantly different across nematicide treatments as well as both varieties.

Treatment and Rate[w]	Stand[x]	Vigor[y]	Root-knot eggs/g root	Seed Cotton (lb/A)
1. Untreated Control	82 a[z]	2.5 c	14,977 a	1939 a
2. Gaucho 12.8 oz/cwt seed	79 a	2.9 bc	12,591 ab	1814 a
3. Velum Total 14 fl oz/A	81 a	2.6 c	3615 ab	2079 a
4. Velum Total 18 fl oz/A	87 a	3.0 bc	2318 b	2612 a
5. Velum Total 14 fl oz/A + Aeris 25.6 oz/ cwt seed	81 a	3.8 a	9168 ab	2293 a
6. Aeris 25.6 oz/ cwt seed	81 a	3.2 b	10,963 ab	1956 a
7. Gaucho 12.8 oz/cwt seed + Fluopyram 8.5 oz/cwt seed	83 a	4.1 a	7663 ab	2294 a
Varieties				
'ST 4946' (tolerant)	83 A	3.2 A	7039 A	2178 A
'ST 4747' (susceptible)	81 A	3.1 A	10,474 A	2104 A

[w]Due to no varietal interaction indicated through data analysis, treatments are compared with each other.
[x]Stand indicates the number of seedlings in 25 ft of row 28 days after planting (DAP).
[y]Plant vigor ratings ranged from 1-6 with 1 indicating strong proliferation and 6 representing extremely poor vitality.
[z]Column numbers followed by the same letter are not significantly different within nematicide or variety treatments at $P \leq 0.1$ as determined by the Tukey-Kramer method.

Cotton Variety Evaluation with and without Velum Total for Root-Knot Management in South Alabama, 2016

S. Till, K.S. Lawrence, N. Xiang, W. Groover, D. Dodge, D. Dyer, and M. Hall

Ten cotton varieties were evaluated along with Velum Total for control of the root-knot nematode at the Gulf Coast Research and Extension Center near Fairhope, Alabama. The field was artificially inoculated with root-knot nematode in 2013 and inoculation has been repeated in subsequent years. A control field of the same ten varieties was also planted in an adjacent field that is absent of root-knot nematode. The soil is a Malbis sandy loam, which contains 59% sand, 31% silt, 10% clay. The root-knot field trial was installed as a split plot design (variety and nematicide treatments) with five replications. Plots were planted on 12 May, and consisted of 4 rows, 25 feet long with 36-inch row spacing and 20-foot-wide alleys. Seed varieties contained standard seed treatment as sold based upon variety, and Velum Total was applied in-furrow to two rows in each plot with 8002 flat fan nozzles angled diagonally across the seed furrow at a rate of 14 oz/acre. The other two rows were left untreated. Seed was planted at a 1-inch depth. The control field consisted of 2-row plots arranged in a randomized complete block design replicated five times. All plots were maintained as recommended by the Alabama Cooperative Extension System with typical pesticide and fertility production practices, and an overhead irrigation system was used for watering as needed. Nematode densities were measured in the root-knot field at 46 days after planting (DAP) by digging up four random samples for both treated and untreated rows. Nematodes were extracted from the cotton roots using 6% NaOCl and collected on a 25 um sieve. Plots were harvested on 31 Oct, and data were subjected to analysis of variance in SAS 9.4 (SAS Institute Inc.) using the PROC GLIMMIX procedure and means compared using Tukey-Kramer with $P \leq 0.10$. Monthly average maximum temperatures from planting to harvest (May through Oct) were 82.7, 88.9, 90.1, 89.2, 88.7, and 83.4°F with average minimum temperatures of 63.9, 71.1, 74.8, 74.2, 70.7, and 58.3°F, respectively. Rainfall accumulation for each month was 2.31, 3.39, 2.91, 3.95, 0.00, and 0.00 in. respectively, with a total of 12.56 in. over the entire growing season.

Root-knot disease pressure ranged from moderate to heavy for irrigated cotton at the Gulf Coast Research and Extension Center. ST 4848 GLT with Velum Total supported fewer eggs/g of root than both DP 1555 B2RF and PHY 444 WRF without the nematicide. Velum Total treated CR 3885 B2XF and DP 1555 B2RF yielded significantly better than untreated PHY 444 WRF, ST 4848 GLT, PHY 552 WRF, and treated PHY 552 WRF in the root-knot field. The root-knot nematode-resistant DP 1558 NR B2RF, both with and without Velum Total, yielded significantly better than PHY 552 WRF with Velum Total and PHY 444 WRF without Velum Total. In the field without root-knot infestation, DP 1555 B2RF had significantly higher yield than all but three varieties, CR 3885 B2XF, DP 1646 B2XF, and PHY 444 WRF.

Nematicide	Variety	Eggs/g of root[y]		Lbs/A seed cotton			
				With Root-knot Nematode		No Root-knot Nematode	
No nematicide	CR 3885 B2XF	2076	ab	2628	abcd	3572	ab
Velum Total[z]	CR 3885 B2XF	672	ab	3557	a		
No nematicide	DP 1538 B2XF	3533	ab	2802	abcd	2860	b
Velum Total	DP 1538 B2XF	953	ab	3165	abcd		
No nematicide	DP 1555 B2RF	6777	a	2802	abcd	4095	a
Velum Total	DP 1555 B2RF	1952	ab	3514	a		
No nematicide	DP 1558NR B2RF	1363	ab	3412	abc	3064	b
Velum Total	DP 1558NR B2RF	983	ab	3354	abc		
No nematicide	DP 1646 B2XF	2943	ab	3093	abcd	3528	ab
Velum Total	DP 1646 B2XF	663	ab	3485	ab		
No nematicide	PHY 333 WRF	1660	ab	2802	abcd	2991	b
Velum Total	PHY 333 WRF	1324	ab	2643	abcd		
No nematicide	PHY 444 WRF	5216	a	1902	d	3267	ab
Velum Total	PHY 444 WRF	1298	ab	2715	abcd		
No nematicide	PHY 552 WRF	5926	ab	2105	cd	3049	b

Velum Total	PHY 552 WRF	2674	ab	1873	d		
No nematicide	ST 4848 GLT	1463	ab	2193	bcd	3209	b
Velum Total	ST 4848 GLT	1614	b	2860	abcd		
No nematicide	ST 6182 GLT	1559	ab	2585	abcd	2759	b
Velum Total	ST 6182 GLT	1725	ab	2817	abcd		

[z]Velum Total was applied as an in-furrow spray at a rate of 14 oz/acre.
[y]Data was log transformed in order to satisfy model assumptions.
[x]Column numbers followed by the same letter are not significantly different at $P \leq 0.10$ as determined by Tukey's multiple-range test.

Determination of Role of Salicylic Acid in Nematode-Induced Hypersensitive Responses

S. W. Park, and K. Lawrence

The proposed study is to understand the **innate immune response** of cotton plants toward reniform nematode (*Rotylenchulus reniformis*) infections, in order to deposit genetic repertoires for the development of new, sustainable transgenic lines which will boost cotton's own disease resistance capacity. Towards this, our studies aim to substantiate if cotton roots (i.e., Lonren-1 line) are able to confer hypersensitive responses (**HR**) upon *R. reniformis* infections, which are the most eminent and effective defense machinery in plants. HR is characterized by rapid cellular suicide (programed cell death, PCD) in the local region surrounding infections, which limits pathogen establishment and spread.

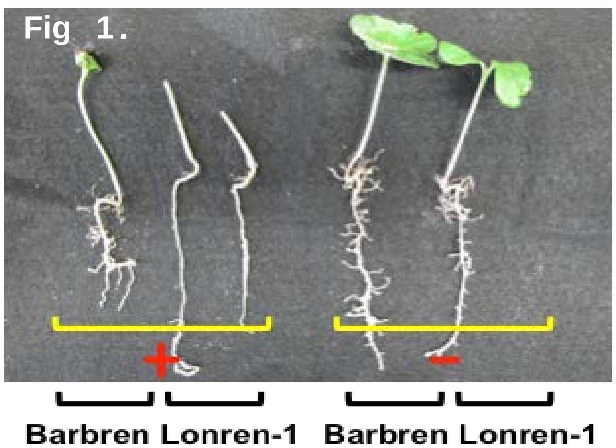
SPECIFIC AIMS

Phenotyping *R. reniformis*-induced HR in the Lonren-1 roots.

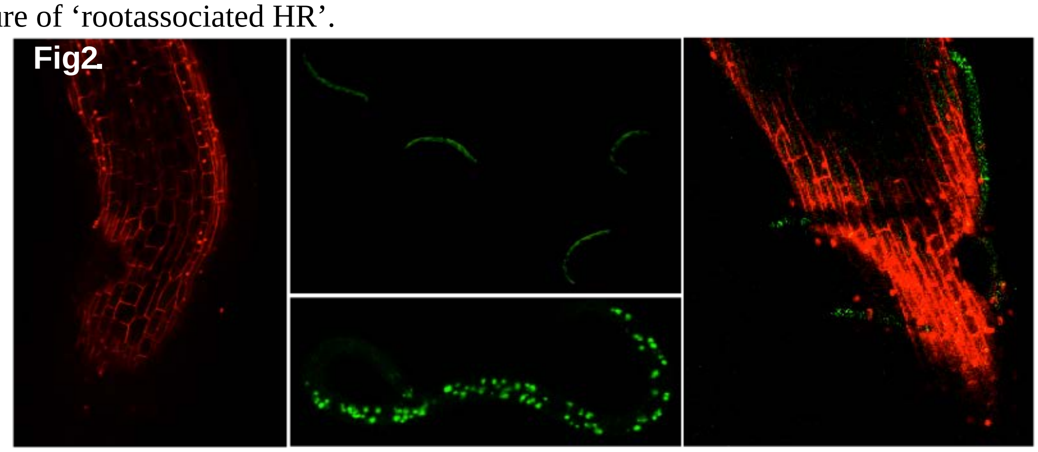
Establishing a confocal microscopy technique for co-imaging the real-time interactions of nematodes with cotton roots**.**

Cellular characterization of HR: reactive oxygen species (ROS) burst (rapid production) at the region of cotton roots infected by *R. reniformis*.

Aim 1. The lateral roots of Lonren-1 are hypersensitive towards *R. reniformis* infections.
As an initial step to access HR associated with ***i***) cotton, ***ii***) root tissues and/or ***iii***) nematodes, we monitored the morphological response of roots in two cotton lines (Lonren-1 and Barbren) towards *R. reniformis* infections (Fig. 1). Note that Lonren-1 is referred to as the HR developing line, while Barbren is considered as a tolerance line (Nematropica 41:68). Indeed, the infected ('+') roots of Lonren-1 formed an extended taproot system with vastly smaller lateral roots, whereas Barbren showed reduced taproot, yet normal lateral root system. The *R. reniformis*-mediated shortening of lateral roots in Lonren-1 is caused by perhaps rapid HR development in the localized area of infections.

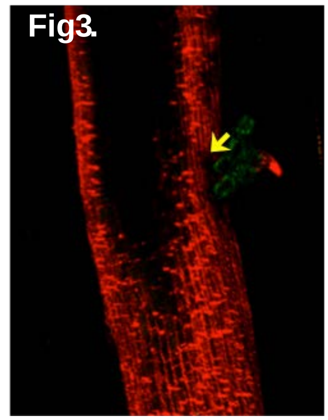


Aim 2. Real-time co-imaging of Lonren-1 roots and *R. reniformis* interactions.
To define the molecular fingerprints of HR development in cotton roots, we developed a cell biological mean to co-image '**realtime**' interacttions between cotton roots and nematodes (Fig. 2). This is possible as nematodes are autofluorescent at an excitation of 488nm wavelength, emitting a **green** color, while cotton roots are stained with propidium-iodide (PI) solution that is excited at 516nm excitation, producing a **red** color. It is worth noting that our imaging technique utilizing a confocal laser scanning microscope (Nikon) is <u>the first and</u> <u>successful</u> attempt to feed '**live'** images in a single cell level of cotton roots, and their interactions/ responses to other organisms (e.g., nematodes). Using this technique, our analyses revealed that Lonren-1 roots develop rapid (< 24 hr), and localized cell death (LCD, collapse) at the site of *R. reniformis* infections (Fig. 3, see yellow arrow). Since nematodes are biotrophic, or transient biotrophic pathogens (keep host cells alive), these results corroborate for the first time the cell biological signature of 'rootassociated HR'.

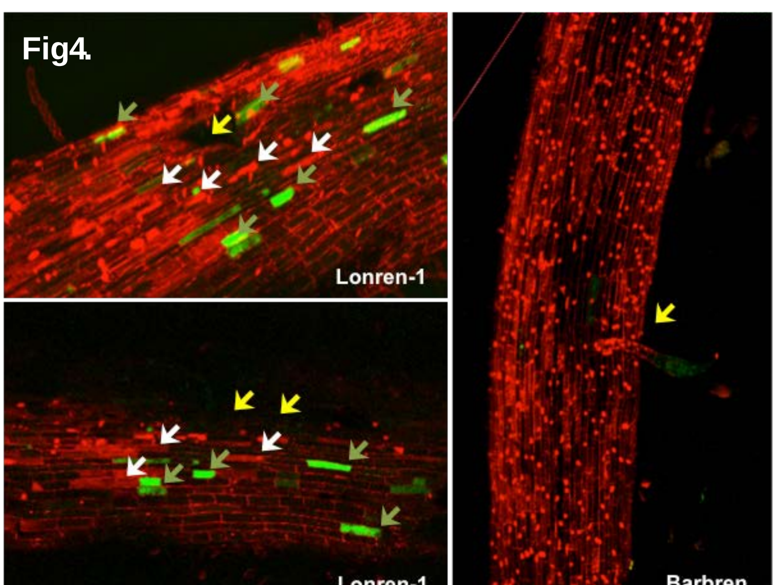


Aim 3. *R. reniformis* interactions stimulate localized ROS burst in the root tissues of Loren-1, but not Barben.

To further substantiate if the LCD (shown in Fig. 3) is ‘true’ HR occurring as a part of defense response (HR) or, otherwise, disease symptom (chlorosis), this sub-aim tackled if the LCD accompanies **‘biphasic oxidative burst**’, the most well described, distinctive molecular and metabolic fingerprints of HR. Towards that, we have employed a cell-permeable H_2O_2-specific fluorescent probe (2’,7’-dichlorofluorescin diacetate, **green**), and displayed the sequential co-imaging with PI-stained roots and nematode autofluorescence (Fig. 4). This unique approach unraveled, in further support of our physiological and cellular observations, that some cells in close proximity to *R. reniformis*-infection site accumulate H_2O_2 (**green**, green arrowhead) or some are dead (**red**, white arrowhead), indicating that the LCD is highly likely HR, developed likely by systemic and programmed cell necrosis mechanisms. In contrast, the same analysis revealed that the cell damage in root tissues of Barbren at/nearby the site of *R reniformis* infection is if any minimal and has little sign of ROS burst, proposing a novel mode of defense response that explains possible tolerance phenotype of *Barbren* to *R. reniformis* infections. Note that red dots indicate the PI-stained membrane of nucleolus (live cells).



FUTURE DIRECTIONS: We will perform further characterization of Lonren-1 root-associated HR e.g.,) by determining ***i***) chromatin condensation, ***ii***) DNA laddering, ***iii***) HR-associated marker gene expression, and ***iv***) system biology analysis of Lonren-1 against a susceptible cotton line (SG747) as well as a tolerance line (Barbren). The later system biology studies will also elucidate and uncover molecular principle of unknown mode of defense manifesting in Barbren.



Isolation of a Root Signal, Attracting a Semi-endoparasitic Nematode *Rotylenchulus reniformis*

S. W Park

Plant-parasitic nematodes have received only limited study as cotton pathogens, and thus little is known about how they recognize and interact with host cells (e.g., cotton roots). Recent studies from our group have shown a presence of signal molecules in cotton root extracts, needed for cotton root-reniform interactions/infections. We hence hypothesized that cotton roots secrete metabolic compounds that signal and attract reniform nematodes.
Discovery of the signal molecule(s) will not only increase our basic understanding on plant-nematode interactions, but also assist the development of unique strategies and resources to control nematode diseases. We believe that the proposed activities are well aligned with the cotton commission's mission, particularly research that tackles the immediate and long-tern needs of its industry and producers in increasing production efficiency and profitability.

We aimed to define if cotton plants produce underground signal chemicals in the short-distance communication with nematodes.

It has long been recognized that chemotaxis (a movement in the direction of higher concentrations of semiochemicals) is the primary means by which nematodes locate host plants (Parasite 15:310). Nematodes are indeed motile animals, undulating in the dorsal ventral direction (snake-like motion), and commonly referred to move ~1 meter through the soil within their lifetime (apsnet.org). However, it is unclear if the movement of nematodes is autonomous or need environmental matrices such as water, wind, insects and/or animals.

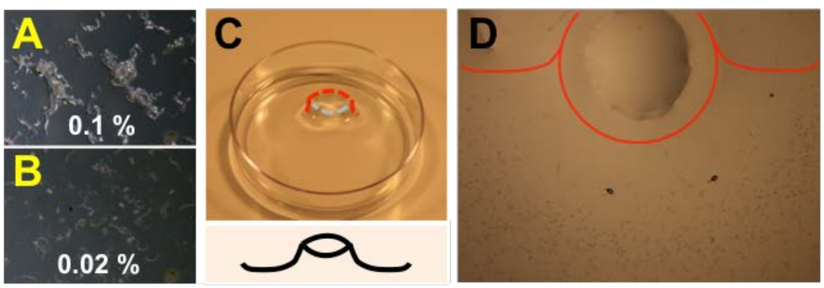
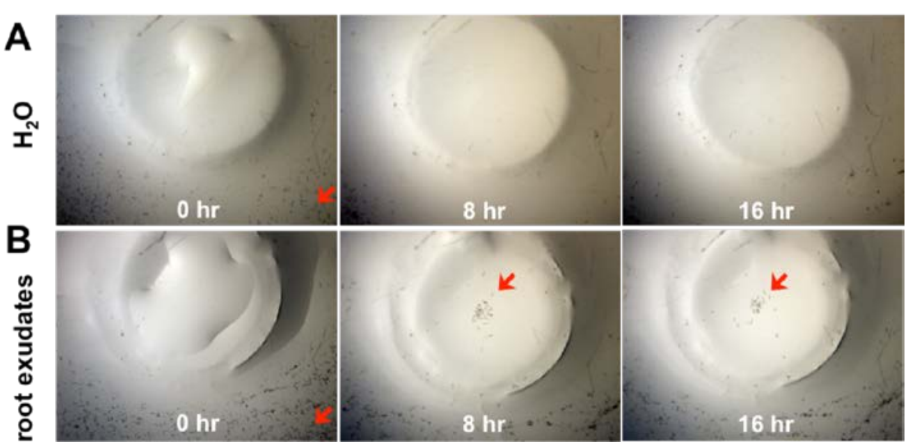


Fig 1. Development and optimization of nematode behavioural assay.

1. Establishment of the novel nematode behavioural assay.
To substantiate if nematodes can *i*) sense and *ii*) deliberately move towards chemical cues, we developed the agar assay plate of which surface *a*) is hydrophilic (0.02% agar, Fig. 1A) enough to evade the surface tension of nematodes (adhesion, shown in e.g., 0.1% agar; Fig. 1B), and *b*) forms the shape of a volcano in the middle (Fig. 1C). Nematodes are then placed around the slope (of volcano), and their behavioural movements are monitored in response to plant-derived



compounds introduced on the top (of volcano, Fig. 1D). Note that nematodes and plant compounds are closely positioned, but yet not directly contact each other.

Root exudates signal and attract parasitic nematodes. In response to water, reniform nematodes gradually slid away from the top (Fig. 2A), because of gravity on the slope. In [TC1]contrast, reniform nematodes stayed on the slope, and/or crawled up to the top, upon the application of cotton root extracts or exudates (Fig. 2B), underpinning that cotton roots secret underground signal compounds seducing nematodes (hereafter named as 'nematode attractant' Interestingly, reniform nematodes exhibited little if any response to the extracts and exudates prepared from nonhost plants such as peanut (data not shown), proposing the host specific production of nematode attractants.

Fig 2. Cotton root exudates signal and attract *R. reniformis* movement. Times in *A*) and *B*) indicate hr-post-*R. reniformis* inoculation, and red arrowheads indicate *R. reniformis*.

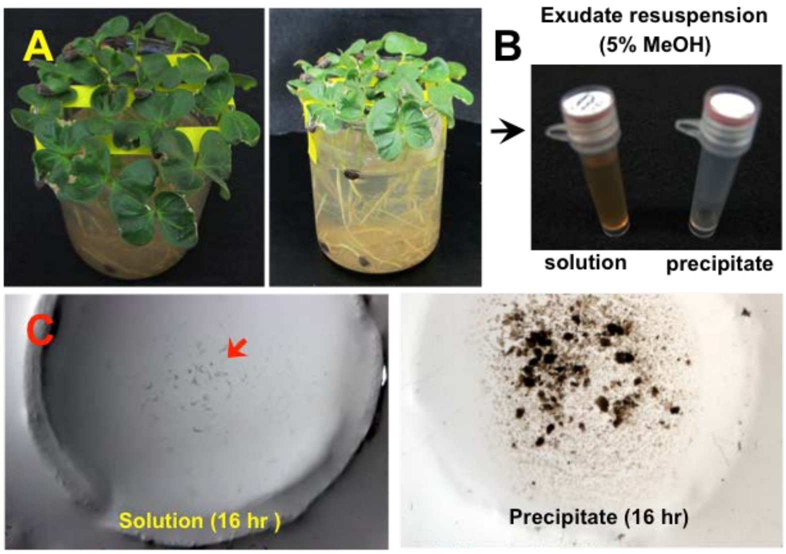


Fig 3. Chemotaxis activity of *R. remiformis* are found in the hydrophilic fraction of cotton root exudates.

3. Cotton root exudates are complex mixtures of diverse chemical compounds.

As an initial step to identify nematode attractant, we began to iteratively follow the activity of attractant in parallel to the fractionation of cotton root exudates. Root exudates, collected in watercontaining beakers for 24 hr (Fig. 3A), were then separated into hydrophilic and hydrophobic fractions by 5% MeOH, of which only hydrophilic fraction displayed the activity nematode attractant (Figs. 3B and 3C).

Root exudates are complex mixtures of diverse in/organic compounds (J Plant Nutr Soil Sci 174:3). In our preliminary studies, the preparatory HPLC of cotton root exudates repeatedly showed the broaden shape of peaks (Fig. 4), indicating that cotton roots release a wide range of metabolic compounds as 'rhizodeposits'.

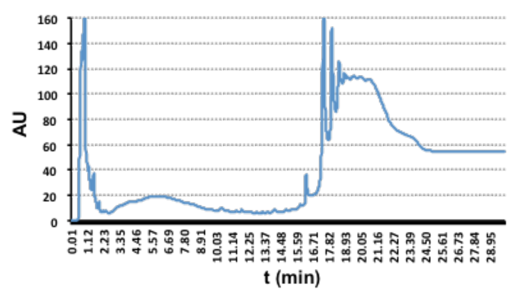


Fig 4. HPLC separation of the hydrophilic fraction of cotton root exudates.

FUTURE DIRECTION: Hence, the identification of long sought plant semiochemicals that signal and seduce nematodes will be best approached from the point of view of chemical biology, using analytical separations and sequential enrichment processes as the principal discovery tool (via multiple HPLC applications).

HPLC isolation of nematode attractant(s) from cotton root exudates. **As an additional, albeit, discovery driven aim,** In the future studies, the enrichment of nematode attractants will be prioritized; 1 (or 2) min interval fractions by HPLC separations will be collected throughout the retention time of 10 to 30 min, and each fraction will be subsequently subjected to the nematode behavioural assay. All fractions attracting nematodes will then be pooled together, and applied to the second round HPLC separations; the same experiment procedures (i.e., HPLC → nematode behavioural assay) will keep being repeated until one single peak with nematode attraction activity will be isolated.

VII.Extras

Continued Development of ACES Auburn Univ. Exp. Station Information Transfer for Alabama Row Crops, 2016

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

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

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

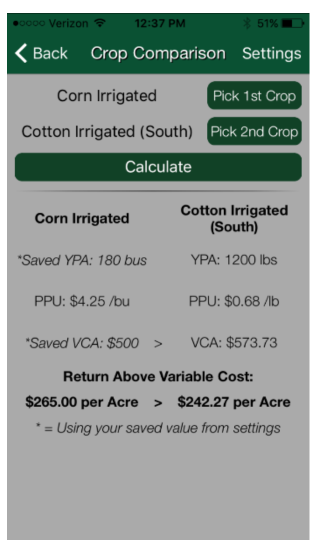
Jon's assistance to the Agronomic Crops team has been expanded to planting and harvesting on-farm tests, equipment maintenance and management, and a variety of other team activities. Jon has been trained to analyze, tabulate, and prepare research and demonstration results for posting to the web site.

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

Web statistics for the period of January 1st through December 31st indicate that the Alabama Crops web site had 15,895 visits and 22,659 page views in 2016. A visit is a series of actions that begins when a visitor views their first page from the server, and ends when the visitor leaves the site or remains idle beyond the idle-time limit. Views are hits to any file classified as a page. The analytical software used to evaluate web traffic was changed after 2015, and different metrics were used. Therefore, numbers from 2016 are not comparable to previous years. After the home page, the pages for the Alabama Variety Testing Program and Alabama Corn Production were the most visited.

Alabama Crop Production Mobile App Upgrade

T. Cutts, B. Dillard, and M. Runge



Original Features:

Original features on the Alabama Crops app include sections for: Crop Production News, Profit Profiles, Contact a Crop Specialist, Calendar, Submit a Photo/Question, and AlabamaCrops.com link.

To date, the app has been downloaded over 400 times and has been advertised at many grower events throughout the state.

Recently Added:

A crop comparison tool was recently added to allow growers to compare 2 potential crops for planting on farm._ Producers can use the data from ACES budgets or each user can customize their own numbers such as yield and inputs to compare variable input costs and potential profit from two crops.

Things to come:

We are working with the app developer to give the Agronomics Team the ability to set up push notifications at planned intervals for upcoming events to make farmers aware of meetings and remind them as meeting time approaches without actively having to check the Alabama Crops App calendar.

IPM section that will allow farmers to access IPM guides with drop down menus. With drop down menus, growers could select the crop, then either disease, weed control, or insect control. This would bring up the ipm guide and section for that particular crop/issue. For example, a grower wanting herbicide options for wheat production could easily access the ipm section for chemical weed control in wheat.

Agriculture Discovery Day

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Objective:

Conduct education awareness of traditional Alabama agriculture and advanced production technologies for the community and producers.

Activity:

The Alabama Cooperative Extension System, AU College of Agriculture, and Alabama Experiment Station conducted the 4th annual Agricultural Adventure Discovery Day to promote our industry and educate Alabamians on its importance to our economy and livelihood. This event was at the EV Smith Research Center on October 8th, 2017. Extensive planning went into making this year's event a success and events included various education venues and tours for youth and adults. Advertisement was very effective in increasing overall attendance from past years.

Events included:

1- Cotton picking & ginning;
2- Peanut digging and boiling;
3- Farm and wild life animal interactive activities;
4- Fish production in pond raceways;
5- Field corn maze, picking, shucking, & grinding;
6- Small grain grinding;
7- Forestry, pine straw harvest, and tree identification;
8- Hay bale maze;
9- Precision ag activities & pedal car races;
10- Food safety & prep by a local chef;
11- Wildflowers and honey bee education;
12- Trailer tour of the farm, displays by sponsors, and other activities.

2016 Results:

The 2016 Ag Adventure Discovery Day drew over 2300 participants, up from 1900+ in 2016. We have had an increase of 300 to 400 participants each year and hope to reach 2500 at the 2017 event. This does not include over 200 volunteers that work together to make it possible. The overall budget is just over $40,000 which does not include donations of food, supplies, etc. We appreciate the support that you have provided and feel that this continues to be a major educational event for the state. We have begun to see more visitors from western Georgia and southern Tennessee as a destination event as well.