Auburn University Crops:

Soybean Research Report

2013 & 2014

Research Report No. 45
Alabama Agricultural Experiment Station, 2015
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Acknowledgements

This publication is a joint contribution of Auburn University, the Alabama Agricultural Experiment Station, and the USDA Agricultural Research Service and National Soil Dynamics Laboratory. Research contained in the AU crops research reports was partially funded through the Alabama Cotton Commission, the Alabama Wheat and Feed Grains Producers, the Alabama Soybean Producers and private industry grants. All funding is appreciated.

I. Cultural Management

Improving Soil Quality, 2013.

C. C. Mitchell and G. Huluka

COOPERATORS: Extension Agronomy Team, Extension Commercial Horticulture Team

OBJECTIVE: (1) develop a reasonable soil quality/soil productivity index that can be used on routine soil samples, (2) make producers aware of soil quality and how it influences productivity and sustainability and (3) adopt practices that will increase the soil quality index over time.

2013 ACTIVITIES/ACCOMPLISHMENT:

- In August, 2013, Ms. Tabby Bosarge, graduate research assistant, began work on this project as the focus of her M.S. degree program. Prior to this time, only a few samples had been collected for analysis. Since then, over 200 soil samples have been collected from on-going research projects and farmers' fields to be used to evaluate components of a potential Soil Quality Index (see example).
- Each sample is associated with an actual crop yield or relative yield to be used as the independent variable. A goal is over 300 samples.
- Powerpoint presentations have been presented at 6 meetings around the state with two more scheduled this year (2013).
- Additional funding for this project was sought from the Southern SARE program and the USDA-NRCS Conservation Initiative Grants program. Support was successful from the Alabama NRCS office to help fund Ms. Bosarge's assistantship.
- Goal is to present a draft index (similar to below) to the Southern Soil Test Work Group in June, 2014.

Possible input factors for an Alabama Soil Quality Index Value							
Factor	Values					Max. value	Your Score
Soil CEC/soil group	<4.6 (Grp 1)	4.7-9.0 (Grp 2)	9.0- 15.0 (Grp.3)	>15,0 (Grp 4)			
	2	4	5	5		5	
Soil pH_w	<5.0	5.1-5.8	5.9-7.0	7.0-8.0	>8.0		
	0	10	15	10	5	15	
P RATING	VL/LOW	MEDIUM	HIGH	VERY HIGH	EXT. HIGH		
	0	5	10	5	0	10	
K RATING	VL/LOW	MEDIUM	HIGH	VERY HIGH	EXT. HIGH		
	0	3	5	3	2	5	
Base saturation	<10%	11-25%	26-50%	50-75%	>75%		
	0	3	6	10	8	10	
Soil O.M.(%)	<0.5	0.6-1.0	1.1-2.0	2.1-3.0	>3.0		
	0	5	15	20	25	25	
N mineralized (lb/a)	<10	11-20	21-30	31-50	>50		
	0	1	2	3	5	5	
Soil respiration	V. LOW	LOW	MEDIUM	HIGH	V. HIGH		
	0	1	2	3	5	5	
Aggregate stability	No aggregates	Weak	Moderate	Good	Very strong aggregates		
	0	2	4	6	8	8	
EC (1:2) Mmho/cm	<0.40	0.40-0.80	0.81-1.60	1.61-3.20	>3.20		
	3	5	3	2	0	5	
Metals	2 or more metals "very high"		One metal is "very high"		Metals low		
	-10		-5		7	7	
TOTAL SOIL QUALITY INDEX						**100**	

Improving Soil Quality, 2014

C. C. Mitchell and G. Huluka

COOPERATORS: Extension Agronomy Team, Extension Commercial Horticulture Team

OBJECTIVE: (1) develop a reasonable soil quality/soil productivity index that can be used on routine soil samples, (2) make producers aware of soil quality and how it influences productivity and sustainability and (3) adopt practices that will increase the soil quality index over time.

2014 ACTIVITIES/ACCOMPLISHMENT:

- Ms. Tabby Bosarge, graduate research assistant, began work on this project in Augusts, 2013, as the focus of her M.S. degree program
- Addition support was successful from the Alabama NRCS office to help fund Ms. Bosarge's assistantship.
- In 2014, over 150 paired soils (300+ samples) were collected and analyzed for (1) routine soil test, (2) soil organic C, (4) soil respiration, (5) mineralization N, (6) EC, and (7) micronutrients and metals. Over 20 preliminary estimates of soil quality were returned to Alabama farmers through their county extension agents.
- 20+ meetings were held throughout Alabama in which soil quality issues were presented via Powerpoint presentation
- 1125 individuals received training in soil quality issues.
- A final, proposed version of the SQI report follows. The new Alabama SQI is planned to be released as early as the summer of 2015.
- Through collaboration with the state office of NRCS, certain established NRCS production standards have been adopted to include as interpretation practices in association with the proposed Alabama Soil Quality Index:

Factor	Comment on report	NRCS practice
If SQI>80	Continue with existing practices	
If P value = VL or L	Consider using animal manures to build soil P (PP4)	PP4
If SOM= <1.0%	Consider residue and tillage management and cover crops	PP2, PP3, SP3, SP7
If N mineralized > 50 lb/a	Consider reducing commercial N applied by 30 to 50 lb. N/acre	
If aggregate stability is moderate or less	Soil compaction and runoff is a hazard. Consider reduced or no-till, high residue management, use of cover crops, and mulching. Consider in-row subsoiling or strip tillage.	PP1, PP2, PP3, SP7, SP2
If EC>1.60	WARNING. . . SALT BUILDUP COULD DMAGE CROPS.	
If one metal is VH	**CAUTION. Zn, Cu, Cd, Pb, or** Cr is very high. This could be an indication of contamination from micronutrient fertilizers, manures or some other application. Metals cannot be removed from the soil. Keep soil pH above 6.0 to reduce metal uptake by plants.	
If 2 or more metals are VH	**WARNING.** This soil has been contaminated from excessive metal application either from fertilizers or some other application; Metals cannot be removed from the soil. Keep soil pH above 6.0 to reduce metal uptake by plants.	
If SQI< 50	Your total soil quality index is low. Use one or more of the following primary practices to help improve the soil quality index. Re-test your soil in 3 years to determine if the practices are helping. You may be eligible for	(list of NRCS Primary and Secondary

Example of proposed SQI report for a Tennessee Valley cotton field.

Factor84	Values					Max. value	Your Score	BMP recommended
Soil CEC/soil group	<4.6 (Grp 1)	4.7-9.0 (Grp 2)	9.0- 15.0 (Grp.3)	>15,0 (Grp 4)				
	2	4	5	5		5	5	
Soil pH_w	<5.0	5.1-5.8	5.9-7.0	7.0-8.0	>8.0			
	0	10	15	10	5	15	15	
P RATING	VL/LOW	MEDIUM	HIGH	VERY HIGH	EXTREMELY HIGH			
	0	5	10	5	0	10	10	
K RATING	VL/LOW	MEDIUM	HIGH	VERY HIGH	EXTREMELY HIGH			
	0	3	5	3	2	5	5	
Base saturation	<10%	11-25%	26-50%	50-75%	>75%			
	0	3	6	10	8	10	10	
Soil O.M.(%)	<0.5	0.6-1.0	1.1-2.0	2.1-3.0	>3.0			
	0	5	15	20	25	25	15	
N mineralized (lb/a)	<10	11-20	21-30	31-50	>50			
	0	1	2	3	5	5	3	
Soil respiration	VeryLow	Low	Moderate	High	Very High			
	0	1	2	3	5	5	2	
Aggregate stability	No aggregates	Weak	Moderate	Good	Very strong aggregates			
	0	2	4	6	8	8	4	
EC (1:2) Mmho/cm	<0.40	0.40-0.80	0.81-1.60	1.61-3.20	>3.20			
	3	5	3	2	0	5	5	
Metals	Two or more metals “very high”		One metal is “very high”		All metals low or high			
	-10		-5		7	7	7	
TOTAL SOIL QUALITY INDEX						100	84	

Conservation Practices to Improve Soil Quality

There will be two sets of practices recommended to improve soil quality:

(1) A PRIMARY PRACTICES that would be recommended in all situations.
(2) A SUPPORTING PRACTICE that would be recommended depending upon specific site situations and conditions (soil type, slope, operations goals and needs, etc.).

Primary Practices (PP)

1. Conservation crop rotation
(328) http://efotg.sc.egov.usda.gov/references/public/AL/tg328.pdf
2. Residue and Tillage Management "No-till/strip till"
(329) http://efotg.sc.egov.usda.gov/references/public/AL/tg329.pdf
3. Cover crops (340) http://efotg.sc.egov.usda.gov/references/public/AL/tg340.pdf
4. Nutrient management (590)
http://efotg.sc.egov.usda.gov/references/public/AL/tg590.pdf
5. Integrated Pest Management
(595) http://efotg.sc.egov.usda.gov/references/public/AL/tg595.pdf

Supporting Practices (SP)

1. Contour Farming (330) http://efotg.sc.egov.usda.gov/references/public/AL/tg330.pdf
2. Deep Tillage (324) http://efotg.sc.egov.usda.gov/references/public/AL/tg324.pdf
3. Forage and Biomass Planting (512) – for sod based rations
http://efotg.sc.egov.usda.gov/references/public/AL/tg512.pdf
4. Irrigation water Management (449)
http://efotg.sc.egov.usda.gov/references/public/AL/tg449.pdf
5. Contour Buffer Strips (332)
http://efotg.sc.egov.usda.gov/references/public/AL/tg332.pdf
6. Filter Strips (393) http://efotg.sc.egov.usda.gov/references/public/AL/tg393.pdf
7. Mulching (345) http://efotg.sc.egov.usda.gov/references/public/AL/tg484.pdf
8. Terrace (600) http://efotg.sc.egov.usda.gov/references/public/AL/tg600.pdf

Complete list of conservation practices http://efotg.sc.egov.usda.gov/toc.aspx?CatID=321

Soybean Improvement and Germplasm Enhancement, 2013.

D. B. Weaver

During 2013, seed of cultivar 'Henderson' was once again increased for sale. This is a conventional, Maturity Group VIII cultivar. The primary attributes of this line are high yield (14% higher than the adapted check during the years 2006, 2007 and 2008) and high oil content (overall mean of 23% oil compared with normal oil content in the 20 to 21% range). It could fit into a number of production situations where seed costs for technology added cultivars are prohibitive, such as wildlife plots, organic production, or where high oil production is desired. Due to issues involving the threat of genetic vulnerability, it is always a good practice to have alternatives to industry offerings available. We are planning to incorporate new traits into this genetic background beginning in 2014.

New population development was initiated in 2013. We attempted crosses among elite MG V through VII lines in the USDA Uniform Tests, and were able to generate only 3 hybrid seed. Most of the difficulties were the result of extremely wet weather during the crossing season. We advanced F_2 populations from crosses made in 2012.

We are continuing to cooperate in a nation-wide research effort to identify sources of genetic resistance to Asian soybean rust. In cooperation with the USDA, we evaluated 250 entries from Maturity Groups III, IV, V, VI, VII, VIII, and IX that were introduced from a wide variety of Asian countries where the disease has been endemic for a long time, and have been previously screened at several locations in 2006 through 2012. We planted these lines for evaluation along with several check cultivars in the field at Fairhope. Planting was done very late to encourage rust development, and plots have still not been rated as of the writing of this report.

Our main research effort continues to focus on participation in the USDA Uniform Cooperative Tests, growing 12 tests in 3 locations (Tallassee, Belle Mina, and Fairhope) and evaluating over 230 elite public breeding lines of Maturity Groups V, VI, VII and VIII in both Preliminary and Uniform Tests. This continues to be a major resource of genetic material, as well as a great testing network for evaluation of new genotypes from all public breeding programs in the Southeast. Without these tests, there would be no evaluation of elite public germplasm in Alabama. These lines not only are subject to release by the public developers, they also serve as a major source of germplasm for use by industry in development of high-yielding, good agronomic cultivars with transgenic traits for the production market. However, extensive resources, in terms of labor and materials, are required to conduct these tests. We receive no money from USDA.

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Our main research effort continues to focus on participation in the USDA Uniform Cooperative Tests, growing 12 tests in 3 locations (Tallassee, Belle Mina, and Fairhope) and evaluating over 230 elite public breeding lines of Maturity Groups V, VI, VII and VIII in both Preliminary and Uniform Tests. This continues to be a major resource of genetic material, as well as a great testing network for evaluation of new genotypes from all public breeding programs in the Southeast. Without these tests, there would be no evaluation of elite public germplasm in Alabama. These lines not only are subject to release by the public developers, they also serve as a major source of germplasm for use by industry in development of high-yielding, good agronomic cultivars with transgenic traits for the production market. However, extensive resources, in terms of labor and materials, are required to conduct these tests. We receive no money from USDA.

Soybean Production Tools for Alabama, 2013.

D. Delaney, E. Sikora, K.S. Lawrence, M. Runge, J. Howe, R. Yates, D. Derrick, C. Hicks, and W. Griffith.

OBJECTIVES AND RESULTS:

Objective 1: To evaluate soybean cultivars suitable for Alabama growing conditions under producer practices and growing conditions.

Results: On-farm variety trials were planted at five locations across the state – in Baldwin, Cherokee, Perry, and Fayette Counties. The Perry and Fayette Co trials were full-season, while others were double-cropped after wheat. An additional trial planned for Elmore Co was not planted due to weather delays. Weather and yields were generally dry after planting, with good late-season rainfall.

Yields ranged from 53 to 64 bu/A in Perry Co, 46 to 57 bu/A in Cherokee Co. (no-till, double-cropped), 44 to 52 in Fayette Co, and 42 to 58 bu/A in Escambia Co. (tilled, double-cropped). Ratings were made for harvest green stem, lodging, and harvest moisture as needed.

Objective 2: To evaluate the use of treatments to control iron chlorosis on high pH Black Belt soils.

Results: Experiments were conducted at 2 locations on high pH soils using cover crop and/or in-furrow iron application combinations with 4 replications. Tests were conducted on-farm in Montgomery Co and at the Black Belt REC. Measurements were made throughout the season of soil available nutrients, plant growth, leaf color/chlorosis using visual ratings, as well as yield and seed weights.

At the BBREC location, pH of 8,1, three winter cover crops were used (oats, wheat and tillage radish) in factorial combinations with Soygreen iron chelate. Cover crops were sampled for biomass then terminated with herbicides. Plots were no-till planted with Pioneer 95Y70 (RR) soybeans, a variety rated relatively tolerant for iron chlorosis. Although in-furrow treatments visibly increased growth and color in fallow and tillage radish treatments early in the season, most differences were not visible by late season. However, oat and wheat cover crop treatments significantly decreased iron chlorosis ratings compared to fallow, with tillage radish intermediate. All cover crop treatments significantly increased yield (Table 1) at the BBREC location, although yields were not improved by use of in-furrow Soygreen.

Table 1. Cover Crop and In-Furrow Treatments for Iron Chlorosis of Soybeans on High pH Soils, BBREC 2013

	Treatment		Fe-chlorosis*	Yield
	Cover	In-Furrow	18 June, V1	Bu/A
1	Fallow	----	4.0	34.3
2	Fallow	Soygreen, 3 lb/A	2.8	35.5
3	Wheat	---	2.3	42.6
4	Wheat	Soygreen, 3 lb/A	2.0	43.3
5	Oats	----	2.3	42.8
6	Oats	Soygreen, 3 lb/A	1.8	42.9
7	Tillage radish	---	3.5	41.6
8	Tillage radish	Soygreen, 3 lb/A	2.5	41.3
		LSD (p=0.10)	*1.0*	*4.0*

*Chlorosis Ratings 0-10, 10=dead

An on-farm study was continued on a high pH site (7.9+) in Montgomery Co comparing all combinations of winter cover crops (wheat vs fallow), 2 tons/A of broiler litter vs none, and four varieties with varying degrees of resistance to iron chlorosis. In 2013, using a cover crop increased average yields from 8.8 bu/A without cover to 36.6 bu/A with a cover. Broiler litter treatments averaged 15.2 bu/A without litter to 30.2 bu/A with litter, with chlorosis susceptible varieties responding with greater increases. Resistant varieties averaged yield increases of 10 bu/A, although were several interactions (additive effects) between the treatments.

Overall, the lowest yielding treatment (fallow, no broiler litter, susceptible var.) yielded 0.5 bu/A while the best treatment (cover, br. litter, susceptible var.) yielded 55.9 bu/A, showing the potential for improving yields on these soils using winter cover crops and broiler litter.

Table 2. Cover Crop, Broiler Litter and Soybean Variety Treatments for Iron Chlorosis on High pH Soil, Montgomery County 2013

		Yield (bu/A)	
Variety	Litter	Fallow	Cover
95Y40	No	0.5	28.5
95Y40	Yes	3.5	55.9
95M82	No	1.9	25.2
95M82	Yes	18.6	43.2
95Y70	No	15.3	33.6
95Y70	Yes	20.7	33.6
96M60	No	2.1	14.4
96M60	Yes	8.0	46.1
"overall" LSD (p=0.10)			*4.0*

Objective 3: To evaluate late planting dates for soybeans using modern improved cultivars and production practices.

Results: Experiments were conducted at 4 Experiment Station locations across the state – Tenn Valley REC (TVREC), Sand Mountain REC (SMREC), Plant Breeding Unit (PBU), and Gulf

Coast REC (GCREC). Initial plantings of soybeans were made as soon as possible after June 1, with more plantings at 7 to 10 day intervals, according to soil conditions. Plots were 4 rows wide, 25 to 30 ft long, with 4 replications. Plots were harvested when mature and yields measured (Table 3). Due to varying weather across the state, plantings were started and finished at differing dates by location (TVREC – June 3 to July 10, PBU – June 15 to July 29, and GCREC – June 18 to July 17). The SMREC site was destroyed by a herbicide error after planting.

Yields at PBU started to decrease after the 28 June planting, although large decreases were not noted until after the 10 July planting. At TVREC, yields began to decrease after the first planting, although over 30 bu/A was still achieved with the last planting. Yields at GCS started to decline after the 02 July planting, although the 4th and 5th plantings still yielded over 40 bu/A. Good late-season rainfall into mid-July likely contributed to good yields even for early to mid-July plantings. Results from several years and varying weather patterns will be combined to determine how late soybeans can be planted with a low risk of declining yields.

Table 3. Yields for late planting dates for soybeans in 2013, in bu/A

	PBU		TVREC		GCREC	
Treatment	Date	Yield	Date	Yield	Date	Yield
1	15 June	41.9	03 June	42.9	18 June	43.2
2	28 June	46.4	12 June	39.8	27 Jun	46.0
3	10 July	40.2	24 June	38.5	02 July	46.3
4	19 July	30.1	03 July	35.7	11 July	43.4
5	29 July	19.2	10 July	31.8	17 July	40.0
LSD (p=0.10)		*6.1*		*4.6*		*3.5*

Yield Response to Seeding Rates for Soybeans, 2013.

M.Hall, D. Delaney, A. Brooke, and J. P. Fulton

30-Inch Rows
Tennessee Valley and Sand Mountain

Seeds/acre	Yield/acre	Price received/acre	Seed cost/acre	Price minus seed cost
30,000	45.05	$ 585.65	$ 10.71	$ 574.94
60,000	56.2	$ 730.60	$ 21.42	$ 709.18
90,000	56.5	$ 734.50	$ 32.13	$ 702.37
120,000	59.15	$ 768.95	$ 42.84	$ 726.11
150,000	60.25	$ 783.25	$ 53.55	$ 729.70
180,000	60.25	$ 783.25	$ 64.26	$ 718.99
210,000	61.05	$ 793.65	$ 74.97	$ 718.68

15-Inch Drilled
E.V. Smith

Seeds/acre	Yield/acre	Price received/acre	Seed cost/acre	Price minus seed cost
30,000	33.7	$ 438.10	$ 10.71	$ 427.39
60,000	41.4	$ 538.20	$ 21.42	$ 516.78
90,000	51.8	$ 637.40	$ 32.13	$ 605.27
120,000	54.0	$ 702.00	$ 42.84	$ 659.16
150,000	55.3	$ 718.19	$ 53.55	$ 664.64
180,000	52.2	$ 678.60	$ 64.26	$ 614.34
210,000	51.1	$ 664.30	$ 74.97	$ 589.33

8-Inch Drilled
E.V. Smith

Seeds/acre	Yield/acre	Price received/acre	Seed cost/acre	Price minus seed cost
30,000	46	$ 598.00	$ 10.71	$ 587.29
60,000	46.3	$ 601.90	$ 21.42	$ 580.48
90,000	47.0	$ 611.00	$ 32.13	$ 578.87
120,000	49.8	$ 647.40	$ 42.84	$ 604.56
150,000	50.8	$ 660.40	$ 53.55	$ 606.85
180,000	48.9	$ 637.70	$ 64.26	$ 573.44
210,000	49.5	$ 643.50	$ 74.97	$ 568.53

Sand Mtn was Pioneer 94Y90 (RR), maturity 4.9; planted 18 April
Tenn Valley was Pioneer 95Y70 (RR), maturity 5.7; planted 22 May
EV Smith, both tests were Pioneer 96M60 (RR), maturity 6.6; planted 22 May

Assumptions:

- 140,000 seed/bag and $50 per bag
- $13/bushel harvest price for soybeans
- Only variable is seeding rate

II. Fertilizer Management

Symbiotic Nitrogen Fixation in Roundup Ready Soybean, 2013.

Y. Feng, D. Delaney

Objectives: To determine if glyphosate affected the growth of soybean and *Bradyrhizobium japonicum* as well as nitrogen fixation in Roundup Ready® (RR) soybean.

Results:

During the second year of the project, we conducted two greenhouse experiments and one field trial to evaluate the growth of glyphosate-tolerant soybean in response to post-emergence glyphosate application. A randomized complete block design was used with four replications. Glyphosate treatments consisted of a single application (1.5 lbs ai/A), a sequential application (1.5 + 1.5 lbs ai/A), and a RR soybean control without glyphosate application (Prichard RR). Isogenic conventional soybean (Prichard) was also included as a cultivar control. Seeds were inoculated with Rhizo-Stick peat inoculant containing *Bradyrhizobium japonicum* ($2x10^8$ cells/g) prior to planting.

In the greenhouse experiments, the first glyphosate treatment was applied around the V2 to V3 growth stage and the second treatment around the V5 to V6 stage. Plants were harvested two days after each glyphosate application. Our results showed that glyphosate-treated soybean had lower chlorophyll content, root mass, nodule mass, total plant nitrogen, and nitrogen fixation activity than the conventional cultivar, especially for the second harvest (V5 to V6 stage). Effects of glyphosate on shoot mass and nodule number did not show a consistent trend. The *nifH* gene, which encodes a subunit of the enzyme complex responsible for nitrogen fixation, was detected in the rhizosphere of all soybean plants, but did not vary by treatment. For most of the parameters measured in this study, no significant differences were observed between the conventional and non-treated RR cultivars.

In the field trial, the first glyphosate treatment was applied at the V2 growth stage and the second treatment at the V5 stage. Weeds in the two control treatments were controlled by other herbicides. Plants with roots were harvested two days after each glyphosate application and then 14 days after the second glyphosate application. None of parameters measured showed significant differences in the field trial, except for yield. RR soybean receiving the sequential glyphosate treatment had a lower grain yield compared with RR soybean without glyphosate treatment.

We are still in the process of evaluating how glyphosate affects the growth of *Bradyrhizobium japonicum*.

III. Weed Management

Herbicide Resistance Management in Conservation-Tillage Soybean, 2013.

A. Price, D. Delaney, M. Patterson, C.D. Monks, and C.H. Burmester

Progress: The experiment was established in fall 2011and 2012 and successfully executed in the 2012 and 2013 growing seasons. Four tables are presented below for agronomic responses in 2012 and 2013 and late-season weed control in 2012. Each factor presented (Seed, Cover Crop, Pre-emergence, Post-emergence) in Tables 1 and 2 is averaged over all other factors within that table. Factors are presented separately in 2013 due to various interactions. Results show that a rye cover crop in combination with PRE plus POST herbicides protected yield potential better than lower input systems.

Table 1. Agronomic Response of Soybeans to Seed Trait, Cover Crop, and Pre and Post-Emergence Herbicide Systems - E.V. Smith 2012

	Agronomics		
Seed	Rye Dry Biomass (kg/Ha)	Soybean Population (plants/Ha)	Soybean Yield (kg/Ha)
RR[1]	---	265672	2075
LL[2]	---	276996	2227
LSD (0.05)	---	7823.9	118.0
Cover Crop			
Winter Fallow[3]	0	268980	2034
Rye[4]	8854	273689	2268
LSD (0.05)	127.7	7823.9	118.0
Pre-emergence			
None[5]	---	270381	2126
Valor[6]	---	272287	2177
LSD (0.05)	---	7823.9	118.0
Post-emergence			
None[7]	---	266849	2040
Early[8]	---	271671	2267
Late[9]	---	273352	2070
Early + Late[10]	---	273465	2227
LSD (0.05)	---	11065.0	166.9

Table 2. Late* Weed Response to Seed Trait, Cover Crop, and Pre and Post-Emergence Herbicide Systems in Soybeans - E.V. Smith 2012

	% Weed Control					
Seed	Crabgrass	Common Purslane	Carpetweed	Spiny Amaranth	Coffee Senna	Morningglory
RR[1]	89	85	93	91	91	88
LL[2]	83	83	92	90	90	87
LSD (0.05)	5.9	5.6	0.7	2.6	3.6	5.5
Cover Crop						
Winter Fallow[3]	77	72	86	85	84	84
Rye[4]	95	96	98	96	98	91
LSD (0.05)	5.9	5.6	0.7	2.6	3.6	5.5
Pre-emergence						
None[5]	82	78	86	83	85	79
Valor[6]	90	90	99	98	97	96
LSD (0.05)	5.9	5.6	0.7	2.6	3.6	5.5
Post-emergence						
None[7]	59	63	74	68	69	57
Early[8]	99	97	98	97	99	98
Late[9]	88	78	99	98	97	96
Early + Late[10]	99	98	99	99	99	98
LSD (0.05)	8.3	7.9	1.0	3.6	5.1	7.7

*Weed ratings were taken prior to the layby herbicide application.
[1]Pioneer 95Y70 Roundup Ready seed was planted.
[2]Pioneer 95L10 Liberty Link seed was planted.
[3]Plots were left fallow throughout the winter, no cover crop was planted.
[4]Wrens Abruzzi rye was planted in the Fall of 2011 at 90 lbs/A then rolled flat prior to planting.
[5]No pre-emergence herbicide was applied.
[6]Valor was broadcasted over the plot pre-emergence at planting at 2 oz/A.
[7]No post-emergence herbicide was applied.
[8]Roundup Powermax (RR plots) and Ignite 280 (LL plots) was broadcasted early post-emergence at 1 lb a.i./A and 29 oz/A, respectively.
[9]Roundup Powermax (RR plots) and Ignite 280 (LL plots) was broadcasted late post-emergence at 1 lb a.i./A and 29 oz/A, respectively.
[10]Roundup Powermax (RR plots) and Ignite 280 (LL plots) was broadcasted early and late post-emergence at 1 lb a.i./A and 29 oz/A, respectively.

Table 3. Agronomic Response of Liberty Link[1] Soybeans to Cover Crop and Herbicide Timing - E.V. Smith 2013

	Agronomics				
	Cover Crop System[3]			Winter Fallow System[2]	
Weed Control	Soybean Population (plants/Ha)	Soybean Yield (kg/Ha)		Soybean Population (plants/Ha)	Soybean Yield (kg/Ha)
Non-treated[4]	262813[a]	1364[b]		262813[a]	1059[c]
A[5]	269989[a]	1352[b]		266401[a]	1460[bac]
B[6]	273577[a]	1587[ba]		282546[a]	1844[a]
C[7]	265504[a]	1812[ba]		274474[a]	1342[bc]
A + B	262813[a]	1767[ba]		262813[a]	1683[ba]
A + C	286134[a]	1799[ba]		268195[a]	1466[bac]
B + C	273577[a]	1851[a]		286135[a]	1682[ba]
A + B + C	273577[a]	1615[ba]		286134[a]	1773[ba]
LSD (0.05)	34390.0	460.3		37459.0	464.0

[1]Pioneer 95L10 Liberty Link seed was planted.
[2]Plots were left fallow throughout the winter, no cover crop was planted.
[3]Wrens Abruzzi rye was planted in the Fall of 2012 at 90 lbs/A then rolled flat prior to planting.
[4]No herbicide was applied.
[5]Valor was broadcasted over the plot pre-emergence at planting at 2 oz/A.
[6]Liberty was broadcasted early post-emergence at 29 fl oz/A.
[7]Liberty was broadcasted late post-emergence at 29 fl oz/A.
[*]Means with the same letter are not significantly different.

Table 4. Agronomic Response of Roundup Ready[1] Soybeans to Cover Crop and Herbicide Timing - E.V. Smith 2013

	Agronomics				
	Cover Crop System[3]			Winter Fallow System[2]	
Weed Control	Soybean Population (plants/Ha)	Soybean Yield (kg/Ha)		Soybean Population (plants/Ha)	Soybean Yield (kg/Ha)
Non-treated[4]	259225[a]	1456[ba]		263710[b]	1486[a]
A[5]	274474[a]	1912[a]		292413[a]	1602[a]
B[6]	282546[a]	1681[ba]		290619[a]	1636[a]
C[7]	257432[a]	1674[ba]		288825[a]	1679[a]
A + B	287928[a]	1820[ba]		273577[ba]	1582[a]
A + C	267298[a]	1421[b]		284341[ba]	1727[a]
B + C	286134[a]	1872[ba]		284341[ba]	1561[a]
A + B + C	274474[a]	1716[ba]		287031[a]	1721[a]
LSD (0.05)	36005.0	477.6		23300.0	436.7

[1]Pioneer 95Y70 Roundup Ready seed was planted.
[2]Plots were left fallow throughout the winter, no cover crop was planted.
[3]Wrens Abruzzi rye was planted in the Fall of 2012 at 90 lbs/A then rolled flat prior to planting.
[4]No herbicide was applied.
[5]Valor was broadcasted over the plot pre-emergence at planting at 2 oz/A.
[6]Roundup Powermax was broadcasted early post-emergence at 1 lb a.i./A.
[7]Roundup Powermax was broadcasted late post-emergence at 1 lb a.i./A.
[*]Means with the same letter are not significantly different.

On-farm Management of Herbicide Resistant Weeds,2013.

D. Delaney, C.H. Burmester, C.D. Monks, M. Patterson, and A. Price.

Objectives and Results:

1. Development of sturdy "Quick Guide" dashboard-capable listings with information of the choices commonly available in Alabama. Herbicide classes and names are color coded on these Guides, so that producers can tell "at a glance" whether their choices will meet their herbicide rotation management goals. Copies of these Guides have been distributed at local and regional meetings, and are posted to www.AlabamaCrops.com for easy access to this information.

2. Field trials were established in order to test programs for control of glyphosate resistant weeds. Verdict herbicide could be a useful herbicide for resistant pigweed control, but the label requires a 30 day plant back restriction on soybean planting when applied to sandy soils. A replicated test evaluated three rates of Verdict on a sandy loam field in DeKalb County at the Sand Mountain REC. Herbicides were applied, then soybeans planted 0, 7, 14, and 21 days after application. Initial yield and ratings results indicate no soybean yield loss with the Verdict treatments even at highest rates tested. However, field reports of stunting after use of herbicides with saflufenacil chemistry indicated there may be also be a variety tolerance issue. Testing with 23 varieties and 2 rates each of Verdict and Sharpen at the Tennessee Valley REC indicated a range of sensitivity between varieties.

   Planned on-farm herbicide trials in central and south AL were not conducted due to a changeover in Regional Agents and adverse weather conditions at planting time. However, Agents are now in place and trials are planned for 2014 with funds originally allocated for 2013.

3. Monitoring efforts were made for fields in Alabama with suspected populations of dicamba resistant horseweed (marestail), and palmer amaranth and common ragweed resistance to glyphosate in soybean fields. Plants were collected and brought to an Auburn University greenhouse for testing. Testing is continuing on these plant materials. Statewide, Regional Extension Agents and Specialists worked to determine resistance by applying 2X to 4X herbicide rates to fields with apparent herbicide failure.

IV. Disease Management

Evaluation of Fungicides for Control of Asian Soybean Rust and Other Foliar Diseases of Soybeans, 2013.

D. Delaney, E. Sikora, and K.S. Lawrence

Objective: To evaluate multiple fungicide for control of soybean rust and other foliar diseases in Alabama.

Results:
Fungicide trials for the control of Asian soybean rust (ASR) and other foliar soybean diseases were established at four Experiment Stations around the state. Due to a relatively mild winter, ASR overwintered successfully on kudzu in south and central Alabama. With favorable weather conditions during the growing season, ASR spread to all 67 counties in Alabama much earlier than in past years. Frogeye leaf spot, target spot and aerial web blight were also common problems in Alabama soybean fields in 2013

Sand Mountain REC
Asgrow 5233 RR was planted on 25 June in 30-inch rows, with 10 treatments applied at the R3 stage. A heavy infection of ASR was diagnosed in nearby earlier planted experiments within 2 weeks after spraying, implying that the test was already exposed to ASR before fungicides were applied. Significant differences were noted between treatments, with all treatments having significantly lower ASR ratings than the untreated check, and treatments containing a Topguard, Domark or tebuconazole component having significantly lower ASR ratings than those with no triazole (Headline alone, Priaxor). This also suggested that infection likely started before fungicide application and that the triazole-type fungicides had a slight “curative effect” on recent ASR infection. Although a moderately frogeye leaf spot susceptible variety was planted, frogeye was not observed at high enough levels to be rated, likely due to the presence of ASR on leaves.

Similar results were noted in yield, with all treatments yielding greater than the untreated check: <u>up to 15.8 bu/A or 31% increased yield</u> for the highest yielding treatment (Table 1) after a single foliar fungicide application at R3.

Table 1. Foliar fungicide treatments for control of ASR and frogeye leaf spot, Sand Mountain REC 2013

				Early R5		late R5		Yield	
Trt	Treatment	Rate	Unit	ASR		ASR		bu/ac	
1	TOPGUARD	7	fl oz/a	1.48	e	2.03	ef	70.2	bc
2	Domark	5	fl oz/a	1.43	e	2.48	ef	73.4	ab
3	tebuconazole	4	fl oz/a	1.70	e	2.85	e	71.6	ab
4	Headline	6	fl oz/a	2.90	d	5.28	c	72.0	ab
5	Headline	6	fl oz/a	1.13	e	1.83	f	75.3	a
	+ TOPGUARD	7	fl oz/a						
6	Priaxor	4	fl oz/a	5.13	b	7.18	ab	63.5	d
7	Quadris Xcel	14	fl oz/a	4.05	c	6.90	b	62.6	d
8	Priaxor	6	fl oz/a	3.35	cd	6.48	b	66.8	cd
9	Stratego YLD	4	fl oz/a	1.88	e	3.75	d	72.7	ab
10	Untreated Check			7.28	a	7.93	a	57.6	e
	LSD (P=.10)			*0.716*		*0.845*		*4.32*	

Tennessee Valley REC
Asgrow 5732 RRwas planted on 03 June in 30-inch rows, with 10 treatments applied at the R3 stage. Despite plentiful early season rainfall, enough to cause severe lodging, late summer dry weather limited disease progression. ASR and other foliar diseases were in the area, but were not severe enough to rate. Yields ranged from 41 to 44 bu/A, although no significant differences were observed between control and sprayed treatments.

EV Smith Field Crops Unit
Prichard RR, a frogeye susceptible variety, was planted on 22 May in 36-inch rows under irrigation, with early season rainfall plentiful. Ten treatments were applied at the R3 stage, with heavy lodging noted. ASR appeared in plots by the early R5 stage, along with target spot, and was rated. All treatments reduced ASR severity, although only Headline + Topguard and Quadris Top SB reducing target spot (Table 2). Headline + Topguard, and Domark significantly increased yield compared to the check <u>by up to 19% or 8.2 bu/A.</u>

Table 2. Foliar fungicide treatments for control of ASR and target spot, EV Smith Field Crops Unit 2013

				SBR early R5		SBR early R5		SBR late R5		Target spot		Yield	
				9/11/2013		9/18/2013		10/1/2013		9/11/2013		10/23/2013	
Trt	Treatment	Rate	Unit	0-8		0-8		0-8		0-10		bu/ac	
1	TOPGUARD	7	fl oz	0.5	b	0.7	cd	1.3	d	3.6	abc	44.1	b-e
2	Domark	5	fl oz	0.2	b	0.7	d	1.5	d	3.6	abc	49.0	ab
3	tebuconazole	4	fl oz	0.3	b	0.9	cd	2.0	cd	4.0	a	47.7	a-d
4	Headline	6	fl oz	0.6	b	1.2	bcd	2.7	bc	3.9	ab	42.9	de
5	Headline	6	fl oz	0.2	b	0.5	d	1.3	d	3.1	c	51.4	a
	TOPGUARD	7	fl oz										
6	Priaxor	4	fl oz	0.7	b	1.7	b	3.6	b	3.5	abc	41.5	e
7	Quadris Xcel	14	fl oz	0.4	b	1.2	bcd	3.5	b	3.6	abc	44.5	b-e
8	Quadris Top SB	12	fl oz	0.3	b	1.5	bc	2.7	bc	3.3	bc	46.3	a-e
9	Stratego YLD	4	fl oz	0.3	b	0.7	d	2.7	bc	3.8	abc	48.2	abc
10	Untreated Check			2.1	a	3.3	a	4.9	a	4.0	a	43.2	cde
	LSD (P=.10)			*0.6*		*0.7*		*0.9*		*0.6*		*4.7*	

Gulf Coast REC

Asgrow 7502 RR soybeans were planted on 28 May for all fungicide trials. Plots were 4 * 38-inch rows * 30 ft long with 4 replications. Fungicides were applied in 18 gal/A of water using a Lee Spider high clearance sprayer with Turbodrop TDXL 10002 flat fan nozzles on 19-in. centers at 60 psi. The center two rows of each plot were harvested on o6 November. Although ASR had been noted in nearby sentinel plots, and spring rainfall was heavy, mid-summer rainfall was unfavorable for soybean rust (SBR) development after July with monthly totals of: Jul: 1.78 in; Aug: 5.98 in; Sept 1.01 in; and Oct 1.11 in. ASR appeared in the plots by early September, but did not spread rapidly due to the relatively dry conditions.

Priaxor, a premix of the active ingredient in Headline (pyraclostrobin) and fluxapyroxad was recently registered for use. Since fluxapyroxad is in a class of chemistry = carboxamides (boscalid, Vitavax) not previously registered for foliar application to soybeans, it was included in the Triazole timing test for comparison. In this trial, fungicide treatments were applied as a foliar spray at either R3 or R5 (R3 + 21 days) to evaluate preventive and curative effects of several triazole fungicides. Soybean foliar diseases were evaluated by rating severity in each plot regularly after symptoms appeared.

There were no significant differences in yield among treatments (Table 3). There were no significant differences in SBR severity on 10 September or 24 September. Domark, Topguard and Folicur applied @ R3, and Folicur applied at R5, had significantly lower SBR severity ratings than Priaxor applied @ 4 oz on 7 October. There were no differences among the other treatments including Priaxor applied @ 6 oz.

Table 3. Disease Ratings and Yield for Triazole Timing trial at GCREC, 2013

Fungicide	Rate/A	Stage	SBR* 9 Sept	SBR 24 Sept	SBR 7 Oct	Yield (bu/A) 6 Nov
Topguard	7 oz	R3	1.35 a	1.00 a	1.45 bcd	70.1 a
Topguard	7 oz	R5	1.28 a	1.07 a	2.17 abcd	68.4 a
Domark	5 oz	R3	1.28 a	1.13 a	1.17 d	70.8 a
Domark	5 oz	R5	1.23 a	1.03 a	2.33 abc	69.7 a
Folicur	4 oz	R3	1.10 a	1.33 a	1.43 cd	70.5 a
Folicur	4 oz	R5	1.40 a	0.90 a	1.60 bcd	69.5 a
Quadris	6 oz	R3	1.43 a	1.67 a	1.83 abcd	67.1 a
Quilt Xcel	14 oz	R3	1.40 a	1.43 a	2.08 abcd	69.2 a
Quadris Top SB	12 oz	R3	1.40 a	1.20 a	2.60 ab	69.7 a
Stratego YLD	4 oz	R3	1.38 a	1.03 a	2.60 ab	69.2 a
Priaxor	4 oz	R3	1.13 a	1.27 a	2.97 a	69.1 a
Priaxor	6 oz	R3	1.40 a	1.30 a	2.10 abcd	68.5 a
Untreated check	--	--	1.23 a	1.30 a	2.6 ab	68.9 a
LSD (P=0.10			0.426	0.682	0.991	3.48
*SBR = 0-8 Bayer Scale, 8=severly affected						

Two similar trials were conducted at the Gulf Coast REC to study timing and rates of Topguard and Fortix. ASR appeared late and spread slowly in these tests, leading to very small or no differences in ratings or yield between treatments.

Monitoring for Soybean Vein Necrosis Virus, a New Disease of Soybean in Alabama, 2014.

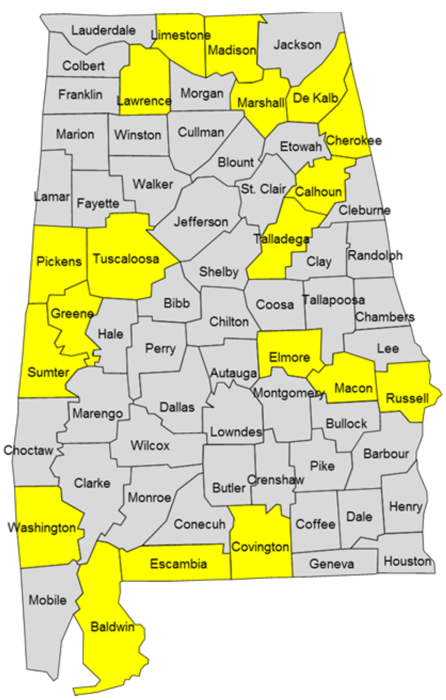
E. Sikora, K. Conner, L. Zhang and C.H. Burmester

Soybean vein necrosis virus (SVNV) was first found in Alabama in Limestone County in 2012. Characteristic symptoms of the disease include brown necrotic blotches along major veins of the upper and lower leaf surface, resulting in a scorched appearance of the damaged leaves. In 2013 a multi-year survey was initiated to determine the distribution of SVNV in the state. The survey was focused initially in North Alabama where the disease was known to occur, but also included counties in central and south Alabama.

Results from the first year of the survey (2013) found SVNV in 14 new counties in the state. The majority of these counties were in North Alabama; however, the disease was also detected in Sumter, Chilton and Autauga counties in central Alabama. The highest incidence of SVNV was detected in Jackson (56%) and Limestone Counties (54%) but the virus was not detected in south Alabama (Baldwin and Escambia Counties).

Results:

In 2014 SVNV was found in an additional 13 counties in the state with many of these counties in central and south Alabama. Incidence of the disease within a field was highest in North Alabama with some fields near 100% infection. Disease incidence in central and south Alabama was relatively low compared to the levels in the northern section of the state but may be on the increase based on the first two years of this study.



SVNV distribution: 2014

SVNV distribution: 2013

Determining the Relationship of Soybean Vein Necrosis Virus with Morning Glory and other Weeds in Soybean Fields in Alabama, 2014.

E. Sikora, K. Conner, L. Zhang and C.D. Monks

The objective of this study is to establish the importance of morning glory (MG) found near soybean fields to determine its impact on soybean vein necrosis virus (SVNV). The disease was first found in Alabama in 2012 and has since been detected in 28 counties in the state.

In the first year of this project, leaves were collected from MG populations growing adjacent to soybean fields showing symptoms of SVN. These populations typically consisted of "entire leaf" species of MG; the most common type found in Alabama. Of the seven populations of MG screened for SVNV, only one population tested positive for the virus. This MG population was growing next to a soybean field in Madison County that had 100% incidence of the disease. Incidence of SVNV in adjacent soybean fields to the six MG populations that tested negative for the virus ranged from 4-50%. This "may" be an indication that MG populations in Alabama are acting a source of SVNV.

There is little information on the host range of SVNV in the Southeastern U.S. The fact that MG is a host of SVNV and considered one of the top 10 most common weeds in Alabama suggest the weed may play a significant role in the disease cycle of SVNV in the state.

Location/county	date collected	Host/number of leaves tested	Percent infected with SVNV
Talladega	9/18/14	soybean 50	18
		Morning glory 20	0
Calhoun	9/17/14	soybean 50	50
		Morning glory 20	0
Madison (A)	9/17/14	soybean 50	24
		Morning glory 20	0
Tuscaloosa	9/28/14	soybean 50	14
		Morning glory 20	0
Pickens	9/28/14	soybean 50	16
		Morning glory 25*	0
Madison (B)	10/1/14	soybean 50	100
		Morning glory 20	25
Escambia	10/6/14	soybean 50	4
		Morning glory 20	0

*Total included 10 arrow leaf morning glory, and 15 entire leaf morning glory plants.

Identifying Soybean rust-resistant & Susceptible Kudzu Populations to Increase Monitoring Efficiency, 2013.

E. Sikora and M. Delaney

Soybean rust (SBR) was a significant problem in 2012 and 2013 with estimated yield losses of over 50% in some commercial soybean fields in Alabama. SBR overwinters on kudzu which acts as a breeding ground for the pathogen before soybeans are planted in the spring. Research has shown that some kudzu populations (patches) are resistant to SBR, meaning that scouting these patches for the disease is fruitless. In 2013, to improve our scouting efficiency we continued testing kudzu populations in Alabama to determine their level of resistance or susceptibility to SBR. This information will allow us to target only known SBR-susceptible kudzu sites when scouting, making monitoring more efficient and cost effective.

Our objectives for this project are:

1) Increase number of kudzu sites screened for SBR resistance.
2) Map positive and negative sites to determine if a pattern exists in kudzu across the state.
3) Use this information to increase efficiency and reduce cost associated with SBR monitoring.

Results: A total of 74 kudzu sites were tested for resistance to SBR in 2013. Visually negative leaf petioles were collected from random kudzu patches in south Alabama and mapped by GPS coordinates, then tested for susceptibility/resistance in laboratory inoculations. Thirty percent of the samples were found to be resistant to SBR. This is consistent with results obtained in 2012 where 27.7% of the 36 populations tested were deemed resistant to SBR.

Identifying Soybean rust-resistant & Susceptible Kudzu Populations to Increase Monitoring Efficiency, 2014.

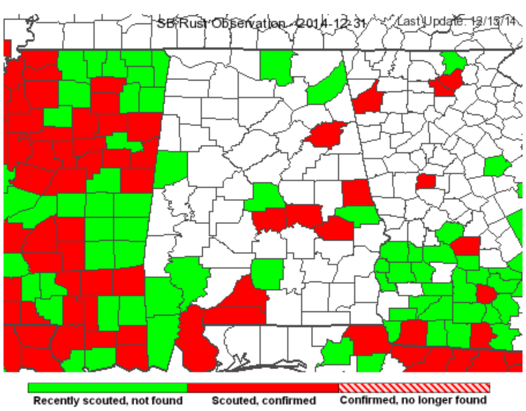
E. Sikora and M. Delaney

Soybean rust (SBR) was not a significant problem in Alabama for the first time since 2011. In both 2012 and 2013, yield losses of over 50% due to the disease were reported in some commercial fields in Alabama. In 2014 SBR was only detected in eight counties in the state by the end of the growing season (Fig. 1).

A relatively cold winter resulted in very little green kudzu persisting through this period, therefore only a limited amount of SBR inoculum was present in the southeastern United States (and Alabama) prior to the growing season. This situation, coupled with a relatively dry weather conditions in many parts of Alabama from mid-July through September, limited SBR development and spread during the year. For this reason we were unable to perform a significant number of screening trials of kudzu sites for resistance/susceptibility to SBR.

Leaves from a total of 23 kudzu locations in 12 counties were sampled in SW Alabama. The kudzu leaves were sprayed with SBR spores under laboratory conditions; the spores were obtained from SBR-infected soybean plants. Unfortunately, SBR did not develop on any of the 23 kudzu populations screened. This included kudzu populations that were susceptible to the disease the previous year. We suspect the SBR inoculum used this year was of low virulence. We suspect the unfavorable environmental conditions the pathogen was exposed to during the growing season may have affected spore viability.

Figure 1. Map of soybean rust distribution in Alabama in 2014.



Monitoring for Fungicide-resistant Strains of Frogeye Leaf Spot in Alabama, 2013.

E. Sikora and D. Derrick

A strobilurin-resistant isolate of the foliar pathogen (*Cercospora sojina*) which causes frogeye leaf spot (FLS) of soybean was detected in a field in Limestone County in 2012. This was the first report of strobilurin resistance in a soybean pathogen in Alabama. This is critical because once a fungal population develops resistance to a particular fungicide, it will stay resistant to that product and to all other fungicides with the same active ingredient. Having this knowledge allows farmers to adjust their fungicide spray programs accordingly depending on the disease prevalent in their area.

The objective of this study was to survey soybeans fields in Alabama for populations of strobilurin-resistant strains of FLS to determine its distribution in the state. FLS was a relatively common problem in Alabama in 2013, especially in the northern half of the state. Isolates of the pathogen were collected from 10-12 fields and samples were sent to the lab of Dr. Carl Bradley, a Plant Pathologist at the University of Illinois, for strain identification. Laboratory results showed that strobilurin-resistant strains of FLS were detected in soybean fields in Cullman, Escambia, Morgan and Pickens counties in 2013 (Fig. 1). This brought the total number of counties reporting strobilurin-resistant strains of FLS to five in the state when we include Limestone County from 2012 (Fig. 1). A total of nine states have now reported fungicide resistant FLS in the U.S. (Fig. 2).

Figure 1.

Distribution of fungicide-resistant FLS in AL

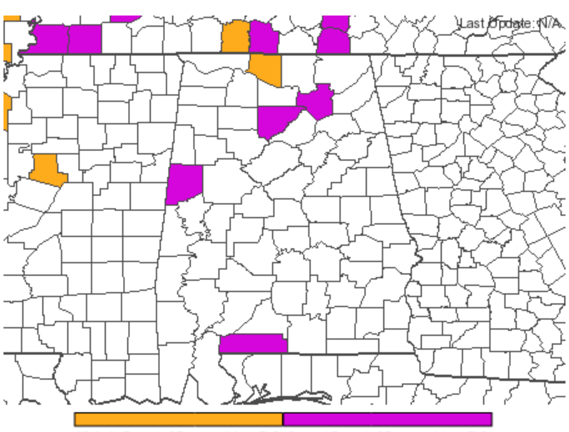
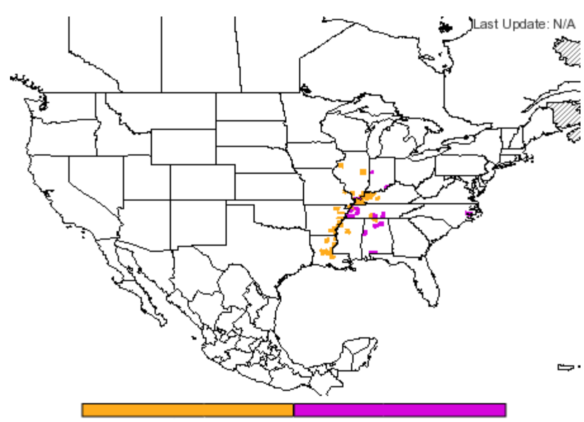


Figure 2.

Distribution of fungicide-resistant FLS in U.S.



Information available at: http://frogeye.ipmpipe.org/cgi-bin/sbr/public.cgi

Monitoring for Fungicide-resistant Strains of Frogeye Leaf Spot in Alabama, 2014

E. Sikora and D. Derrick

Laboratory results show that a strobilurin-resistant strain of Frogeye leaf spot (FLS) was detected for the first time in soybean fields in DeKalb, Marengo, Marshall, Perry and Washington counties in 2014. The fungicide resistant strain was also detected from fields in DeKalb and Pickens counties, as was the case in 2013. This brings the total number of counties in Alabama reporting strobilurin-resistant strains of FLS to 10 since it was first found in Limestone County in 2012.

The objective of this study was to survey soybeans fields in Alabama for populations of strobilurin-resistant strains of FLS to determine its distribution in the state. FLS was a relatively common problem in Alabama in 2014. Leaves with symptoms of the disease were collected from multiple fields during the season and samples were sent to the lab of Dr. Carl Bradley, a Plant Pathologist at the University of Illinois, for strain identification. Laboratory results showed that strobilurin-resistant strains of FLS were detected in soybean fields in seven counties in the statein 2014 (Fig. 1). The strobilurin-resistant strain of FLS has now been detected in 10 counties in Alabama.

Figure 1. Distribution of fungicide-resistant FLS in AL in 2014.

Evaluation of Fungicide Programs with Large-Scale Strip Tests, 2014.

E. Sikora and D. Delaney

Six large-scale fungicide strip trials were established at Auburn University research stations to determine the benefit of fungicide applications in soybean production. Trials varied slightly by location but each included an 1) unsprayed control; 2) a single application of Topguard (a relatively expensive triazole fungicide); and, 3) a single application of a tebuconazole fungicide (a relatively inexpensive triazole). At some locations a tank mix product such as Stratego YLD was also included where space permitted. Each trial had a minimum of three replications.

Relatively dry conditions from mid-July through September inhibited disease development at all locations. When disease did appear, it typically arrived late in the crops development and had little effect on yield. Cercospora leaf blight was observed at Fairhope, but no differences were observed among treatments. Cercospora leaf blight and Septoria brown spot were observed at Crossville, but again no significant differences were noted among fungicide programs. Frogeye leaf spot was detected at Bell Mina but was at very low levels; the same was true of target spot at both the Clanton and Brewton sites. Soybean rust did develop in the trial in Shorter, but not until early October as plants were beginning to dry down prior to harvest. Basically, it was a poor year for plant diseases.

In previous years we have seen a benefit from timely fungicide application for disease control. In the strip tests conducted in 2013, fungicide applications increased yields by about 25% at Fairhope and 50% at Crossville compared to the unsprayed controls. The benefit of a fungicide application is dependent on its timing, with applications made prior to disease onset more effective at protecting the yield potential of the crop.

Trial locations	Plant diseases observed
Bell Mina	Frogeye leaf spot
Brewton	Target spot
Clanton	Target spot
Crossville	Cercospora leaf blight and Septoria brown spot
Fairhope	Cercospora leaf blight
Shorter	Soybean rust

V. Nematode Management

Soil Type and Irrigation Effects on Reniform Nematode Damage to Soybeans, 2013.

K.S. Lawrence, E. Sikora, J. Murphy, D. Delaney, and D. Bailey

Justification: The reniform nematode may cause comparable yield declines in a wide range of soil types even though population densities differ significantly. Additionally, the interaction of water stress and the reniform nematode may be a more significant factor to yield loss than water stress alone.

Objective: Our objectives are to determine if adequate irrigation can reduce the soybean yield reduction potential of the reniform nematode on six different soil types representative of the major agronomic regions of Alabama.

Results: The test were conducted in the greenhouse and in microplots established at the Plant Science Research Center on the Auburn University campus. Six different soil types were evaluated from the major crop cultivated regions of Alabama. The soil types that will be used in the trials are Vaiden clay (9-53-38 S-S-C), Decatur silt loam (18-49-33 S-S-C), Lloyd loam (38-35-27 S-S-C), Dothan sandy loam (82-11-7 S-S-C), Hartsells fine sandy loam (66-21-13 S-S-C), and Ruston very fine sandy loam (64-21-15 S-S-C).

Greenhouse experiments are ongoing at this time (Fig.1). Microplots were set up with the 6 different soil types both with and without irrigation. A lack of rainfall allowed for water stress in May and June however, rainfall was abundant in July and August thus eliminating water stress during the reproductive stage (Fig. 2). Reniform nematode numbers per gram of soybean root were similar between soil types and irrigation at 30 days after planting (DAP) and at harvest at 140 DAP. The reniform nematode increased in population density similarly in all six soil types with and without irrigation this first year. Root fresh weight significantly increased with irrigation in Dothan sandy loam, Hartsells fine sandy loam, and Lloyd soils (Table 1.). Root mass was approximately 50% greater in these three soil types. The larger root system may support more nematodes. Soybean seed yield was affected by irrigation. The lack of irrigation reduced soybean seed yield by 10 % over all five of the soil types. The Dothan sandy loam, Decatur silt loam, the Hartsells fine sandy loam and the Lloyd loam all increased seed weight yields with irrigation. Interestingly, the 100 seed weight was also increase by irrigation in the Lloyd loam. The Vaiden Clay was not affected by irrigation as measured by reniform numbers or seed yields as this soil held water. Similarly the Dothan sandy loam also was not affected by irrigation with similar numbers of reniform and seed yields, however this soil often was drought stressed.

Outcome: These trials are in place to determine the amount of moisture that is needed in the soil to achieve the best yield eliminating all water stress and potentially reducing reniform nematode damage.

Table 1. Soybean microplot test with Alabama soil types and irrigation effects on reniform nematode populations, root weights, and soybean yield and 100 seed weight, 2013.

		Rotylenchulus reniformis eggs per gram of root[y]				Root Fresh Weight					
	Irrigated	30DAP		140 DAP		30DAP	*P* value	100 Seed weight (gm)		Seed weight per plots (gm)	
Dothan Sandy Loam	No	72	BC	277	ABC	4.2	0.0383	14.5	ABC	27.2	B
	Yes	63	BC	131	C	8.8		14	ABC	34.8	AB
Decatur Silt Loam	No	188	ABC	286	ABC	2.4		12	C	20.4	B
	Yes	85	BC	490	ABC	5.8		12	C	34.0	AB
Ruston Very Sandy Loam	No	235	A	593	A	6.0		14.5	ABC	50.0	AB
	Yes	136	ABC	235	BC	9.1		16.2	ABC	35.2	AB
Hartsells Fine Sandy Loam	No	103	BC	289	ABC	3.2	0.025	13.9	ABC	33.2	AB
	Yes	69	BC	192	BC	8.2		15.1	ABC	64.8	A
Lloyd	No	162	ABC	345	ABC	4.9	0.0097	12.7	AB	23.6	B
	Yes	64	BC	141	BC	10.9		16.2	ABC	53.6	AB
Vaiden Clay	No	50	C	302	ABC	5.6		15.8	ABC	48.0	AB
	Yes	62	BC	204	BC	9.3		13.9	ABC	46.0	AB
P value		≤0.05		≤0.05				≤0.05		≤0.05	

[z]Means in the same column followed by the same letter do not differ significantly ($P \leq 0.05$) according to differences in least squares means.

[y]Reniform eggs were sampled at 30 and 140 DAP by the Sodium hypochlorite extraction method.

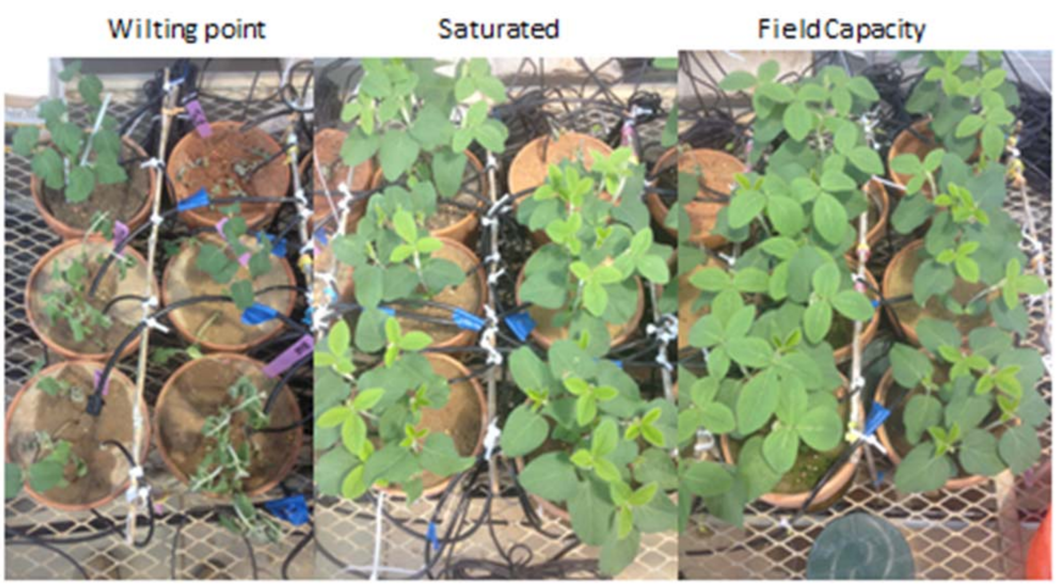
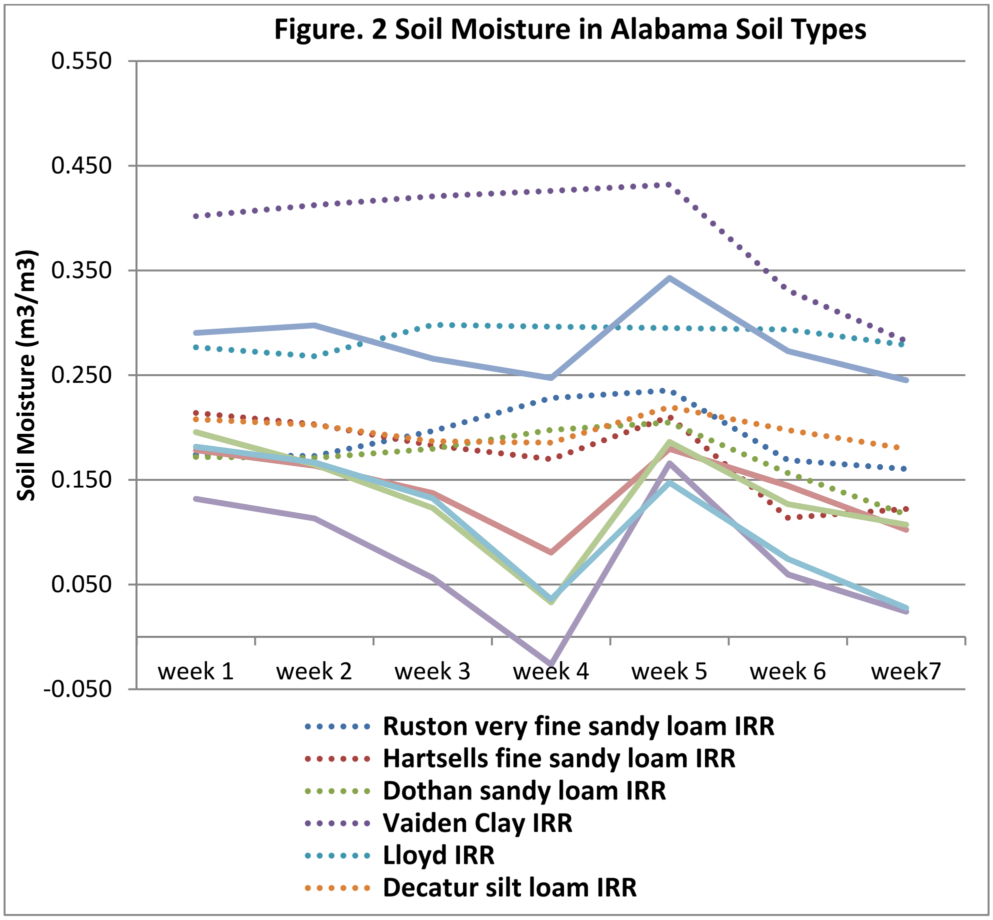


Figure 1. Greenhouse soil type moisture levels for reniform stress on soybean.

Note: On-going greenhouse trials are determining at what moisture levels reduce nematode numbers and damage on six soil types and three moisture regimes. The moistures that are being evaluated are wilting point, saturation, and field capacity. These three moisture regimes are being held constant by drip irrigation that is specific to each soil type and moisture regime.



Soil Type and Irrigation Effects on Reniform Nematode Damage To Soybeans, 2014.

K.S. Lawrence, E. Sikora, J. Murphy, and D. Delaney.

Justification: The reniform nematode may cause comparable yield declines in a wide range of soil types even though population densities differ significantly. Additionally, the interaction of water stress and the reniform nematode may be a more significant factor to yield loss than water stress alone.

Objective: Our objectives are to determine if adequate irrigation can reduce the soybean yield reduction potential of the reniform nematode on six different soil types representative of the major agronomic regions of Alabama.

Procedures: The test were conducted in the greenhouse and in microplots established at the Plant Science Research Center on the Auburn University campus. Six different soil types were evaluated from the major crop cultivated regions of Alabama. The soil types that will be used in the trials are Houston clay (9-53-38 S-S-C), Decatur silt loam (18-49-33 S-S-C), Lloyd loam (38-35-27 S-S-C), Dothan sandy loam (82-11-7 S-S-C), Hartsells fine sandy loam (66-21-13 S-S-C), and Ruston very fine sandy loam (64-21-15 S-S-C).

Results: In the greenhouse, the optimum soil moisture supported more reniform nematodes per plant and per gram of root compared to the wet and dry soil moisture regimes (Table 1). Either extreme in soil moisture, (wet or dry) similarly supported fewer reniform nematodes. Thus the nematode reproduced best under the optimum soil moisture. Plant growth or plant biomass was largest also with the optimum soil moisture. The wet and dry soil conditions reduced plant biomass by 17 and 7 %, respectively with the wet saturated soil supporting less plant growth than the dry soil. All soil types supported the reniform nematodes and there were no significant differences between reniform populations levels produced between the sands to the clays.

Microplots were irrigated or non-irrigated and in 2014 non-irrigated microplots had adequate moisture in May and June but were dry in July through September (Table 2). Reniform numbers were the same in irrigated and non-irrigated microplots over all soil types for both the 30 and 140 days after planting samples. Soybean yields were increased by irrigation with a 24% increase in soybean bu/a. The soybean yield varied by 11 bu/a in the microplots over all soil types. Irrigation increase yield in all soil types except the clay.

Outcome: All soil types supported reniform nematodes population when planted with soybean. Irrigation did increase yield in reniform infested microplots in all soil but the clay soil.

Table. 1 Soil type and irrigation effect on Reniform numbers, and plant parameters in the greenhouse, 2014.						
		Rotylenchulus reniformis		Fresh weight gm		Plant height
		Eggs total	Eggs/gm root	Shoot	Root	in
Irrigation	High	103	25	4.7 b	4.2 a	68.5 a
	Optimum	235	75	6.1 a	4.6 a	67.3 a
	Dry	134	59	5.8 ab	4.1 a	59.4 a
Soil	Clay	172	33	10.6	4.8	71.6
	Silty loam	222	63	5.0	3.8	70.0
	Loam	85	41	2.4	2.9	45.5
	Sandy loam	109	16	6.6	5.4	68.9
	Fine sandy loam	254	59	5.0	5.5	65.7
	Very fine sandy loam	301	106	3.7	3.4	68.8
Data were statistically analyzed using SAS Proc Glimmix and means followed by different letters are significantly differ according to Tukey-Kramer ($P \leq 0.10$).						

Table. 2 Soil type and irrigation effect on Reniform numbers, and yield in microplots.						
		Rotylenchulus reniformis		100 Seed weight	Yield	
		Eggs total	Eggs/gm root	gm	bu/a	
	Irrigation	80	232	28.6	28.6	
	No irrigation	135	349	21.6	21.6	
Soil	Clay	56	253	7.5	30.1	
	Silty loam	137	388	4.1	20.0	
	Loam	113	243	7.9	24.7	
	Sandy loam	86	241	6.5	31.3	
	Fine sandy loam	86	241	5.7	31.3	
	Very fine sandy loam	186	414	7.6	27.2	
Data were statistically analyzed using SAS Proc Glimmix and means followed by different letters are significantly differ according to Tukey-Kramer ($P \leq 0.10$).						

Identification of Soybean Cyst Nematode "Races" in Alabama, 2013.

E. Sikora and K.S. Lawrence

Soybean cyst nematode (SCN) is one of the most common nematode pests of soybeans in Alabama. SCN was found in approximately 15% of soybean fields surveyed. During that survey we identified field populations of races 2, 4, 5, 6, and 14 marking the first time these races were reported in Alabama.

Our current project proposed to expand this information through continuous race tests conducted on field populations collected during the season. Our objectives included: 1) conducting 8-10 SCN-race tests under greenhouse conditions, 2) develop a publication on identification and management of SCN in Alabama, and 3) develop a SCN-race distribution map for Alabama.

Unfortunately, the late season drought across much of Alabama in 2013 made collecting soil samples from the hard, dry field soil nearly impossible. Because of this we were unable to recover "usable" SCN populations for greenhouse studies in 2013.

In an effort to push the program forward we did work with Dr. Tom Powers, a Nematologist at the University of Nebraska, to try to develop a rapid DNA-type race test for SCN. Populations of SCN previously collected from Alabama were included in study with isolates collected from eight U.S. states that included Delaware, Nebraska and Minnesota. Experiments were conducted to test haplotype and nucleotide diversity in the isolates. Unfortunately, all of the SCN races from Alabama were found to be of a single haplotype with no diversity in the cytochrome oxidase primers. To date there are no known physiological differences among the different haplotypes.

Soybean Variety Trial with Nematicides to Boost Yield Potential, 2013.

K.S. Lawrence, E. Sikora, J. Murphy, D. Delaney, and D. Bailey

Justification: Seed treatment nematicides are now available to soybean producers. How much yield loss are the reniform nematodes causing? Will nematicides enhance soybean yield in a reniform infested field?

Objective: To determine the yield potential of multiple varieties of soybeans infested with the reniform nematode and treated with nematicides.

Note: Soybean seeds we obtained were treated with various seed treatments depending on the company. We were unable to obtain the Syngenta or Bayer seed treatments, Avicta or Aeris, in time to treat the seed for planting. We have both now and will add it to the seeds this season.

Results: Greenhouse tests screened 41 soybean varieties commonly grown in Alabama. Hartwig and Hutcheson are our standard resistant and susceptible comparison varieties. Asgrow AG5831, S51-H9, Progeny P 5111 RY, Bayer HBK RY 4721, and Asgrow AG5732 supported very low numbers of reniform nematodes in the greenhouse (Table 1.). In an irrigated reniform infested field at the Tennessee Valley Research and Extension Center, soybeans yielded from a high of 68 to 34 bu/A for Progeny P 6710 RY and Bayer HBK RY5421, respectively. We were unable to correlate high reniform population densities on soybean roots at 45 days (data not shown) after planting to reductions in yield. Interestingly, Progeny P 4850 RYS produced the second highest yield and supported very low numbers of reniform nematodes. This suggests that planting varieties with high yields and low reniform numbers could help keep nematode populations at a lower level for following crops.

Outcome: The highest yielding varieties in reniform infested fields were determined. Optimum variety selections would include those that produce high yields and support low populations of reniform nematodes.

Table 1. Greenhouse soybean variety screen for reniform nematode susceptibility, 2013.		
Variety	Reniform eggs and vermiform life stages /gram of root 60 DAP	
Bayer HBK RY5221	774	A
Henderson	691	AB
Asgrow AG7333	650	ABC
Progeny P 7310 RY	559	ABCD
NK Brand S77-T7	473	ABCD
Dyna-Gro 39RY57	372	ABCD
Hutcheson	362	ABCD
Asgrow AG7532	354	ABCD
Dyna-Gro S54RY43	340	ABCD
Asgrow AG5633	317	ABCD
Dyna-GroS48RS53	285	ABCD
Bayer HBK RY5421	281	ABCD
Asgrow AG7231	266	ABCD
SS 5911N R2	265	ABCD
Progeny P 5811 RY	259	BCD
Carver	249	BCD
Progeny P 5655 RY	249	BCD
Dyna-Gro 37RY52	244	BCD
Dyna-gro 37RY48	243	BCD
Asgrow AG6132	231	BCD
Bayer HBK RY4620	227	BCD
Asgrow AG6732	224	BCD
Bayer HBK RY5521	223	BCD
SS 6810N R2	217	BCD
SS 5510N R2	211	BCD
NK Brand S74-M3	208	BCD
Dyna-Gro 36RY68	201	BCD
Asgrow AG4832	184	BCD
Stonewall	173	BCD
Dyna-Gro S47RY13	164	BCD
Progeny P 6710 RY	164	BCD
Asgrow AG4933	149	BCD
Asgrow AG7733	148	CD
SS 5112N R2	144	CD
Dyna-Gro 34RY75	144	CD
Progeny P 5711 RY	142	CD
Asgrow AG5831	133	D
S51-H9	123	D
Progeny P 5111 RY	122	D
Bayer HBK RY4721	91	D
Hartwig	77	D
Asgrow AG5732	67	D
P value	≤0.05	
Means in the same column followed by the same letter do not differ significantly ($P \leq 0.05$) according to Tukey-Kramer HSD.		

Table 2. TVREC soybean variety screen for reniform nematode susceptibility, 2013.				
Variety	Reniform eggs and vermiform life stages /gram of root[y]		Yield bu/A	
Progeny P 6710 RY	55	AB	68	A
Progeny P 4850 RYS	37	B	62	AB
Bayer HBK RY 4620	53	AB	61	AB
REV 47R34	45	AB	61	AB
Dyna-Gro S56RY84	73	AB	60	AB
Progeny P 5213 RY	71	AB	59	AB
NK S 52-Y2	76	AB	59	AB
MYCOGEN 5N451R2	102	AB	57	AB
SS 5213 NR2	68	AB	57	AB
USG 75Q42R	35	B	56	AB
NK S49-48	45	AB	56	AB
Asgrow AG 4934	66	AB	55	AB
Dyna-Gro S48RS53	91	AB	53	AB
Asgrow AG 5532	108	AB	53	ABC
Hartwig	39	B	52	ABC
SCHILLINGER 4712 R2	66	AB	52	ABC
REV 52R74	56	AB	51	ABC
SS 4912 NR2	92	AB	51	ABC
Bayer HBK R5226	84	AB	50	ABC
Progeny P 5711 RY	120	AB	50	ABC
Bayer HBK RY 5221	169	A	45	BC
Hutcheson	40	B	44	BC
Bayer HBK RY5421	45	AB	34	C
P value	≤0.05		≤0.05	

Means in the same column followed by the same letter do not differ significantly ($P \leq 0.05$) according to Tukey-Kramer HSD.
[y] Root samples were taken 45 DAP for eggs per gram of root.

Soybean Variety Trials with Nematicides to Boost Yield Potential, 2014.

Investigators: K.S. Lawrence, E. Sikora, and D. Delaney

Justification: Seed treatment nematicides are now available to soybean producers. How much yield loss are the reniform nematodes causing? Will nematicides enhance soybean yield in a reniform infested field?

Objective: To determine the yield potential of multiple varieties of soybeans infested with the reniform nematode and treated with nematicides.

Materials and Methods:

Field trial: Ten commercial soybean varieties were evaluated with and without seed treatment nematicides for their performance in a reniform infested field at the TVREC. The soil was a Decatur silt loam (sand, silt, clay of 23-49-28). Plots consisted of 2 rows, 25 ft long with 30 in. row spacing and were arranged in a RCBD with 5 replications. All plots were maintained throughout the season with standard production practices as recommended by the Alabama Cooperative Extension System. Plots were irrigated with a linear sprinkler system as needed. Nematode samples were collected near 30 days after planting by digging up three plants and extracting the reniform eggs from the roots. Plots were harvested on October 23.

Greenhouse trials: Ten commercial soybean varieties were evaluated with and without seed treatment nematicides and with and without reniform nematode to determine the effects of reniform and nematicides on soybeans. Soybeans were planted in 150 cc conetainers and inoculated with 2000 reniform eggs and vermiform life stages and allowed to grow in the greenhouse for 45 days before harvest. Two tests were completed. Data from field and greenhouse tests were statistically analyzed by ARM and means compared using Tukeys ($P \geq 0.05$) test.

Results:

Field trial: Reniform nematode egg counts were statistically similar across all soybean varieties with the seed treatment nematicide. HBK RY 5221 and Pioneer 95Y71 supported the greatest number of reniform eggs per gram of root of all the varieties when grown without a nematicide. The presence of the nematicide reduced reniform reproduction on 9 of the 10 varieties reducing reniform nematode eggs by 70%. Soybean variety trials yields ranged from 37.3 to 59.8 bu/a. The top two varieties were HBK RY 5421 and Terral REV 56R63. These top two yielding varieties also supported lower numbers of nematodes with or without the nematicide. The seed treatment nematicide increased yields in 8 of the 10 varieties with an average increase of 4 bu/a.

Greenhouse trials: Reniform nematode egg counts were statistically higher without a nematicide compared to the varieties treated with a nematicide. Averaged overall varieties reniform numbers were 83 eggs per gram of root with the seed treatment nematicides and 6140 eggs per gram of root without that nematicide treatment. Plant biomass was also reduced by the presence of the nematode. In the absence of the nematode, soybean varieties averaged 20 grams of biomass (roots and shoots combined) in the greenhouse. Reniform nematode reduced the total biomass 25% with an average of 15.2 gm of biomass when the soybeans are grown with the nematode. Interestingly, HBK RY 5421 which produced the highest yield in the field also did not have a reduction in plant biomass when exposed to reniform in the greenhouse. The nematode did reproduce on this variety but it did appear to be tolerant in the 2014 tests.

Outcome: HBK RY 5421 appeared tolerant to reniform nematode in the field and greenhouse test. Overall, in the field, the seed treatment nematicide increased yield by 4 bu/a and reduced reniform numbers by 41%.

Table 1. Soybean varieties with and without nematicides Reniform population densities and yields, TVREC 2014.

	Variety	Reniform eggs/gm root		Yield bu/a	
		No nematicide	Nematicide	No nematicide	Nematicide
1	HBK RY 5421	359 b	371 a	50.7 a	59.8 a
2	Terral REV 56R63	249 b	242 a	48.6 ab	54.5 ab
3	HBK RY 5221	1861a	587 a	46.1 ab	50.2 ab
4	Terral REV 53R23	594 b	287 a	42.4 bc	49.9 ab
5	Terral REV 55R53	495 b	488 a	45.6 ab	49.2 ab
6	Pioneer 95Y71	699 a	159 a	48.3 ab	46.5 b
7	Terral REV 57R21	317 b	443a	41.4 bc	45.2 b
8	Pioneer P54T94R	469 b	365 a	40.6 bc	44.3 b
9	Asgrown AG 5831	520 b	313 a	42.5 bc	42.4 b
10	Asgrow AG 5633	244 b	163 a	37.3 c	42.3 b

Means followed by same letter do not significantly differ according to Tukeys test ($P \leq 0.05$)

Table 2. Soybean varieties growth in the greenhouse with and without reniform nematodes and with and without nematicides, PSRC 2014.

	No Reniform		Reniform with nematicide		Reniform without nematicide	
	Plant biomass gm	Reniform eggs/gm root	Plant biomass gm	Reniform eggs/gm root	Plant biomass gm	Reniform eggs/gm root
HBK RY 5421	15.1	0.0	17.0 a	98.0	16.1ab	4809.9
Terral REV 56R63	23.0	0.0	16.9 a	32.4	17.6 a	4625.1
HBK RY 5221	20.6	0.0	12.6 a	255.3	11.1 b	4083.2
Terral REV 53R23	19.6	0.0	19.7 a	46.3	13.7 ab	3131.4
Terral REV 55R53	19.8	0.0	12.4 a	69.7	14.3 ab	5558.4
Pioneer 95Y71	18.9	0.0	11.6 a	72.8	14.8 ab	8111.9
Terral REV 57R21	17.9	0.0	16.8 a	53.0	16.0 a	11002.3
Pioneer P54T94R	21.5	0.0	14.4 a	111.2	11.6 ab	8419.5
Asgrown AG 5831	22.7	0.0	21.3 a	58.4	18.0 a	5398.9
Asgrow AG 5633	21.0	0.0	10.1 a	32.7	17.4 ab	6263.3

Means followed by same letter do not significantly differ according to Tukeys test ($P \leq 0.05$)

Root-knot Nematode Species Identification for soybeans, 2014.

Investigators: K.S Lawrence, E. Sikora, D. Delaney and P. Donald

Justification: The Root-knot nematode is common in Alabama and as soybean acreage has increased this nematode has become more of a management problem. Two separate surveys indicate that more than 10% of Alabama soybean fields have a detectable level of root-knot nematodes. Successful crop rotations depend on identification of the root-knot nematode species and races present in the field. In Alabama, we have the southern cotton root knot, peanut root-knot and soybean root-knot and they are not crop specific.

Objective: Our objectives are to collect root-knot nematode samples from across the state and determine the species and races present using the traditional host differential test, morphological characterization, modified isozyme analyses of root-knot nematode species, and DNA analysis.

Procedures: Root-knot nematodes populations were collected from soybean fields displaying nematode problems in Alabama during the 2014 season. Three pathogenic populations were increase in the greenhouse at the Plant Science Research Center on the Auburn University campus. The traditional host differential tests were established for each population in the greenhouse this fall semester. The nematode populations are allowed to increase on tomato, watermelon, pepper, tobacco, cotton, peanut, corn, and soybean for 45 days and populations are quantified to determine species and races present in the field.

Preliminary results: All three nematode populations were determined to be *Meloidogyne incognita* race 3 or our southern root-knot nematode using the host differential tests. Morphological characterizations also confirmed the host differential identification.
A molecular protocol is also being tested for distinguishing the most common and economically important
root-knot nematode species. DNA was extracted from individual second-stage juvenile nematodes of the root-knot populations collected and increased in the greenhouse. DNA was extracted and amplified by PCR. PCR products are being stored at -20C until all the samples are completed.
In February we plan to analyze the root-knot populations using isozyme analyses with esterase and malete dehydrogenase which requires a few days to run the lab analysis. Isozyme patterns are matched to species of the root-knot nematode.
Speciation will be determined by the four techniques to determine consistency.

Outcome: The pathogenic root-knot populations collected from soybean fields in Alabama to date have been identified as *Meloidogyne incognita* race 3 by the host plant differential test and morphological characteristics. We are working on the isozyme and DNA analysis.

VI. Insect Management

Determining Optimal Timing For Kudzu Bug Insecticide Applications To Soybeans To Prevent Yield Loss And Maximize Soybean Profits, 2013.

T. Reed

Materials and Methods: This study was conducted at the Prattville Agricultural Research Unit. Pioneer 94Y70 soybeans were planted 4/22 in 36" rows. . Experimental plots were 8 rows wide and 30 feet long with 4 replications per treatment arranged in a RCB design. The 6 treatments utilized were insecticide applications made at different times during the growing season. Insecticides were applied using a tractor-mounted CO_2 pressurized spray boom equipped with TX6 nozzles that delivered 6.4 oz bifenthrin/acre in 10 gpa at 50 psi. Treatment application dates and yields are presented in Table 1. Soybeans were then sweep net-sampled on 5 different dates to determine numbers of kudzu bugs and other insect pests present. Plots averaged 5.6 kudzu bugs/sweep on 6/11 the day before insecticide treatments were initiated. Results are presented in Tables 1 and 2.

Table 1. Insecticide application dates for different spray treatments in Kudzu bug optimal spray timing study at PARU in 2013.

Trt #	Spray Date 6/12	Spray Date 6/22	Spray Date 7/3	Spray Date 7/26	Yield[1] Bu/A
1	X				52.84 AB
2		X	X	X	54.76AB
3			X	X	56.49 A
4	X	X	X	X	57.2 A
5				X	50.34 BC
6					45.30 C

[1] Yields at 13% moisture

Kudzu bug numbers resurged after initial insecticide applications on 6/12 and 6/22 as adults continued to migrate to soybeans (Table 2). Significantly fewer egg masses were found on 7/1 in Treatment 4 which received 2 insecticide applications prior to sampling on 7/1. Migration slowed significantly by the end of August. There was a significant effect with respect to yield (P>F=0.0227) among the different treatments. The yield of the unsprayed treatment (Treatment 6) was significantly less than that of Treatments 1, 2, 3 and 4 (LSD 0.1= 5.76 bu/ac). This test indicated that a minimum of 2 insecticide treatments (Treatment 3) were needed under test conditions to maintain maximum yields with an average population of 16 kudzu bugs per sweep present in unsprayed plots 8 weeks after planting and 15 kudzu bugs per sweep 9 weeks after planting. The two insecticide applications in Treatment 3 increased yields by 11 bu/ac. in comparison to the unsprayed treatment (Treatment 6).

Table 2. Number of kudzu bugs per sweep on different sampling dates following different insecticide treatment regimens at PARU in 2013 and kudzu bug egg mass density on 7/1/2013

	# Kudzu Bugs per Sweep					KB Egg Masses
	Date	Date	Date	Date	Date	/6 ft on 7/1
TRT #	6/21	7/1	7/12	7/24	7/30	
1	5.8 C	15.1	2.8	8.6	3.7	9.8B
2	16.8 AB	14.6	1.4	12.0	0.1	9.5B
3	12.8 B	16.2	1.2	12.1	0	14.3 A
4	7.5 C	13.0	1.3	11.4	1	4.3 C
5	18.2 A	14.6	2.1	10.5	0.1	12.5 AB
6	16.0 A	17.3	2.4	8.35	5.6	11.0 AB
P>F =	0.0036	0.43	0.18	0.53		0.005

Determining Optimal Timing for Kudzu Bug Insecticide Applications to Soybeans to Prevent Yield Loss and Maximize Soybean Profits, 2014.

T.Reed

This study was conducted at the Brewton Agricultural Research Unit. Asgrow 4933 soybeans were planted May 7. Plots were 8 rows wide and 29 feet long. Row spacing was 36 inches. Treatments were different spray dates as shown in Figure 1 below. Treatment 7 was unsprayed. Each treatment was replicated 4 times with treatments
arranged in a randomized complete block design. Each application date Brigadier insecticide was applied at a rate of 6.1 ounces/acre. The insecticide was applied in 15 gallons water per acre using Lurmark 30HCX8 nozzles, 35 psi and a 20 inch nozzle spacing. Plots were sampled using a 15 inch diameter sweepnet with a sweep defined as a sweep across two rows. Sampling dates are presented in Table 1. **Results**: Results are presented in Figure 1 and Table 1.

Figure 1. Kudzu Bug Spray Timing Study – Brewton, AL 2014

Table 1 - Number of Kudzu Bugs Per Sweep, Brewton, AL 2014

	Sampling Date									Yield	
	6/23	7/10		7/17		7/31		8/8		bu/ac	
Trt #	T [1]	T	N [2]	T	N	T	N	T	N		
1	1	17	0	16	0.3	9	0.6	10	1	62.0	ABC
2	0.4	12	1	2.3	1	2	0	2	0	66.6	AB
3	0.2	13	0	1	0.2	2	0.1	0.3	0	71.7	A
4	7	18	4	5	2	4	0.1	2	0.2	66.5	AB
5	7	20	3	0.7	0.2	3	0.13	1	0.2	56.9	BC
6	6	22	3	15	3	17	6	4	2	58.1	BC
7	5	16	2	15	4	10	3	13	4	54.5	C
P = 0.0	0.8	0.04	0.002	0.03	0.001	0.0	0.0	0.1	0.058		

LSD 0.1 - 10.1

[1] T = total number of kudzu bugs. [2] N = number of immature kudzu bugs.

The initial spray application was applied on 6/18 when populations of kudzu bugs averaged 5 adult kudzu bugs per sweep. Immatures were first collected on 7/10 (66 days after planting). Numbers of kudzu bugs resurged by 7/10 at which time there was no significant difference in numbers among the treatments (P>F=0.8). Total numbers of kudzu bugs averaged 19 per sweep (of which 3 per sweep were immatures) in plots that had yet to be sprayed on 7/10. No resurgence occurred after plots were sprayed on 7/14. Note that in Treatment 1 the number of immatures per sweep never exceeded 1 per sweep after a single insecticide spray was applied on 6/18. Yields for Treatments 2, 3 and 4 were significantly greater than that in Treatment 7 (unsprayed) but they were not significantly different from each other at the 90% level of confidence. The single spray applied 7/14 resulted in a yield that statistically was no different than yields obtained with 1 early + 1 mid-season spray, 3 sprays or 1 mid plus one late–season spray. Soybeans reached the late R5 stage by 7/31 (84 days after planting). The results of this study helped validate the current recommendation that a kudzu bug treatment is justified in reproductive stage soybeans when numbers of adult kudzu bugs reach a density of ten per sweep or 1 immature per sweep is present.

Effects of Dimilin on Soybean Insect Pest Populations and Yields, 2013.

T. Reed

Materials and Methods: This study was conducted at the Prattville Agricultural Research Unit . Pre-insecticide application counts were made on 8/30/2013 and the average number of soybean looper (SBL) larvae recovered per 6 row feet in ground cloth samples was 2.8. The average number of kudzu bugs (KB's) recovered per 6 row feet was 13.9. Treatments applied and application dates are presented in Table 1. Soybeans were planted in 36 inch rows. Plots were 4 rows wide and 30 feet long and were arranged in a RCB design with 4 replications per treatment. Insecticides were applied using a tractor-mounted CO_{2-} powered spray boom equipped with TX6 conejet nozzles that delivered 10 gallons of water per acre using 50 psi. Drop cloth samples were taken on 9/11 and 6 row feet were sampled in each plot.

Results: Numbers of SBL larvae and KB adults recovered in the different treatments and yields are presented in Table 1.

Table 1. Effects of Dimilin, Two Pyrethroids and Dimilin Plus Pyrethroid on Soybean Loopers and Kudzu Bugs Infesting Soybeans 7 days post-application at Prattville, AL in 2013.

Treatment	Rate Per Acre	Date & Stage at Application	# SBL/6 ft	Kudzu Bug Adults/6 ft	Bushels/Acre 13% moist.
Dimlin 2L	4 oz.	9/4 – R6	1.5	15.0 CDE	56.5
Dimilin 2L + Karate Z	2 oz. 1.92 oz.	9/4 – R6	2.3	6.8 EF	58.6
Katate Z	1.92 oz.	9/4 – R6	2.5	5.75 EF	57.2
Dimilin 2L + Karate Z	4 oz 1.92 oz.	9/4 – R6	2.8	4.50 F	55.7
Dimilin 2L	2 oz.	9/4 – R6	2.8	19.5 BC	58.1
Mustang Maxx	4 oz.	9/4 – R6	3.0	10.0 CDEF	58.7
Dimilin 2L	4 oz.	9/4 – R6	3.75	26.3 AB	56.6
Dimilin 2L + Karate Z	6 oz. 1.92 oz.	9/4 – R6	4.0	8.8 DEF	56.6
Dimilin 2L	2 oz.	8/21 – R5	4.3	32.5 A	58.4
Control	---	---	5.0	17.5 BCD	58.4

P>F = 0.47 0.0003

0.93

LSD 0.1 = NS 9.6

NS

No kudzu bug immatures were recovered. There was no significant difference among the treatments (P>F = 0.47) with respect to the number of SBL larvae recovered 7 days post-spray. There was a highly significant difference among treatments (P>F=0.0003) with respect to the number of kudzu bug adults recovered (LSD 0.01 = 9.6). The average number of KB's recovered in the 4 treatments with Dimilin alone was 23.3 per 6 row feet. The average number of KB's recovered in the 5 treatments that included a pyrethroid was 5.1. There was no significant difference among the different treatments with respect to yield. Yields ranged from 55.7 to 58.7 bushels per acre.

Determining the Economic Threshold at Different Stages of Soybean Development for 3-Cornered Alfalfa Hoppers Infesting Double Cropped Soybeans, 2013.

T. Reed

Materials and Methods: This study was conducted at the Prattville Agricultural Research Unit. Test plots in this factorial experiment were 4 rows wide and 30 feet long with treatments arranged in a split plot design. The main plot factor was insecticide treatment. Plots either received no insecticide or were sprayed with the insecticide bifenthrin at a rate of 6.4 oz/acre. The subplot treatments were number of sprays with bifenthrin which ranged from 0 to 4 times. Subplot treatment dates for different treatments were 7/3, 7/26, 8/12 and 9/27. Soybeans were sampled on 7/2, 7/30, 8/15, 8/30 and 10/1 using a sweep net and all insect pests collected were counted. Yields were taken at plant maturity.

Results: Sweep net samples on 7/2 when soybeans were in the V6 stage of growth revealed that a very low level of 0.1 three-cornered alfalfa hoppers (3CAH's) per sweep were present in the plots. Numbers of 3CAH's per sweep remained low throughout the study in untreated plots and averaged 0.1 on 7/30, 0.38 on 8/15, 0.45 on 8/30 and 0.9 on 10/1. The 8 plots sprayed on 7/3were sampled on 7/24 and an average of 6.3 and 4.6 kudzu bugs per sweep were collected in sprayed plots and their corresponding unsprayed controls, respectively. Numbers of kudzu bugs collected on the remaining sampling dates in the different treatments are presented in Table 1.

Table 1. Number of Kudzu Bugs per sweep recovered at Prattville, AL in 2013 on different sampling dates and yields in sprayed and unsprayed plots.

	7/30		8/15		8/30		10/1		Bushels/Acre	
Treatment #	Sprayed	Not Sprayed	Sprayed	Not Sprayed	Sprayed	Not Sprayed	Sprayed	Not Sprayed	Sprayed	Not Sprayed
1[1]	1.0	7.1	0.9	1.4	0.3	0.1	0.7	1.1	57.1	54.1
2[2]	0.5	8.4	0	1.5	0.04	1.5	0.2	1.6	57.2	55.9
3[3]	8.3	7.3	0.04	1.9	0.1	1.4	0.5	1.4	52.5	56.0
4[4]	6.3	6.0	1.0	2.0	0.7	2.7	0.2	1.6	54.3	52.5
	P>F = 0.000		0.093		0.17		0.32		0.56	
	LSD 0.1= 2.1		0.47		---		---		__	

[1] Bifenthren applied 7/3 and 7/26; [2] Bifenthren applied 7/3, 7/26, 8/12, 9/27; [3] Bifenthren applied 8/12; [4] Bifenthren applied 9/27

Numbers of kudzu bugs were as high as 8.4/sweep in unsprayed plots on 7/30 but then numbers declined. Low levels of stink bugs (mainly immature southern green stink bugs) were first detected in plots on 8/30 where they averaged 0.2/sweep.The 8 bifenthrin-treated plots sprayed on 9/27 averaged 0.28 stink bugs per sweep on 10/1while the remaining plots had an average of 2 to 4.3 per sweep. Yields are presented in Table 1. 3CAH, kudzu bug and stink bug numbers were not sufficient to cause a significant yield reduction.

Effect of Planting Date on Kudzu Bug Infestation Level and Economic Loss in Alabama Soy Beans, 2013.

T. Reed

Materials and Methods: This study was conducted at the Prattville Agricultural Research Unit. This factorial experiment utilized a split plot experimental design with insecticide treatment being the main plot factor with plots either receiving insecticide treatments or not receiving insecticide treatments. Bifenthrin at a rate of 6.4 oz/ac was applied in 10 gallon water/acre each insecticide application using a tractor-mounted CO_2 pressurized spray boom using TX6 nozzles and 50 psi. The subplot factor was planting date. Initially we planned to plant plots monthly beginning April 20 but frequent rains resulted in plots being planted 4/20, 6/12, 6/26, and 7/31. Plots planted April 20 were treated with insecticide on 6/21, 7/2, 7/26, and 8/12. Plots were sampled with a sweep net on 7/1, 7/11, 7/24, 7/30 and 8/14. Plots planted 6/12 were sprayed 7/2, 7/26, and 8/12 and sweep net-sampled on 7/11, 7/24, 7/30, 8/14 and 8/30. Plots planted on 6/26 were sprayed on 7/26, 8/12 and 9/27 and were sampled on 7/30, 8/14, 8/30 and 10/1. Plots planted on 7/31 were sprayed on 9/27 and were sampled on 10/1 and 10/8.

Results: Pre-spray counts on 6/19 revealed a density of 14 KB's/sweep in plots planted 4/20. Plots planted 4/20 had the highest density of kudzu bugs (KB's) present for all planting dates with numbers resurging to 22 per sweep on 7/1 in plots previously sprayed with insecticide on 6/21. Following the second spray on 7/2 kb's resurged again to 11 adults /sweep in sprayed plots with 9 adults and 8 nymphs/sweep in unsprayed plots. KB numbers did not rebound following the 7/26 spray and numbers of Kb's declined to 9 and 7/sweep in unsprayed plots on 7/30 and 8/4 respectively. For the 4/20 planting date the mean yield of sprayed plots was 53.9 bu/ac and unsprayed plots yielded 48.2 bu/acre. The pre-spray KB density in plots planted on 6/12 was 5.4/sweep on 7/1. KB's resurged to 6.4/sweep in the second planting date plots on 7/11 after the 7/2 spray. Numbers held steady at this level in sprayed and unsprayed plots until the 7/26 spray and numbers did not rebound in the sprayed plots afterwards. Numbers also began to decline in unsprayed plots after 7/26 and KB density was 2/sweep in unsprayed plots on 8/30. Mean yields in plots planted 6/12 was 57.7 bu/ac in sprayed plots and 54.8 bu/ac in unsprayed plots. The pre-spray kudzu bug density in plots planted on 6/26 was 2.5/sweep on 7/24. KB density did not resurge after plots were sprayed on 7/26. The number of KB adults /sweep in unsprayed plots was 5.5 on 7/30; 2 on 8/14 and 1.6 on 10/1. The mean yield in plots planted 6/26 was 30.1 bushels/acre in sprayed plots and 29.1 bushels/acre in unsprayed plots. The pre-spray density of KB's on 8/30 in plots planted on 7/31 was 2.5/sweep. KB numbers did not resurge in sprayed plots following the spray applied 9/27. KB density in unsprayed plots per sweep was 3.5 on 10/1 and 7.7 on 10/8. Soybean rust was heavy in plots planted on 7/31 and probably hurt yields. The sprayed plots planted on 7/31 averaged 19.2 bu/ac and the unsprayed plots averaged 18.2 bu/ac. There was not a significant spray treatment x planting date interaction with respect to yield ($P>F = 0.95$) (there was not a statistically significant difference between the yields of sprayed and unsprayed plots for any individual planting date. However, there was a significant difference with respect to yield (P>F = 0.025) between all the 16 plots in the test that were sprayed (40.2 bu/ac) and the 16 plots that were not sprayed (37.6 bu/ac) (LSD 0.1 = 1.49 bu/ac).

Effect of Planting Date on Kudzu Bug Infestation Level and Economic Loss in Alabama Soybeans at Prattville, AL in 2014

T. Reed

Materials and Methods: This study was conducted at the Prattville Agricultural Research Unit. Varieties planted, planting dates, and insecticide application dates are presented in Table 1. This study utilized a split plot design with planting date being the main plot factor (16 rows x 30 ft long) and the sub-plot factor being sprayed and unsprayed (8 rows each). There were 4 planting dates but the 4th planting date (6/30) had a poor stand and significant deer damage. Kudzu bug counts were made in the 4th-planting –date plots but no insecticide spray was applied. Insecticide-treated plots were sprayed with bifenthrin at a rate of 6.4 oz/acre using TX 6 conejet nozzles in 8.5 gallons of water per acre using 50 psi. There were 4 replications for each planting date x spray type combination. Plots were sampled using a 15 inch diameter sweep net with a sweep defined as one sweep of the net across two rows.

Table 1. Planting date, variety and spray dates for Prattville kudzu bug planting date study 2014.

Planting Dates	Variety Planted	Spray Dates
4/25	ASG 4993	7/2, 7/12, 7/30
5/16	ASG 5332	7/2, 7/12, 7/30
6/10	ASG 6132	7/12, 7/30
6/30	ASG 7231	Not Sprayed

Results: Results are presented in Table 2: Prior to the first bifenthrin application on 6/30 the mean number of kudzu bugs per sweep and soybean stage of development for each planting date were as follows: PD1 = 21/sweep- R4.5, PD2=12/sweep- R1, and PD3=1.3/sweep-V1.

Table 1. Number of Kudzu Bugs in Sprayed and Unsprayed Plots with Different Planting Dates, Prattville, AL 2014.

PDXSPTRT P>F =		0.076	0.046	0.011	0.57	0.03	0.72	0.51
LSD 0.1 =		3.8	2.98	1.39	1.07	1.07		

	Total Number of Kudzu Bugs per Sweep							
Planting Date	**Spray Treatment**	**Date 7/9**	**Date 7/16**	**Date 7/30**	**Date 8/6**	**Date 8/20**	**Date 9/11**	**Yield Bu/Ac**
PD 1	Sprayed	1.4	0.1	1.0	0.3	0	NA	24.8
PD 1	Unsprayed	11.5	9.4	5.0	2.5	1.9	NA	25.5
PD 2	Sprayed	4.4	0.1	2.8	0.2	0.0	1.3	36.8
PD 2	Unsprayed	8.5	5.2	3.1	2.7	0.9	2.6	41.4
PD 3	Sprayed	NA	0.1	3.1	0.2	0.2	0.9	47.3
PD 3	Unsprayed	14.4	2.7	2.9	3.7	3.7	2.6	46.2

Samples taken on 6/30 prior to an insecticide application showed that the mean number of kudzu bug adults per sweep were as follows: PD1 = 21.0, PD2 = 12.0, PD3 = 1.3. There was a significant planting date effect with respect to kudzu bug density on 6/30 (P>F = 0.0012) with mean densities for each planting date significantly different from each other (LSD 0.1 = 7.0). There was a significant interaction between planting date and spray treatment with respect to kudzu bug density for samples taken on 7/9 (P>F=0.076) , 7/16 (0.046), 7/30 (0.011)and 8/20 (0.03). Numbers of kudzu bugs were significantly greater in unsprayed plots than in sprayed plots on 7/9, seven days post-spray. PD3 plots were not sprayed on 7/2 and numbers of kudzu bug adults were higher in the PD3 plots than in unsprayed PD1 and PD2 plots. PD3 plots were not included in the statistical analysis for the 7/9 sampling date. Immatures were not found in the PD2 plots on 7/2 (53 days post-planting) but they comprised 9% of all kudzu bugs collected in PD1 plots on 7/9. After 7/9 there was a decline in the number of kudzu bugs in unsprayed plots for each planting date. Mean numbers of kudzu bugs recovered per sweep for the 4th planting date and the stage of development on the sampling date were as follows 7/30- V6-1.3/sweep; 8/6-V10-2.0/sweep; 8/20- R2-1.6/sweep; 9/11- R5.2- 1.0/sweep. No immature kudzu bugs were recovered from the 4th planting date. There was no significant interaction between planting date and spray treatment with respect to yield (P>F=0.51). There was no significant effect on yield with respect to spray treatment (P>F=0.50). There was a significant effect on yield with respect to planting date (P>F = 0.02, LSD 0.1= 10.7). Mean yields per acre for the different planting dates were PD1 = 25.2 bu., PD2 = 39.1 bu., and PD3 = 46.8 bu. Yields for PD1 were low because beans could not be harvested in a timely manner due to combine issues and the soybean pods shattered and soybeans fell on the ground.

Determining Which Insecticide Provides the Most Cost-Effective Control of Soybean Loopers Infesting Soybeans,2013.

T. Reed

Materials and Methods: This study was conducted at the Gulf Coast Research and Extension Center at Fairhope, AL. The five insecticides evaluated in the study and the rate applied of each chemical are presented in Table 1. Each insecticide was applied to one plot and each plot was 4 rows wide (38 inch row spacing) and 606 feet long. There was an untreated control plot adjacent to each insecticide-treated plot. The insecticides were applied on 9/10/2013 using a Spyder Sprayer equipped with 11002 spray nozzles that delivered 12 gallons per acre at 40 psi. The Croplan 6810 soybeans were 48 inches tall, had a closed canopy and were in the late R5 stage of development. Plots were sampled 9 days post-application using a ground-cloth and 6 row feet were shaken for each sample. The per cent defoliation in both the upper and lower canopy was estimated when larval counts were made. Plots were harvested at maturity.

Results are presented in Table 1.

Table 1. Efficacy of 5 insecticides in controlling soybean loopers infesting soybeans 9 days post-application

		# SBL Larvae / 6 Row Feet				% Defoliation		
Insecticide	Rate/Acre	Lg	Sm	Total	Percent Reduction	Upper Canopy	Lower Canopy	Yield Bu/Acre
Prevathon	20 oz	0.3	1.5	1.8	85	0	1	60.9
Untreated	_____	3.5	8.5	12.0		2	10	59.3
Belt	3 oz	0.8	2.0	2.80	78	1	1	61.4
Untreated	_____	4.3	8.3	12.6		3	10	65.4
Intrepid	5 oz	0.5	0.5	1.0	92	1	3	63.9
Untreated	_____	4.5	8.5	13.0		3	12	65.4
Steward	7 oz	0.3	0.3	0.6	95	0	5	62.1
Untreated	______	3.8	8.0	11.8		2	10	63.8
Blackhawk	2 oz	0.3	0.3	0.6	96	1	2	64.4
Untreated	_______	2.8	11.3	14.1		5	15	57.7

Insecticides reduced SBL numbers by 78% to 96%. All insecticides reduced defoliation in the lower canopy by an average of 9%. Few loopers had moved into the upper canopy by 9/19. Yields for all insecticide treatments combined averaged 62.5 bu/ac and the average for the untreated plots was 62.3 bu/ac. The study indicated that all 5 insecticides were effective against soybean loopers and that yields were not impacted at the levels of defoliation in this study.

Efficacy of Select Insecticides in Controlling Kudzu Bugs and a Complex of Caterpillars Infesting Soybeans at Brewton, AL in 2014

T. Reed and R. H. Smith

Materials and Methods--There were 2 control treatments in the test (8 plots). All other treatments were replicated 4 times using a randomized complete block design. Irrigated plots were planted on 6-6-14 with Asgrow AG6132 soybeans. Plants were in the very early R6 stage and 37 to 42 inches tall when plots sprayed 8/27. Insecticides were applied in 15 gallons water per acre using Lurmark 30HCX8 nozzles, 35 psi and a 20 inch nozzle spacing. Treatments and application rates are presented in Tables 1-5. Plots were sampled by ground-cloth (6 row feet/plot/ sampling date at 8 (9/4) 14 (9/10) and 22 (9/18) days after treatment. Plots were 6 rows wide and 29 feet long with 36 inch row spacing. No noticeable drift occurred during spray application. Four rows were sprayed and 2 rows were used as a buffer between each plot. One row per plot was harvested on 10/15 and test weight and per cent moisture was recorded. One row per plot was harvested due to uneven row heights in half the plots. Yields were calculated at 13% moisture**.** A crop oil concentrate was added to the Intrepid Edge, Prevathon, Belt, Beseige and Brigade treatments at 1% v/v. **Results—**Results are presented in Tables 1-5.

Table 1. Efficacy of Selected Insecticides in Controlling Kudzu Bugs in Soybeans at Brewton, AL in 2014.

		Total # Kudzu Bugs / 6 row ft		
Treatment	Rate Oz./Acre	8 DAT	14 DAT	22 DAT
Dimilin 2L	4.0	70.5 A	19.0 A	3.8 ABCD
Prevathon 50 SC	14.0	41.5 B	19.8 A	4.5 ABC
Untreated	----	34.2 B	17.9 A	3.9 ABCD
Intrepid Edge	6.0	32.0 B	13.5 A	5.0 AB
Belt	3.0	25.0 BCD	17.5 A	4.5 ABC
Intrepid Edge	4.0	24.0 BCD	20.8 A	7.8 A
Beseige	8.0	7.5 CDE	1.3 B	1.0 BCD
DoubleTake	4.0	5.5 DE	0.8 B	0 D
Brigade	6.4	0.0 E	0.3 B	0.3 CD
		P>F=0.0001 LSD 0.1=20.3	P>F=0.002 LSD 0.1=8.9	P>F=0.12 LSD 0.1=4.4

Table 2. Efficacy of Selected Insecticides in Controlling Velvet Bean Caterpillars in Soybeans at Brewton, AL in 2014.

		Total # VBC / 6 row ft		
Treatment	Rate Oz./Acre	8 DAT	14 DAT	22 DAT
Untreated	----	17.0 A	5.1 A	4.4 A
Dimilin 2L	4.0	0.3 B	0.0 B	0.0 B
Doubletake	4.0	0.0 B	0.0 B	0.0 B
Brigade	6.4	0.0 B	0.0 B	0.0 B
Intrepid Edge	4.0	0.0 B	0.0 B	0.5 B
Prevathon 50 SC	14.0	0.0 B	0.0 B	0.0 B
Belt	3.0	0.0 B	0.0 B	0.0 B
Intrepid Edge	6.0	0.0 B	0.0 B	0.0 B
Beseige	8.0	0.0 B	0.0 B	0.0 B
		P>F=0.000 LSD 0.1=5.1	P>F=0.001 LSD 0.1=3.0	P>F=0.004 LSD 0.1=2.3

Table 3. Efficacy of Selected Insecticides in Controlling Soybean Loopers in Soybeans at Brewton, AL in 2014.

		Total # SBL / 6 row ft		
Treatment	Rate Oz./Acre	8 DAT	14 DAT	22 DAT
Doubletake	4.0	26.0 A	22.5 A	4.5 A
Untreated	----	24.5 A	7.5 C	5.0 A
Dimilin 2L	4.0	24.0 A	16.8 B	2.8 AB
Brigade	6.4	14.5 B	9.5 C	4.3 A
Belt	3.0	9.0 BC	1.0 D	0.0 B
Beseige	8.0	5.5 CD	2.5 CD	0.8 B
Prevathon 50 SC	14.0	2.5 CD	0.3 D	0.3 B
Intrepid Edge	4.0	2.0 CD	0.3 B	0.3 B
Intrepid Edge	6.0	0.5 D	0.0 D	0.0 B
		P>F=0.000 LSD 0.1=5.1	P>F=0.000 LSD 0.1=3.6	P>F=0.003 LSD 0.1=2.0

Table 4. Efficacy of Selected Insecticides in Controlling Green Cloverworms in Soybeans at Brewton, AL in 2014.

		Total # GCW / 6 row ft		
Treatment	Rate Oz./Acre	8 DAT	14 DAT	22 DAT
Untreated	----	34.0 A	17 A	0 B
Dimilin 2L	4.0	0.0 B	0.0 B	0.0 B
Doubletake	4.0	0.0 B	0.0 B	0.3 B
Brigade	6.4	0.0 B	0.3 B	0.0 B
Intrepid Edge	4.0	0.0 B	0.0 B	1.5 A
Prevathon 50 SC	14.0	0.0 B	0.0 B	0.0 B
Belt	3.0	0.0 B	0.0 B	0.0 B
Intrepid Edge	6.0	0.0 B	0.0 B	0.0 B
Beseige	8.0	0.0 B	0.0 B	0.0 B
		P>F=0.002 LSD 0.1=18.1	P>F=0.000 LSD 0.1=5.4	P>F=0.205 LSD 0.1=0.94

Table 5. Yields and Efficacy of Selected Insecticides in Preventing Defoliation of Soybeans by a Complex of Caterpillars at Brewton, AL in 2014.

		% Defoliation			Yield[1]
Treatment	Rate Oz./Acre	8 DAT	14 DAT	22 DAT	Bushels/Acre 13 % Moisture
Untreated	----	17 A	33 A	50 A	63.5
Dimilin 2L	4.0	8 B	9 B	14 B	62.2
Doubletake	4.0	6 BC	8 BC	14 B	71.4 (3 reps)
Brigade	6.4	5 CD	6 BCD	9 BC	See notes
Intrepid Edge	4.0	4 D	4 CD	5 C	64.9 (3 reps)
Prevathon 50 SC	14.0	3 D	3 D	3 C	68.6
Belt	3.0	3 D	3 D	3 C	68.9 (3 reps)
Intrepid Edge	6.0	3 D	3 D	3 C	70.4
Beseige	8.0	3 D	3 D	3 C	64.8
		P>F=0.000 LSD 0.1=2.6	P>F=0.0014 LSD 0.1=4.0	P>F=0.000 LSD 0.1=7.4	P>F=0.43

[1]There were 8 plots near woods that were on weaker soil and had abnormally low yields. Only one Brigade plot yield was taken due to various issues. 3 other treatments had only 3 good replications each for comparing yields.

Special thanks are given to the Alabama Soybean Producer Committee for funding this project.

VII. Technology

Maintenance and Expansion of the ACES/Auburn Univ. Web Site for Alabama Crops, 2013

D. Delaney, C. Dillard, D. Monks, C. H. Burmester, and P. L. Mask

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, tabulated, and posted 3 weeks before publication of the full Official Variety Report. While this does not provide 2- and 3-year averages, it does provide 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, the Alabama Cotton Picksack Newsletter, on-farm research trial reports, and variety trials. Our Web Manager Mr. Jon Brasher also manages and assists in the maintenance of the Grain Crops (www.aces.edu/dept/grain), GIS (www.alabamagps.com) sites as well as the new Climate Web site, providing information on climate and weather-related factors and how to manage their effects on farming. A Crops Calendar keeps users informed of training opportunities, conferences, and meetings. The web site received a major design change in 2013 based on the current ACES web design template.

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.

In 2013, we received funding from Alabama Soybean Producers, the Alabama Cotton Commission, and the Wheat and Feed Grains Committee. This provides partial funding for the position for web manager, with additional funding coming from industry and other sources. 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 year, as of November 25th, 2013, indicate that the Alabama Crops site had 19,035 visits and 87,763 page views. To better explain the terminology, a **visit** is a series of actions that begins when a visitor goes directly to the web site using the primary web address. **Views** are the number of times this page was viewed by visitors who were directed there from a different starting point. The primary page was viewed the most, after which the "visitor" followed different links within the site according to the desired information.

VIII. Long-term Rotations

"Continued Support of Long-term Research – THE OLD ROTATION" 2013.

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

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

Soybeans are included in the 3-year rotation following a wheat crop. They have responded well to irrigation every year since irrigation was installed in 2003. Corn and cotton yields reflect N availability more than any other factor. There was a response to irrigation in 2013 by all crops.

Crop yields on the OLD ROTATION in 2013.

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

"Continued Support of Long-term Research – THE OLD ROTATION" 2014

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

The "Old Rotation" experiment (circa 1896) is the oldest, continuous cotton study in the world and the third oldest field crops experiment in the U.S. on the same site. With all the renewed interest in "cover crops", we are now claiming that this may be the oldest "cover crop" study in the U.S. The complete history of this experiment was published in 2008 in the centennial issue of Agronomy Journal (*C.C. Mitchell, D.P. Delaney and K.S. Balkcom. 2008. A historical summary of Alabama's Old Rotation (circa 1896): The world's oldest, continuous cotton experiment. Agron. J 100:1493-1498*). We were invited to do a presentation and 2 posters at the annual American Soc. of Agronomy meetings in Long Beach, California, in November. The Old Rotation was also featured during this year's "East Alabama Crops Tour" in August. It is beginning to get more international attention. Many students are using this study for special-problem research and soils from the Old Rotation have been shared with researchers in Ohio, Louisiana and Texas. The Old Rotation is the basis for the soil quality project being conducted.

Corn and cotton yields reflect N availability more than any other factor. There was a response to irrigation in 2014 by cotton, corn and soybean. An interesting observation has been that wheat yields, although not irrigated, seems to always be higher where NO irrigation was applied the previous year. Wheat always follows corn and soybean is double-cropped behind wheat.

Crop yields on the OLD ROTATION in 2014.											
Plot No.	Description	Vetch 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				432	732		
2	winter legume	3728	3234				1126	1089		
3	winter legume	4143	2891				1333	1155		
4	cotton-corn	3473	3043				1859	1539		
5	cotton-corn + N	4078	3388				1765	1539		
6	no N/no legume	0	0				460	460		
7	cotton-corn	5161	6571		192	152.0	corn	corn		
8	winter legume	4425	4310				1943	1117		
9	cotton-corn + N	4431	4319		200	162.0	corn	corn		
10	3-year rotation	0	0				1427	1070		
11	3-year rotation	5319	5213		210	194.0	corn	corn		
12	3-year rotation	0	0	83.9*			soy	soy	51.5	37.1
13	cont. cotton/no legume +N	0	0				1624	1417		
	Mean	4345	4121		205.0	178.0	1582	1275		

*Wheat is not irrigated but these yields were from the half that was not irrigated the previous year; the half that was irrigated produced 72 bu/acre.

"Continued Support of Long-term Research – CULLARS ROTATION" 2013.

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

The Cullars Rotation (circa 1911) is the oldest, continuous soil fertility study in the Southern U.S. In commemoration of the 2011 Centennial Year for this experiment, a comprehensive Ala. Agric. Exp. Station bulletin was published covering the first 100 years of this experiment.

http://www.aaes.auburn.edu/comm/pubs/bulletins/bull676.pdf

A poster was also presented at the 2012 Beltwide Cotton Conference.

This study is non-irrigated and yields reflect growing conditions during the season. Note the dramatic yield response to added K by cotton. Highest cotton yields (1493 lb. lint/acre) were produced on the treatment receiving a complete fertilizer plus micronutrients (boron). No added P (Plot 2) dramatically reduces wheat and corn yields more than cotton yields. Soybean yields are equally affected by P and K deficiencies. The highest soybean yield in 2013 (45.8 bu/acre) was produced on plot A which receives a complete fertilization just like plot 3. All fertilizers are applied to the cotton and wheat crops. The Cullars Rotation Experiment is an excellent site to see dramatic nutrient deficiencies compared to healthy crops each year. This type of comparison does not exist anywhere else in the USA.

Crop yields on the CULLARS ROTATION in 2013.

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

"Continued Support of Long-term Research – CULLARS ROTATION" 2014

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

The Cullars Rotation (circa 1911) is the oldest, continuous soil fertility study in the Southern U.S. This study is non-irrigated and yields reflect growing conditions during the season. Note the dramatic yield response to added K by cotton. Highest cotton yields (1267 lb. lint/acre) were produced on the treatment receiving a complete fertilizer plus micronutrients (boron). No added P (Plot 2) dramatically reduces wheat and corn yields more than cotton yields. Soybean yields are equally affected by P and K deficiencies. All fertilizers are applied to the cotton and wheat crops. The Cullars Rotation Experiment is an excellent site to see dramatic nutrient deficiencies compared to healthy crops each year. This type of comparison does not exist anywhere else in the USA. A poster was presented at the Amer. Soc. of Agronomy meetings in 2014 featuring nutrient movement in these plots over the past 30 years. This experiment will also be featured at a 2015 International Symposium on Soil and Plant Analysis.

Crop yields on the CULLARS ROTATION in 2014.

Plot	Treatment description	Clover dry wt.		Wheat	Corn	Cotton lint	Soybean
		-lb/acre-	Total N fixed (lb/a)	-bu/acre-	-bu/acre-	-lb/acre-	-bu/acre-
A	no N/+legume	2036	82	29.4	101.7	1070	37.8
B	no N/no legume	0	0	22.2	61.3	807	39.0
C	Nothing added	0	0	4.2	6.1	0	0.0
1	no legume	0	0	66.0	147.4	1004	38.3
2	no P	680	52	35.6	45.8	760	10.7
3	complete	3772	97	63.8	148.2	1004	38.5
4	4/3 K	3753	78	69.7	146.0	854	38.9
5	rock P	2863	95	55.9	138.1	1042	40.3
6	no K	1309	63	61.4	30.6	0	15.2
7	2/3 K	2626	153	69.7	131.6	967	36.7
8	no lime (pH~4.9)	0	0	0.0	21.3	0	0.4
9	no S	3355	110	64.4	139.9	1183	33.5
10	complete+ micros	4088	123	61.6	128.0	1267	38.5
11	1/3 K	3000	99	68.0	139.5	657	30.2
	Mean of all treatments	3187	87	61.6	135.6	939	37.6