

Auburn University Crops: Soybean Research Report 2015

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I. Cultural Management

Row Spacing and Population Density Effect on Soybean Seed Yield

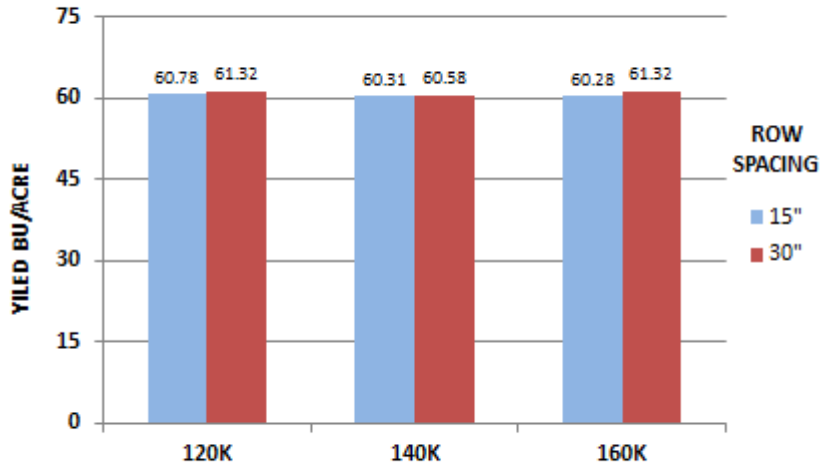
T. Sandlin, D. Delaney, and M. Hall

Two soybean row spacing and seeding rates were conducted in 2015. Frequent early season rainfall did not lend itself to early planted trials. Both soybean tests were double cropped behind wheat. The first test was located on farm in Limestone County (Elkmont, AL). The test was planted June 17, 2015 with Asgrow 5831 RR2 soybeans and harvested on November 15, 2015. The test contained one large strip for each treatment 37.5 feet in width and varied in row length from 355 feet to 378 feet. Yields were as follows for each treatment (1) 15" row x 120,000 seeding rate [60.78 bu/A] (2) 15" row x 140,000 [60.31 bu/A] (3) 15" row x 160,000 seeding rate [60.28 bu/A] (4) 30" row x 120,000 seeding rate [61.32 bu/A] (5) 30" row x 140,000 seeding rate [60.58 bu/A] (6) 30" row x 160,000 seeding rate [61.32 bu/A].

The second test was located at the Tennessee Valley Research and Extension Center in Belle Mina, AL. The test was planted on June 24, 2015 with Asgrow 4933 RR2 soybeans and harvested on October 22, 2015. The test contained two replications for each treatment 10 feet in width and 140 feet in length. Yields were as follows for each treatment: (1) 15" row x 120,000 seeding rate [35.68 bu/A] (2) 15" row x 140,000 [37.32 bu/A] (3) 15" row x 160,000 seeding rate [38.55 bu/A] (4) 30" row x 120,000 seeding rate [38.17 bu/A] (5) 30" row x 140,000 seeding rate [39.66 bu/A] (6) 30" row x 160,000 seeding rate [40.36 bu/A].

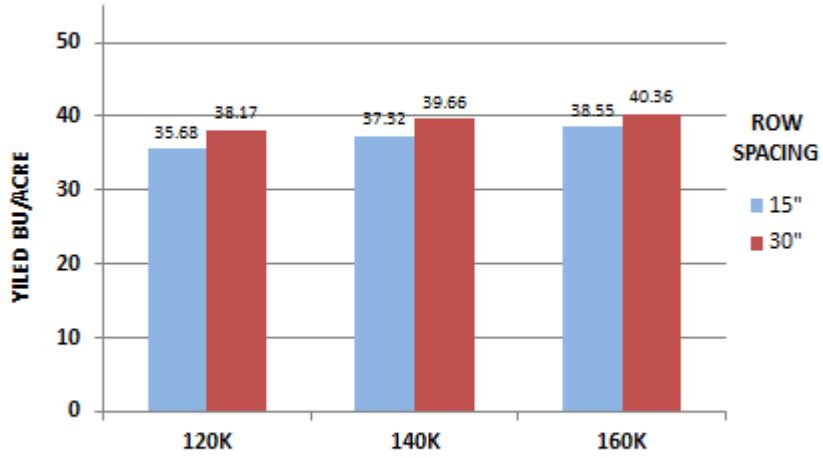
No significant differences were seen with respect to soybean yield for either test. A row spacing of 30 inches proved to yield slightly greater numerically for treatments at the Belle Mina location. Weed control was monitored for both locations with little to no differences observed between locations for any treatment. Consideration should be given to variety and potential for resistant weed populations when choosing soybean row spacing.

SOYBEAN ROW SPACING X SEEDING RATE



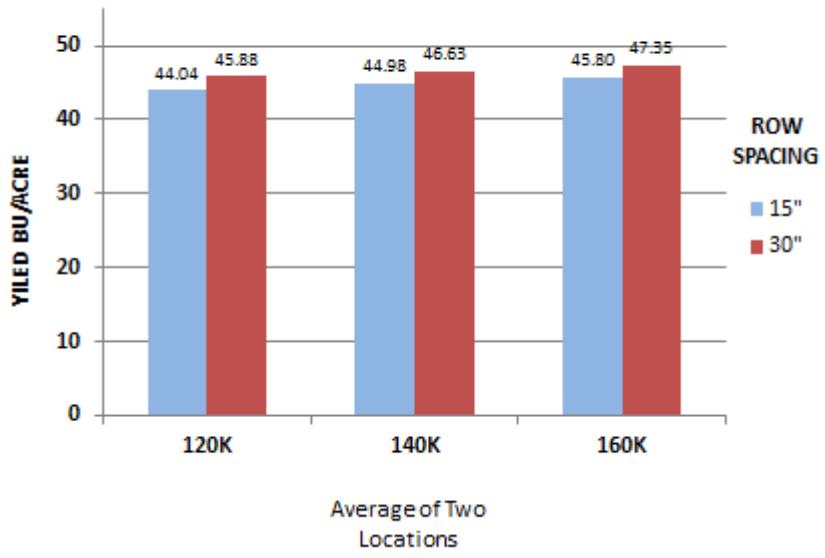
ASGROW 5831 RR2
Elkmont, AL

SOYBEAN ROW SPACING X SEEDING RATE



ASGROW 4933 RR2
Belle Mina, AL

SOYBEN ROW SPACING X
SEEDING RATE



Soybean Improvement and Germplasm Enhancement

D. B. Weaver

During 2015 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 have begun to incorporate new traits into this genetic background beginning in 2014 and continuing into 2015. Our main goal is to utilize the oil-producing capacity of this genotype to produce a nonGMO high oleic acid soybean oil. To this end, we were able to successfully cross Henderson \times S13-16219 (a source of the high oleic acid trait licensed to us by USDA and the University of Missouri) and obtained 22 F₁ hybrid seed. One additional cross that was made was G10PR-2242R (elite experimental line from the University of Georgia) \times S13-16188 (a line similar to S13-16219 and also having the high oleic acid trait). These F₁ plants were grown in the field during 2015 to produce F₂ seed. These have been threshed and are ready to plant in the field for generation advancement in 2016. The combination of a high oil production genotype coupled with the positive influence of high temperatures during the growing season will make this a very attractive package for producers interested in the high-oleic specialty market.

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. One additional aspect this year was that breeders across the southeast report very poor seed quality in their breeding programs due to extensive rainfall during harvest. The Belle Mina location produced seed of reasonable quality, and we are being looked upon as a seed supplier for many of these programs.

Establishment of Soybean Transformation Facility, Optimizing a GM Soybean Production

S.W. Park and K.S. Lawrence

Objective: Establishment of an in-campus soybean (*Glycine max*) transformation facility. The proposed studies aim at equipping the first in-campus facility in the college of Agriculture (AU), which optimize a transgenic (GM) soybean production, and generate initially transgenic soybean lines enhancing defense responses towards biotic and/or abiotic stresses.

A. Identification and characterization of a soybean receptor protein (GmCyclophilin20-3) of phytohormone, 12-oxo-phytodienoic acid, and construction of its plant expression vector.

12-oxo-phytodienoic acid (OPDA) is a major plant hormone in mediating defense signal towards various biotic and/or abiotic stresses such as microbe, insect and herbivore infections, wounding, drought, heat and UV damage. As an initial step to generate the transgenic (GM) soybean lines harboring enhanced disease resistance and/or stress adaptation, a soybean cyclophilin 20-3 (GmCYP20-3, a key receptor protein of OPDA) was isolated from the soybean RNA library on the basis of (A) the amino acid (aa) sequence of its Arabidopsis (a model plant) orthologous, identified previously in our laboratory (PNAS 110:9559), and (B) the soybean genome database (SoyBase, <http://soybase.org>). See below “aa sequence alignment of #259806423 (GmCYP20-3) with CYP20-3 (Arabidopsis CYP20-3).”

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259806423  MASPLSAQLVQCQNSLPPLQGNFS---QDVKVQSRVVCYGRSPPLGGYKALTSRSH 56
CYP20-3    MASSSSMQMVHTSRSLAQIGFGVKS---QLVSNRRTTQSVCFGARS---SGIALSSRLH 53
          *:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*
259806423  NALRFSVTRQS-EARSIQYRRMTCVN---AADNVVELQAKVTTKCFDFVEVGGEVPGRI 111
CYP20-3    YAS--PIKQFSGVYATTKHQRTACVKSMAAEEEEVIEPQAKVTNKVYFDVEIGGEVAGRI 111
          *:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*
259806423  VLGLFGEVVPKTVENFRA-LCTGEEKGYGKSSFHRIIKDFMIQGGDFTEGNGTGGISY 170
CYP20-3    VMGLFGEVVPKTVENFRA-LCTGEEKGYGKSSFHRIIKDFMIQGGDFTEGNGTGGISY 170
          *:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*
259806423  GPSFKDES FALKHVGPGLSMANAGPNTNGSQFFICTVKTPWLDNRHVVFVGHIIIDGMDVV 230
CYP20-3    GAKFEDENFTLKHTGPGILSMANAGPNTNGSQFFICTVKTSWLDNRKHVVFVGHIIIDGMDVV 230
          *:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*
259806423  KTTLESQETSRLDVPKPKCRIVNCGELPIEG----- 260
CYP20-3    RTLESQETRAFDPKKGCRIVNCGELPLDA----- 260
          *:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*:*

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Note that GmCYP20-3 (ID:259806423) shares 61% aa sequence identity with Arabidopsis CYP20-3, which was then further (C) cloned in to a plant expression vector (pCAMBIA) and a bacterial expression vector (pET28a), and (D) tested its exogenous production in the laboratory bacteria, *Escherichia coli* (Fig. 1). This recombinant form of GmCYP20-3 protein was then used to confirm the biochemical and cellular function of GmCYP20-3 as an OPDA receptor (data not shown).

B. Isolation of a beneficial bacterium strain (*Paenibacillus polymyxa*) that is capable of enhancing drought tolerance in soybean. To further expand the genetic repertoire in the development of (A) transgenic GM lines and (B) alternative methods, which enhance drought tolerance in soybeans, we have explored stimuli which is capable of upregulating a pattern of gene, responsible for increasing plant drought tolerance without compromising (or concomitantly enhancing) its capacity of disease resistance, growth and yields.

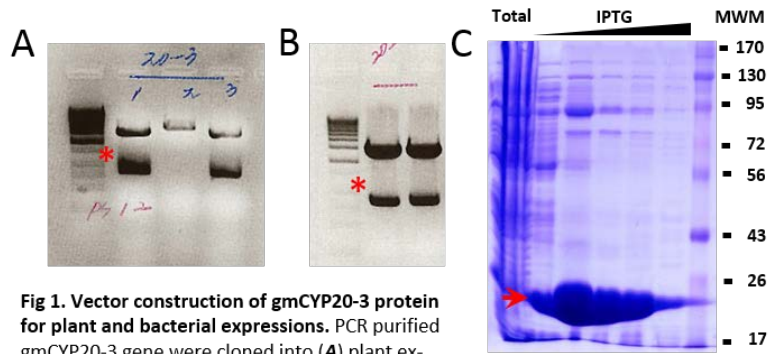


Fig 1. Vector construction of gmCYP20-3 protein for plant and bacterial expressions. PCR purified gmCYP20-3 gene were cloned into (A) plant expression vector (pCambia) and (B) bacterial expression vector (pET28a). The asterisks (*) indicate correct inserts of gmCYP20-3 gene. (C) Expression and purification of *E. coli* expressed recombinant gmCYP20-3 protein, using Ni-affinity chromatography. Column elutes were fractionated by SDS/PAGE (arrow indicate gmCYP20-3).

The first candidates were plant-growth promoting rhizobacteria (PGPR) and their regulatory genes in enhanced drought tolerance. PGPR are a group of beneficial microbes, known to colonize plant roots and enhance plant growth. Recently, a number of reports have revived interests of PGPR in their potential activity of ‘induced systemic tolerance’ to drought stress. Hence, the successful isolation of PGPR, capable of enhancing drought tolerance, can be employed to induce and, therefore, enable us to discern a critical set of regulatory genes that control drought tolerance in soybeans. Upon our yearlong survey and optimization, our tests scrutinized that PGPR is able to enhance drought tolerance in soybeans; the best result was observed with *Paenibacillus polymyxa* CR1 (*PpC1*, Fig. 2) collected from the Agriculture and Agri Food Canada (Dr. Chun, Z. C.). *Ppc1* is a soil borne, gram-positive PGPR strain that also demonstrated the drastic enhancement of drought tolerance and/or resistance in a model plant *Arabidopsis* (Fig. 3).

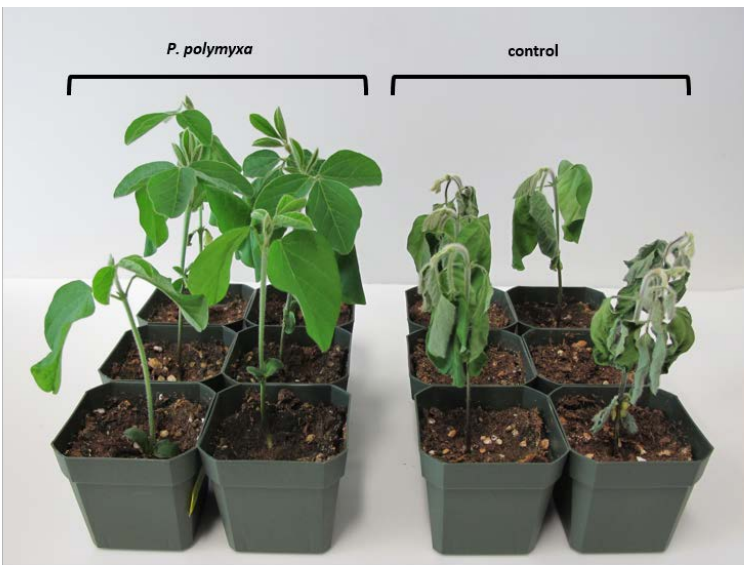


Fig 2. Application of PGPR, *P. polymyxa*, lead to enhanced drought tolerance in soybean. Soybeans were treated with *P. polymyxa* (10^8 colony-forming unit per mL) twice post seed germination (pg; e.i., 1 and 7 d-pg). Each pot was watered (15 mL) every other day 2 wk-pg, and the photograph was taken 3 wk-pg.

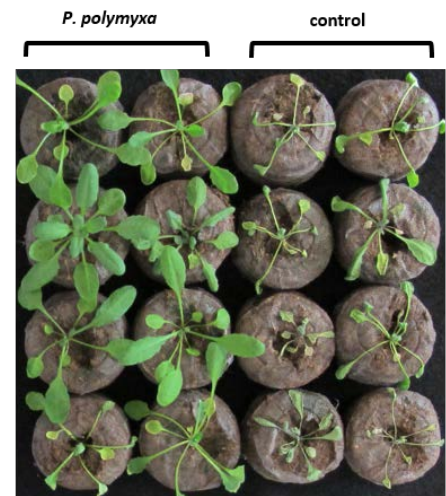


Fig 3. *P. polymyxa* induces enhanced drought tolerance in *Arabidopsis*. *P. polymyxa* (10^8 CFU per mL) was applied twice at 21 and 23 d-pg. Each pellet was watered (12 mL) every other day till 23 d-pg, and the photograph was taken 30 d-pg.

Improvement of Irrigation Management on Alabama Black Belt Soils

T. Knappenberger, B. Ortiz, D. Delaney and A. Dee

Several soybean growers in Alabama's Black Belt Region have installed central pivot irrigation systems in recent years. However, soybean yield response on these heavy textured soils is oftentimes smaller than anticipated. To improve irrigation and soil water management, it is necessary to investigate the yield limiting factors.

On-farm research was carried out on the Dee River Ranch in Aliceville, Alabama. This location was chosen for its unique combination of irrigation and tile drainage. The research field has two irrigation pivots and part of the field is tile-drained (Figure 1) resulting in four treatments: dryland, dryland & tile-drained, irrigated, and irrigated & tile-drained.

Data loggers were installed to measure soil water content (depths of 15, 30, and 60 cm), matric potential (15 cm), and groundwater level on four locations, one for each treatment. The data loggers and the sensors were installed after planting at the beginning of June 2015 and were removed before harvest at the beginning of September 2015.

Yield was measured with a commercial combine yield monitor. Yield from a circular area (30m diameter) was assigned to each data logger location resulting in 69, 77, 93, and 79 measurements for the treatments dryland, dryland & tile-drained, irrigated, and irrigated & tile-drained, respectively. These measurements are used to compute the mean and the standard deviation for each treatment. Yield assessment was based on relative yield of the dryland treatment without irrigation and tile-drainage.

Figure 2 shows rainfall and irrigation data for the study time period. Rainfall occurred frequently every week to every second week. Rainfall was 174 L/m² (6.9 inches) between June 10th and September 4th. In that time period, the research field was irrigated six times with amounts between 19 and 25 L/m² (0.75-1 inches) resulting in an overall irrigation volume of 140 L/m² (5.5 inches).

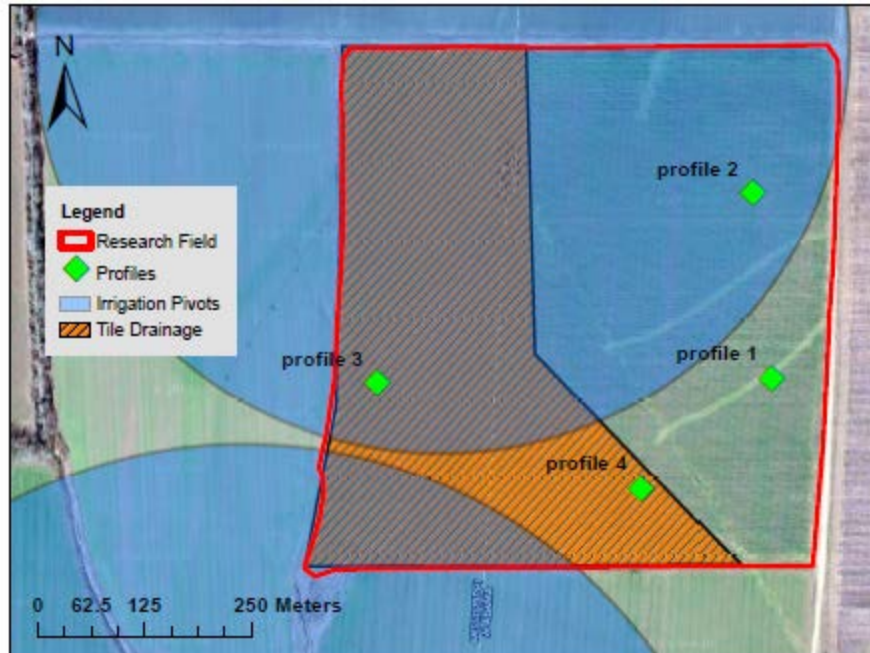


Figure 1: The research field on the Dee River Ranch

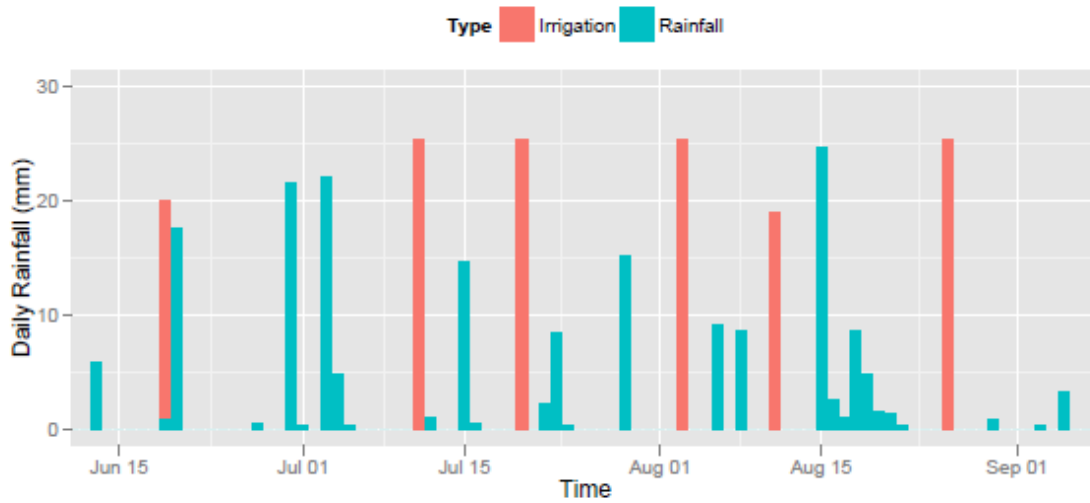


Figure 2: Rainfall and irrigation pattern over the research time period.

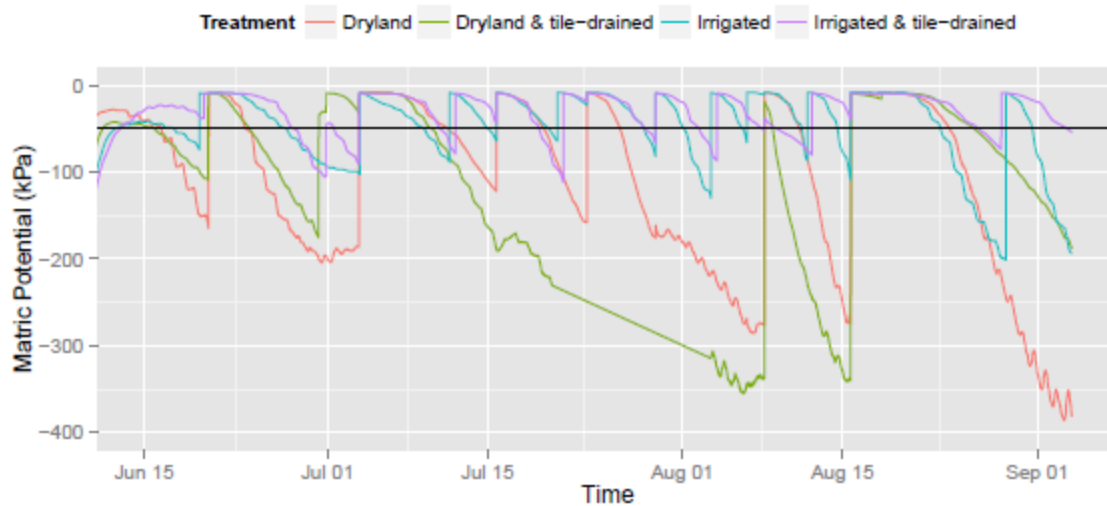


Figure 3: Matric potential at the four treatment locations in a depth of 15 cm (6 inches).

Figure 3 shows the matric potential of the four locations in a depth of 15 cm (6 inches). The black horizontal line is at a matric potential of -50 kPa. Plants are considered to suffer water stress at matric potentials below -50 kPa which is why this value is considered as a irrigation trigger. Irrigated treatments have higher matric potentials with values above -50 kPa for most of the research period (Figure 3). Dryland treatments have lower matric potentials and plants in the dryland may have suffered more water stress than plants under irrigation.

With lower matric potentials in the dryland the volumetric water content was consequently also lower in the dryland in a depth of 15 cm (6 inches). Figure 4 shows the volumetric water content for depths of 15, 30, and 60 cm (6,12, and 24 inches). The water content of dryland and irrigated land differ in depths of 15 and 30 cm (6 and 12 inches) with the most distinct differences in 30 cm depth (12 inches). The water content in 60 cm (24 inches) does not seem to be affected by irrigation as all values are at about the same magnitude.

The groundwater table well depths were 87, 108, 107, and 113 cm for the treatments dryland, dryland & tile-drained, irrigated, and irrigated & tile-drained, respectively (34, 43, 42, and 44 inches). Figure 5 shows the groundwater levels over the research time period. The levels in all four wells approached the corresponding well depth resulting in a horizontal lines in Figure 5. The groundwater is therefore deeper than expected and may have small effects on rooting depth at the end of the growing season. Yield was measured with a commercial combine yield monitor. At reach data logger location the yield of an area with a diameter of 30 cm (100 feet) was allocated to the corresponding data logger location. Figure 6 shows the average yield around the data logger locations. The dryland treatment had the lowest yield (67.4 bu/acre) followed by dryland & tile-drained (76.6), irrigated (80.6), and irrigated & tile-drained (88.6). The yield of each treatment is significantly different.

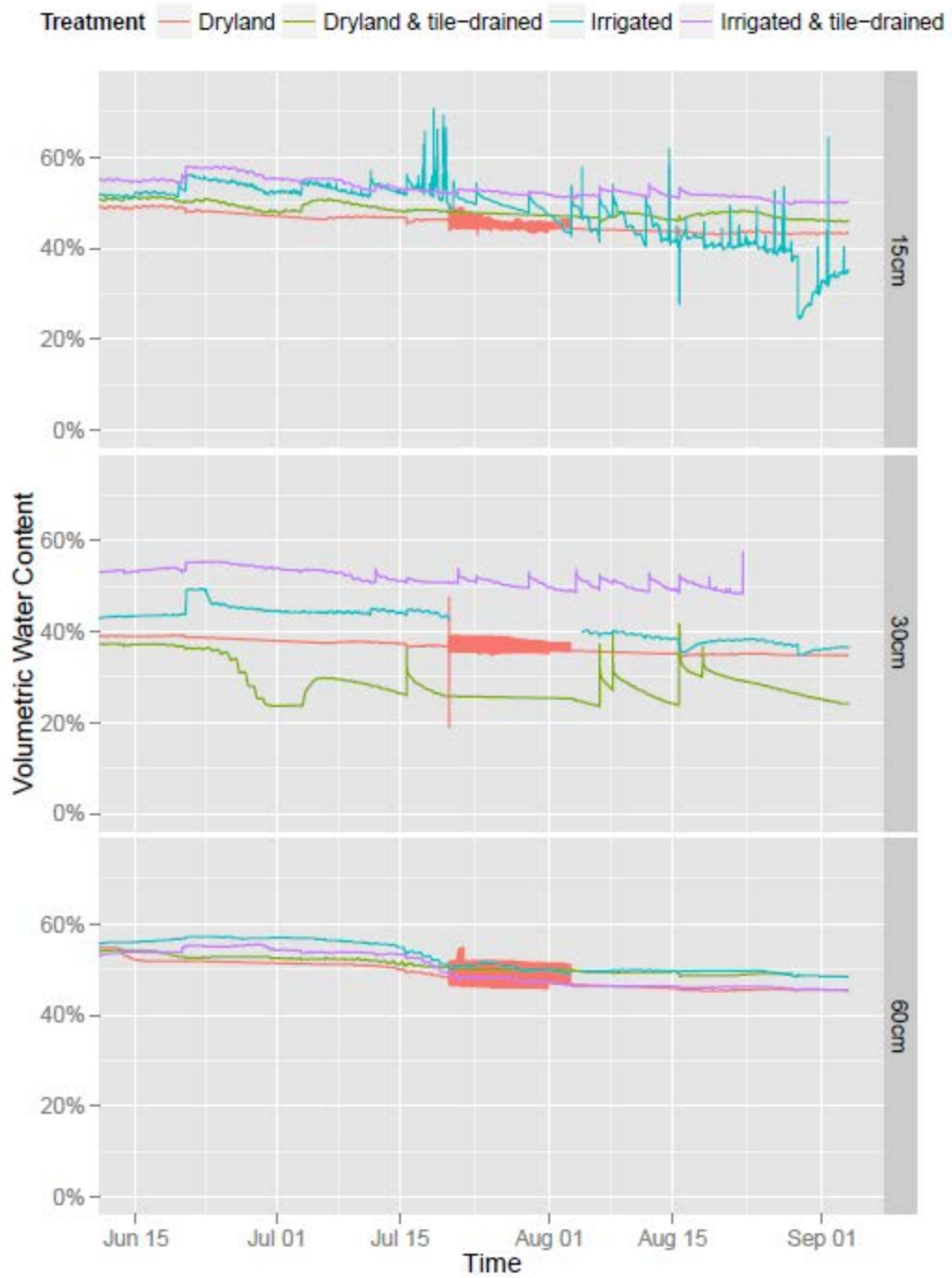


Figure 4: Volumetric water content in depths of 15, 30, and 60 cm (6, 12, and 24 inches).

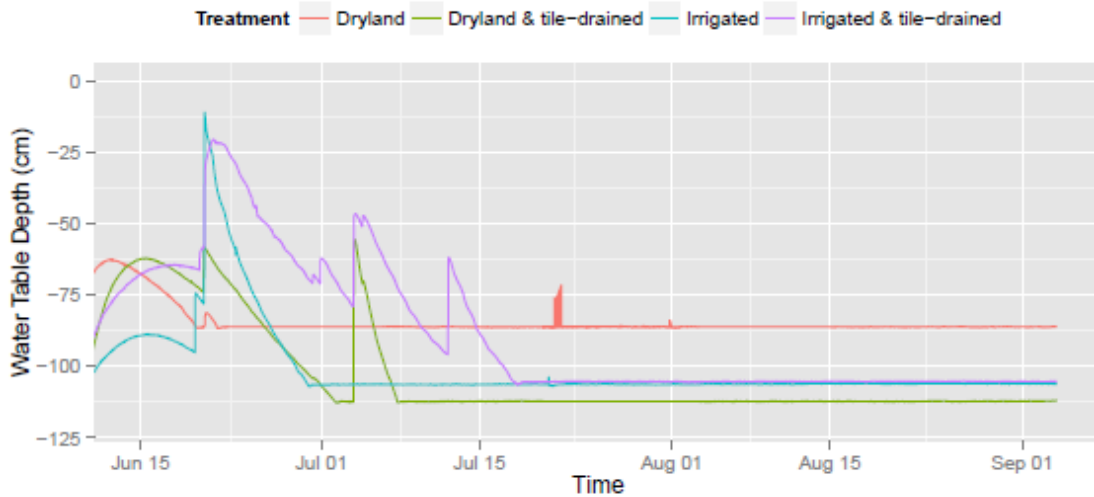


Figure 5: Groundwater levels at reach monitor location. The well depths were 87, 108, 107, and 113 cm for the treatments dryland, dryland & tile-drained, irrigated, and irrigated & tile-drained, respectively (34, 43, 42, and 44 inches). Horizontal lines indicate that the well was dry and the groundwater level was below the bottom of the monitoring well.

The results show that tile-drainage and irrigation both increased the yield. However, only yield around the four monitoring locations (Figure 1) was considered in this assessment. Yield differences can therefore also be caused by soil or plant heterogeneity. A more thorough analysis of yield in the four treatment areas is necessary, for example along a transect.

The research field was irrigated and irrigation showed clear effects on matric potential (Figure 3) and yield (Figure 6). But the year 2015 was not a drought year and the differences between treatments or the effect of irrigation might be even more distinct in dryer years and other crops. This study needs to continue to be able to make stronger conclusions about the effects of irrigation and tile-drainage on Blackbelt soils.

The rooting depth was considered as a yield limiting factor and the water table was expected to be very shallow limiting the rooting depth. However, the data from our monitoring wells (Figure 5) indicate deeper groundwater levels than expected, at least for the later growing season. Other than groundwater rooting depth is also affected by the gas exchange capacity of a soil as roots need oxygen. Heavy and fine textured soils like the Blackbelt soils have low gas exchange capacities. Future studies should therefore also monitor root growth, e.g. with a rhizotron camera, ideally along a transect over the four treatments. Groundwater monitoring wells will have to be placed in a deeper depth to monitor groundwater levels over the whole growing season.

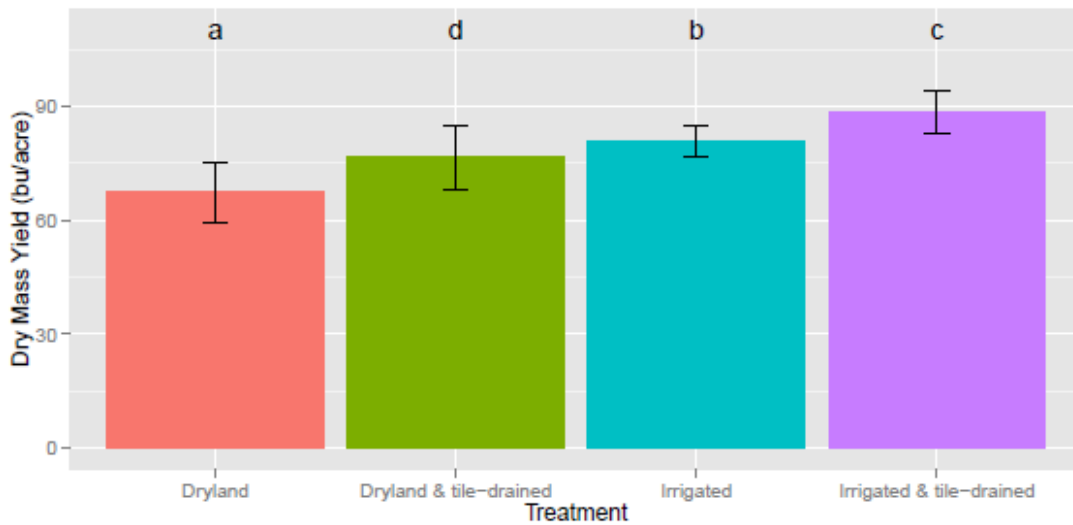


Figure 6: The average yield around the monitoring locations was 67.4, 76.6, 80.6, and 88.6 bu/acre for the treatments dryland, dryland & tile-drained, irrigated, and irrigated & tile-drained, respectively. Error bars represent one standard deviation. All treatments were significantly different from the other treatments at an α -level of 0.01.

Future Research

- Similar experiments should continue on this location because of its unique combination of irrigation and tile-drainage allowing to study effects of both within immediate vicinity.
- Groundwater wells have to be developed to a deeper depth to be able to monitor groundwater levels over the whole growing season.
- Root growth should be monitored with a rhizotron camera along a transect over the four treatments.

II. Fertilizer Management

Symbiotic Nitrogen Fixation in Roundup Ready Soybean

Y. Feng and D. Delaney

Objectives: To determine if glyphosate applications increase uptake of soil-derived nitrogen by Roundup Ready® (RR) soybean.

Results:

In 2015, we continued the field study to evaluate the growth and symbiotic nitrogen (N) fixation capacity of glyphosate-resistant soybean in response to post-emergence glyphosate applications. 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 (Prichard RR) control without glyphosate application. Isogenic conventional soybean (Prichard) was also included as a cultivar control. Seeds were inoculated with Rhizo-Stick peat inoculant containing *Bradyrhizobium japonicum* (2×10^8 cells/g) prior to planting. The first glyphosate treatment was applied 20 days after planting (DAP) and the second treatment 34 DAP. Weeds in the two control treatments were managed by using other herbicides. Entire plants were harvested 46 and 111 DAP, corresponding to V8 and R6 growth stages, for evaluation of plant dry matter, nitrogen content and ^{15}N natural abundance. The sampling times for this year were later than in previous years because young plants are not suitable for ^{15}N natural abundance analysis. Table 1 summarizes the results for selected parameters measured.

At the R6 growth stage (the second harvest), significant treatment differences were observed for shoot N and shoot C/N ratio. Shoot N contents in conventional Prichard and Prichard RR receiving two glyphosate applications were higher than the other two treatments, whereas shoot C/N ratios were lower. The percentage of plant N derived from symbiotic nitrogen fixation (%Ndfa) was calculated using ^{15}N natural abundance data for shoots. Conventional Prichard had the lowest percentage (69%) of N derived from nitrogen fixation compared with Prichard RR. We are still waiting for lab analysis results for the first harvest. Although the conventional cultivar had higher grain yields in the previous two years, no significant differences were found among treatments this year. In addition, there were no significant differences in dry matter contents of shoots, roots and seed pods as well as root N among the treatments. This year's weather conditions were favorable during soybean growing season. Soybean plants may be able to compensate for the stress caused by glyphosate better in good conditions.

Table 1. Effects of glyphosate application on selected parameters measured in the study

Treatment	Shoot N (%)	Shoot C/N	%Ndfa (%)	Grain yield (bu/ac)
Prichard conventional	1.87a	23.6b	69b	53a
Prichard RR check	1.74b	25.4a	85a	59a
PrichardRR Roundup once	1.75b	25.2a	83a	57a
PrichardRR Roundup twice	1.97a	22.4b	80a	52a

III. Weed Management

Rates and Timing of Saflufenacil Herbicide Applications and the Effects on Soybean Variety Yields

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

Background:

In 2013, several farmers reported injury to soybeans following Sharpen (saflufenacil) application. In a 2013 field demonstration conducted at the Tennessee Valley Research and Extension Center, twenty two soybeans varieties were evaluated for tolerance to saflufenacil rates applied directly after planting. Results resulted in the following ratings for soybeans varieties sensitivity to saflufenacil chemistry:

- 7 varieties---- high sensitivity
- 3 varieties---- medium sensitivity
- 4 varieties----- low sensitivity
- 8 varieties-----very low sensitivity

In 2014 and 2015, studies were conducted at the Tennessee Valley and Sand Mountain Research and Extension Centers. The study was conducted on 6 soybean varieties (2 with high sensitivity which were Asgrow 5831 and Progeny 5711, 2 with medium sensitivity which were Cropland 5482 and Progeny 5610 and 2 with low sensitivity to saflufenacil which were Asgrow 5633 and Cropland 5371). Two rates of Sharpen herbicide were applied at rates of 1.0 and 1.5. All treatments were replicated 4 times.

Timing of applications was made at 14, 7 and 0 days prior to planting. Soybean injury ratings were made one, two, and three weeks following planting. Final soybean yields of all plots were measured. Results were similar at locations. The 14 and 7 days prior to planting showed very little injury on all varieties. The 0 days prior to planting for the low and medium sensitivity also showed very little injury at all ratings. The only significant injury was on the high sensitivity soybeans at 0 days prior to planting. Rainfall seems to be the main factor with saflufenacil injury. The more rainfall that is received to the higher sensitive varieties, the more potential for injury. However, yields do not seem to be affected by moderate or low sensitive varieties even if some minor occurs in early season. It is also very important to plant a high yielding variety.

Fertilizer Source Effects on Weed Species Composition, Density, Growth and Yield in Field and Greenhouse Studies

J. T. Ducar, D. B. Watts and A. Price

Field and Subsequent Greenhouse Studies:

Field studies will be conducted at SMREC in Crossville, Alabama in a soybean production system comparing poultry litter vs. commercial fertilizer sources. Weed composition, density and growth stage will be evaluated between flowering and harvest. At harvest, soil samples will be taken from each plot and a 30 day weed emergence test will be conducted under controlled conditions in the greenhouse. Additional soil samples will be taken and soil sterilized. A subsequent greenhouse study will be conducted to determine the presence of weeds in poultry litter and litter effects on weed germination, composition, and growth. This will consist of evaluating three rates of litter with and without the addition of the most prominent weed species observed in the field study and compared to the sterilized soil to determine the effects poultry litter have on weed germination and specifically if litter increases weed competition when weed seeds are present in soil.

Study Location:

Sand Mountain Research and Extension Center in Crossville, Alabama

Cultural Practices:

Wheat (Dyna-Gro Oglethorpe) was drilled on October 27, 2014 for both the corn and soybean plots planted under no-till (NT) and conventional till (CV). Wheat was treated as a cover crop in the corn system and carried to grain for soybean. Cover crop fertilization using either poultry litter or ammonium nitrate occurred on February 25, 2015. Corn (Dekalb DKC 64-69) was planted on April 24, 2014 and harvested on September 9, 2014. Ammonium nitrate was used as the N fertilizer source (applied May 13, 2015) for corn. Soybeans (Asgrow AG5633 MG VI) were planted on June 30, 2015 and harvested on November 20, 2015. Herbicide recommendations for this study were followed according to Alabama Agriculture Experiment Station recommendations.

Crop yield:

Corn yields ranged from 92 to 233 bushel acre⁻¹ with plots receiving poultry litter during winter generally producing higher yields than the commercial fertilizer treatments. Higher yields from the poultry litter plots can be attributed to residual nutrients in soil left over or not taken up by the winter wheat crop (wheat for grain and cover crop). Soybean yields mostly ranged from 28 to 73 bushel acre⁻¹. Similar to corn yields, treatments receiving poultry litter tended to produce higher yields. Plots rotating from corn the previous year also produced higher yields compared to continuous soybean.

Weed measurements:

In years one and year two, Eight soil cores, each with a radius of 2.54 cm, were taken, to a 5.2 cm depth, from each of the 72 plots representing all treatment combinations replicated 4 times. The soil cores were then divided into two depths (0 – 7.6 cm and 7.6-15.2 cm). Following the methods of Cardina and Sparrow (1996), each sample was then placed in a 28 x 28 x 5 cm plastic flat on top of a sand bed in an enclosed greenhouse and watered daily. Temperatures were maintained day/night at 25 and 22°C, respectively. After weed seedling emerged they were identified, counted and then removed from the flats.

Field Assessment of Foliar Potassium Fertilizers for Soybeans

B. Guertal and D. Weaver

The experiment was located at the Field Crops Unit, in Tallassee, AL. There were four replications of each treatment, with an experimental plot consisting of four, 25 foot long rows with 36 inch row spacing. Harvest data was collected by harvesting the entire middle two rows, for a harvested row length of 50 feet. All yields were adjusted to a grain moisture percent of 13%. The soybean cultivar was Progeny 7310RY and was planted on June 12th. Background soil tests indicated soil-test P of 52 lb/A (M), K of 98 lb/A (M) and a soil pH of 6.6.

Treatments were those shown below. Treatments were applied at rates of 2, 4 and 6 pounds K (2.4, 4.8 and 7.2 lb K₂O per acre) in a 10 gallon per acre spray volume on August 27th and September 14th, 2015. These application dates corresponded to growth stages R2 and R5.

Leaf samples were collected at 24 hr after application, but that data is not yet available.

Table 1. Experimental treatments for Field Study, EVS Field Crops Unit, 2015.

Trt	K Source	K Rate lb K acre ⁻¹
1	Potassium sulfate (SOP)	2
2	Potassium sulfate (SOP)	4
3	Potassium sulfate (SOP)	6
4	Potassium thiosulfate (KTS)	2
5	Potassium thiosulfate (KTS)	4
6	Potassium thiosulfate (KTS)	6
7	Potassium nitrate (KNO ₃)	2
8	Potassium nitrate (KNO ₃)	4
9	Potassium nitrate (KNO ₃)	6
10	No potassium	0

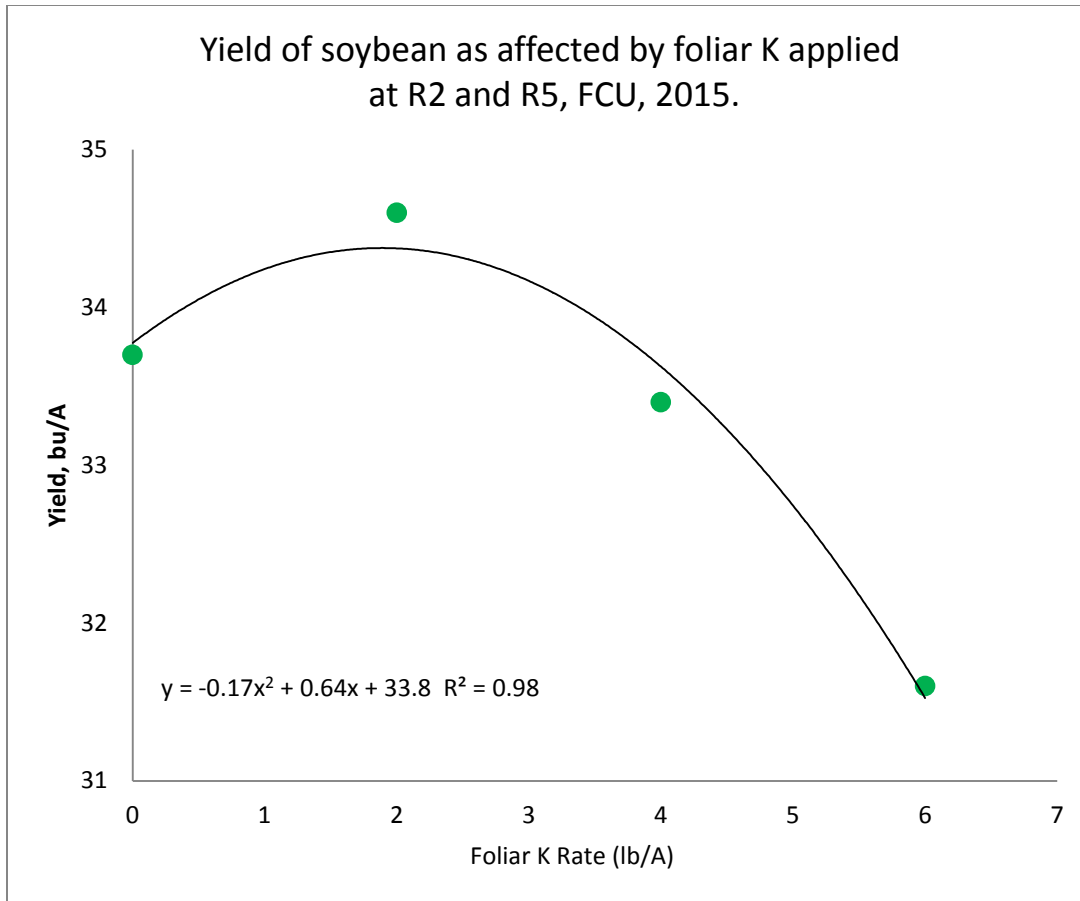
All treatments were balanced to uniformity of N application using urea to provide N equal to that applied in the highest K rate (with the potassium nitrate). Sulfur content was not adjusted. There were 11 treatments in the study (3 K rates x 3 K sources + unfertilized control), with each replicated 4 times.

Yield Results:

There was not a significant K source x K rate interaction and thus main effects are shown.

K Source	Yield (bushels per acre)
Potassium Sulfate	35.0 a
Potassium Nitrate	32.3 a
Potassium Thiosulfate	32.2 a
Control	33.7 a

Means separation are shown at an alpha of 0.05.



Year 1 Conclusions:

- Yield of soybean was unaffected by K source.
- There is slight evidence that foliar application of any K at 2 pounds/A slightly increased yield over than measured in the control plots.
- Application of K at higher rates (4 and 6 lb/A) decreased yield, possibly due to leaf burn (although no notable leaf burn was measured in the field).

Glyphosate Resistant Horseweed Control Provided by Wheat.

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

Justification: Most row crop producers in Alabama have adopted some form of conservation-tillage and are increasingly challenged with controlling glyphosate resistant weeds in their crop rotation. Dicamba is utilized for controlling glyphosate resistant horseweed within wheat and corn and prior to cotton. However, producers have reported control issues using dicamba in 2012 and 2013, described by Joyce Tredaway in a proposal requesting Cotton Committee funding. Previous research has shown fields with winter crops usually contain fewer winter weeds compared systems that contain winter fallow rotations. Thus, wheat fields harvested for grain preceding soybean or utilized as a cover preceding corn or cotton should have fewer horseweed to chemically control in the subsequent crop.

Approach: A field study will be conducted evaluating horseweed control following wheat at the Sand Mountain Research and Extension Centers. The study will evaluate both cultural (wheat crop vs. winter fallow) and chemical (herbicide) weed control options. Each treatment will be replicated 4 times. Horseweed biomass and herbicide efficacy will be evaluated.

Results: Including wheat in a soybean system either as a cover crop or double crop will significantly reduce resistant horseweed population density compared to winter fallow plots (Table 1). At the full season planting time we observed a 73% reduction in horseweed density in the no-herbicide control plots. Including Dicamba in system further decreased horseweed density and complete control was attained in wheat plots that were sprayed with Dicamba and Valor. Yield data is currently being analyzed and will be reported in the future in fact sheets and manuscript.

Table 1. Herbicide and Conservation System Effects on Horseweed Population in Soybeans Planted Full-Season or Double-Cropped with Wheat

Herbicide	Horseweed Population (plants/ha)			
	Full Season Beans ¹		Double-Cropped Beans ²	
	Winter Fallow ³	Wheat (Cover) ⁴	Winter Fallow	Wheat (Stubble) ⁵
Non-treated ⁶	513,322 ^c	73,332 ^c	146,664 ^d	86,665 ^c
A ⁷	86,665 ^a	6,667 ^b	26,666 ^a	6,667 ^b
B ⁸	193,329 ^b	79,998 ^c	913,314 ^c	39,999 ^c
A_B	186,663 ^b	0 ^a	106,664 ^d	0 ^a

¹Soybeans (Asgro 4934) were planted into wheat (grown for a cover crop) or winter fallow plots on 6/12/2015.

²Soybeans (Asgro 4934) were planted into wheat stubble (harvested on 6/18/2015) or winter fallow plots on 6/26/2015.

³Plots were left fallow throughout the winter and spring, no cover crop.

⁴Plots were planted with wheat grown and used primarily as a cover crop.

⁵Plots were planted with wheat grown and harvested as a cash crop.

⁶No herbicide was applied.

⁷Dicamba (3 fl oz/A) was applied Pre-plant.

⁸Valor (3 oz/A) was applied Pre-emergence.

[†]LS-Means with the same letter are not significantly different.

^{**}Proc glimmix was used in SAS for all statistical analysis.

V. Disease Management

Identifying Soybean Rust-Resistant and Susceptible Kudzu Populations to Increase Monitoring Efficiency

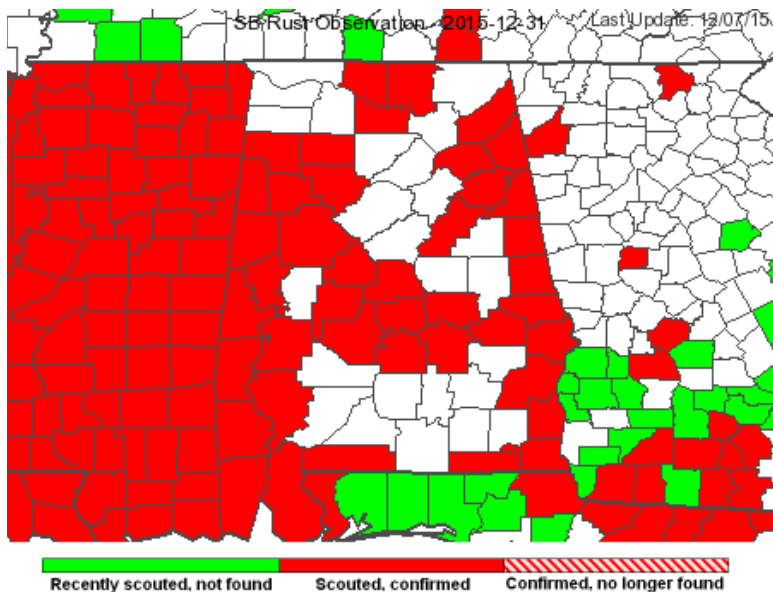
E. Sikora

Soybean rust (SBR) was found in 42 counties in Alabama in 2015, but many of the reports occurred very late in the year. The disease was not a significant problem for growers unless their crop was still in mid reproductive growth stages late into October. Rust has been a significant problem in previous years with yield losses of over 50% reported in commercial fields in both 2012 and 2013.

A relatively cold winter resulted in no green kudzu surviving the winter in Alabama or Florida Panhandle therefore greatly limiting the amount of SBR present in the southeastern United States prior to the 2015 growing season. This situation, coupled with a relatively dry weather conditions in many parts of Alabama from mid-July through October limited SBR development and spread during the year. For this reason we were only able to conduct a moderate number of

Screening trials of kudzu sites for resistance/susceptibility to SBR were delayed because of the lack of SBR spores available for use in our laboratory procedure. Beginning in late October, leaves were collected from 43 kudzu locations in 14 counties in south Alabama. The leaves were sprayed with SBR spores under laboratory conditions; the spores were obtained from SBR-infected soybean plants. Six of the 43 kudzu patches were resistant to SBR in the laboratory.

Figure 1. Map of soybean rust distribution in Alabama in 2015.



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

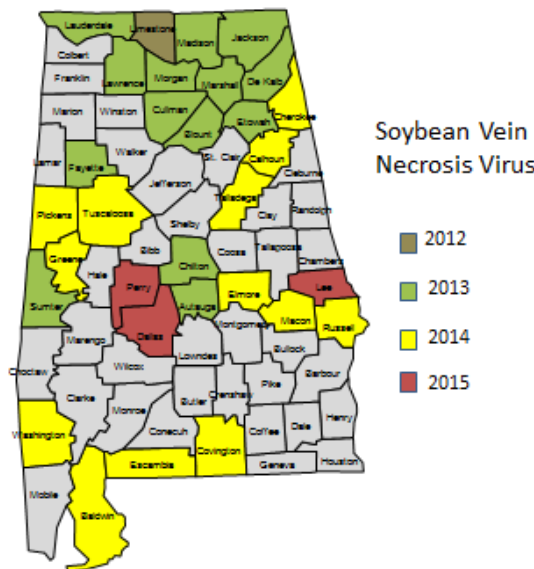
E. Sikora, K. Conner, and L. Zhang

Soybean vein necrosis virus (SVNV) has now been found in 31 of the 67 counties in Alabama based on the results of this study. 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 three year study was initiated to determine the distribution of SVNV in the state.

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%). SVNV was not detected in a handful of fields surveyed in south Alabama (Baldwin and Escambia Counties).

In 2014 SVNV was found in an additional 13 counties with many of these located 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 appeared to be increasing slightly based on our results.

SVNV was found in three additional counties (Dallas, Lee and Perry) in central Alabama in 2015. Incidence within a field was highest in North Alabama where incidence ranged from 22-90% in individual fields. Incidence in the central and southern part of the State was comparatively lower than North Alabama, but increasing in occurrence based on our results. For example, one field in Baldwin County had SVNV incidence of 28%, the highest ever recorded in south Alabama.

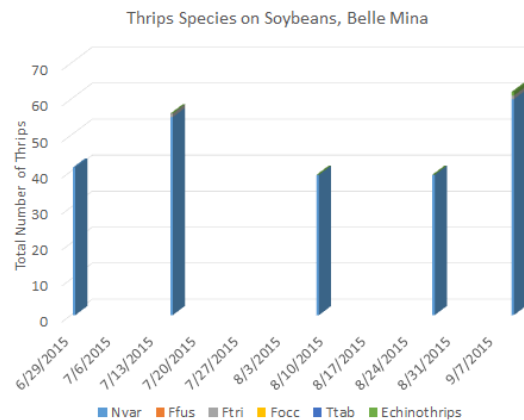
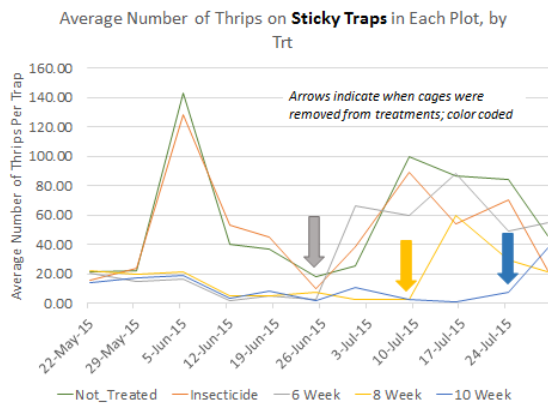


Determining if Soybean Vein Necrosis Virus Causes Yield Loss in Soybeans

E. Sikora, A. Jacobson, K. Conner, J. Kemble, D. Delaney and J. Murphy

Soybean vein necrosis virus (SVNV) has been detected in 31 counties in Alabama since 2012. It is unclear whether SVNV causes significant yield loss in commercial soybean fields. The objective of this study is to determine if SVNV causes yield loss in soybeans. The experiment was conducted at the Tennessee Valley Research Center in Bell Mina. The replicated trial used row covers to prevent thrips feeding and virus transmission from planting through the first 6, 8, or 10 week period of the growing season. Populations of migrating thrips were monitored, SVNV incidence was determined periodically, and yield and seed quality were determined after harvest.

Results: The majority of thrips captured during the test were soybean thrips, a known vector of SVNV. Numbers of thrips were consistent throughout the growing season but with two peaks in the population in mid-July and early September. Row covers did an acceptable job of keeping thrips out of the row cover treatments, but once the covers were removed, the insects quickly migrated to the unprotected plants. Incidence of SVNV was reduced with the row cover protection based on periodic symptom ratings. Yield increased incrementally the longer soybeans were protected with row covers. We are still awaiting seed quality results including protein, oil and fatty acid analysis.



Row cover/soybean vein necrosis virus effect on soybean yield.

TREATMENT	Yield bu/ac
1) Check – uncovered	76.2
2) Insecticide – uncovered	79.4
3) Row cover for 6 weeks	80.4
4) Row cover for 8 weeks	84.8
5) Row cover for 10 weeks	89.5

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

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

The objective of this study is to establish the importance of MG and other weeds found near soybean fields to determine their role in the disease cycle of Soybean vein necrosis virus (SVNV). 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 damaged leaves. Previous studies have reported that morning glory (MG) is a symptomless host of SVNV and can act as a source of inoculum for soybean fields. Since 2012 SVNV has been detected in 31 counties in Alabama. Incidence of the disease within a field is typically highest in North Alabama with some fields approaching 100% infection.

In the first year of this project (2014), leaves were collected from MG populations growing adjacent to soybean fields showing symptoms of SVN. Of the seven populations of MG screened for SVNV, only one tested positive for the virus. This MG population was growing next to a soybean field that had 100% incidence of the disease. Incidence of SVNV in adjacent fields to the six MG populations that tested negative for the virus ranged from 4-50%.

In 2015 leaves were collected from MG populations growing adjacent to soybean fields in nine locations. In each case none of the MG plants tested positive for SVNV. Incidence of SVNV incidence typically ranged from 45-85% in soybean fields adjacent to the nine MG populations. Our inability to detect SVNV in the MG population suggests that MG is a poor host in nature for the virus.

In addition to screening populations of MG, we also tested other weed species growing near fields with a history of high levels of SVN incidence. These weeds were collected in the spring of 2015 prior to planting of soybeans, or in the fall after soybeans had senesced in the field. We suspected these weeds could act as overwintering or “bridge” hosts for the virus and play a role in the disease cycle of SVN. Weeds collected and tested included English plantain, white clover, large yellow vetch, Virginia pepperweed, sheperd’s purse, Maypop passionflower, field pepperweed, wheat, false garlic, wild carrot, Carolina geranium, curly dock, buckhorn plantain, deadnettle, henbit, golden ragwort and hairy bittercrest. Number of weeds collected and tested varied over three sampling dates but typically ranged from 10-20 specimens of each species. All weeds tested negative for the presence of SVNV.

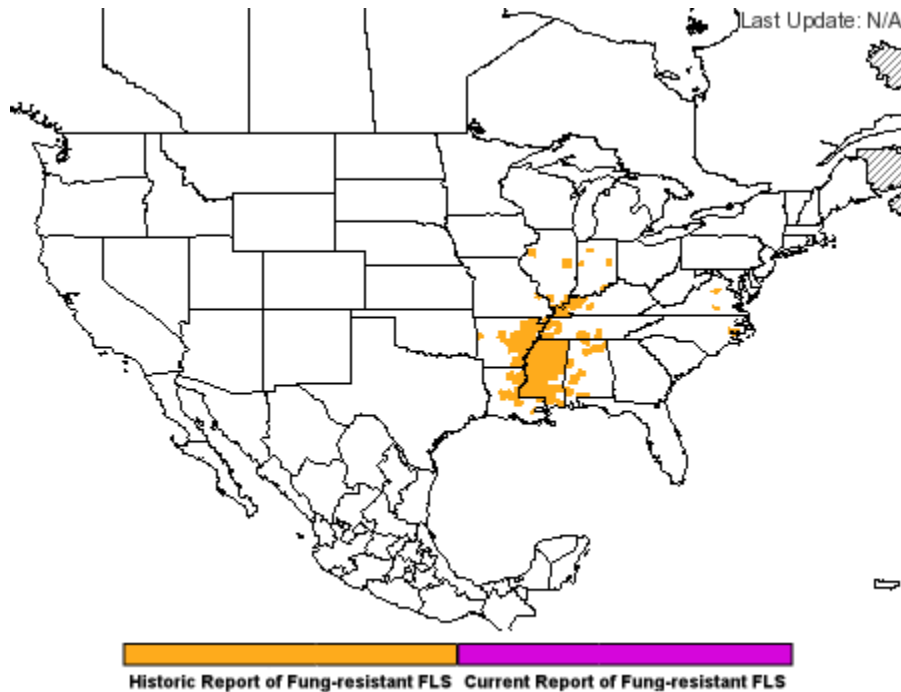
Monitoring for Fungicide-resistant Strains of Frogeye Leaf Spot in Alabama, 2015

E. Sikora

The objective of this study was to survey soybeans fields in Alabama for populations of strobilurin-resistant strains of frogeye leaf spot (FLS) to determine their distribution in the state. FLS was a relatively common problem in Alabama from 2013-2015. Leaves with symptoms of the disease were collected from multiple fields each year and samples were sent to the lab of Dr. Carl Bradley, a Plant Pathologist at the University of Illinois, for FLS-strain identification. Laboratory results showed that strobilurin-resistant strains of FLS were detected in soybean fields in one county (Limestone) in 2012, two additional counties in 2013, and seven counties in 2014. FLS was not a significant problem in 2015 due to the drought-like conditions that developed late in the growing season. Three FLS populations were collected from counties in Alabama in 2015 but none of these populations were found to be resistant to strobilurin fungicides.

In summary, strobilurin-resistant populations of FLS have been detected in 10 of the 67 Alabama counties since 2012. The problem is increasing and growers need to be prepared to adjust their fungicide spray programs accordingly. In addition to the survey we have also developed an extension publication outlining the problem and offers FLS-resistance management recommendations.

Figure 1. Distribution of fungicide-resistant FLS in the United States.



Evaluation of Fungicide Programs with Large-Scale Strip Tests

E. Sikora and D. Delaney

Five 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 October inhibited disease development at all locations. When disease did appear, it typically arrived late in the crops development and had little effect on yield. No foliar diseases were observed at either the Fairhope or Brewton sites and no differences in yield were observed at these locations. Frogeye leaf spot was observed at low levels at the Crossville and Belle Mina location with minor differences in disease severity (analysis of yield data was not available at this time). Soybean rust developed in the trial in Shorter and there were differences among treatments however analysis of yield data was not available at the time of this writing.

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 due to control of soybean rust 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. In years when weather conditions do not favor disease development there is rarely a benefit from a fungicide application.

Trial locations	Plant diseases observed
Bell Mina	Frogeye leaf spot
Brewton	No disease
Crossville	Frogeye leaf spot
Fairhope	No disease
Shorter	Soybean rust

Evaluation of Experimental Compounds for Soybean Seedling Disease Management in North Alabama, 2015

N. Xiang and K.S. Lawrence

Five experimental compounds and fungicides were evaluated for the control of damping off disease caused by *Rhizoctonia solani* on soybean in the field at Tennessee Valley Research and Education Center in Belle Mina, AL. The soil is a Decatur silt loam (24% sand, 28% clay, and 49% silt). Seed treatments were applied to GLXM02 soybeans by Valent BioSciences Corporation. Plots consisted of 2 rows, 25 ft long with a 36 in row spacing and were arranged in a randomized complete block design with five replications. Blocks were separated by a 15 ft wide alley. All plots were maintained throughout the season with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Plant stands and diseased plants were counted, along with vigor ratings at 28 DAP. Soybeans were harvested on 16 Oct at 162 DAP. Data were analyzed in SAS 9.4 by using the Proc Glimmix procedure with $P \leq 0.05$. Monthly average maximum temperatures from planting in May through harvest in October were 82.3, 90.1, 91.6, 88.1, 84.8, and 75.5 °F with average minimum temperatures of 60.1, 69.2, 71.7, 67.6, 63.1, and 51.6 °F, respectively. Respective rainfall accumulation for each month was 4.62, 3.48, 4.18, 2.16, 0.98, and 2.2 in, with a total of 17.62 in over the entire season.

The 2015 growth season was ideal for seedling disease development. The rainfall was adequate in May, June, and July but became limited through the remainder of the season. Temperatures were normal for soybean development. Plant stands were similar among all the treatments and ranged from 27 to 33 plants per 5 ft row at 28 DAP. All the experimental treatments except the inoculated control (Trt 2) significantly increased plant vigor ($P \leq 0.05$). Disease incidence was similar among the treatments. Soybean yields were similar ($P \leq 0.05$) but did vary by 9.9 bu/a across all treatments. Plots treated with the experimental compound combination V-10385 + S-2399 (Trt 7) yielded the highest followed by V-10385 + S-2200 (Trt 4).

No.	Treatment and rate ^z	28 DAP	28 DAP	28 DAP	162 DAP
		Stand ^y / 5 ft row	Vigor ^x	Incidence ^w	Yield bu/a
1	Non-inoculated control	29	8.8 a ^y	1	48.1
2	Inoculated control	29	8.2 b	1	45.1
3	V-10385 3.37 fl oz/cwt	30	9.0 a	1	52.6
4	V-10385 3.37 fl oz/cwt	27	9.0 a	1	53.3
	S-2200 0.4 fl oz/cwt				
5	V-10375 3 fl oz/cwt	28	9.0 a	1	51.7
	Keystone trt sol red 0.4 fl oz/cwt				
6	S-2399 0.2 fl oz/cwt	29	9.0 a	1	46.5
	Keystone trt sol red 0.4 fl oz/cwt				
7	V-10385 3.37 fl oz/cwt	28	9.0 a	1	55.0
	S-2399 0.2 fl oz/cwt				
8	V-10375 3 fl oz/cwt	28	9.0 a	1	52.0
	S-2399 0.2 fl oz/cwt				
	Keystone trt sol red 0.4 fl oz/cwt				
9	S-2399 0.2 fl oz/cwt	33	9.0 a	1	52.3
	S-2200 0.4 fl oz/cwt				
	Keystone trt sol red 0.4 fl oz/cwt				
10	V-10385 3.37 fl oz/cwt	29	9.0 a	1	51.3
	V-10394 technical 2 m-cfu/seed				
	LSD $P=0.05$	7.64	0.25	0	9.97

^zTreatments 1, 2, 6, and 9 included a base treatment of the following fungicides: 0.3 fl oz/cwt of Intego solo and 0.1 fl oz/cwt of Sebring 318 FS.

^yNumber of seedlings in 5 ft of row.

^xVigor rating from 1 to 10 with 10 being the best and 1 the worst.

^wNumber of plants infected by *Rhizoctonia solani* in 25 ft of row.

^vMeans followed by the same letter do not significantly differ according to analysis of variance followed by Tukey's Honest

Significant Difference test with $P \leq 0.05$.

Evaluation of Experimental Compounds for the Control of Soybean SDS in North Alabama, 2015

N.Xiang and K.S. Lawrence

Four experimental compounds and fungicides were evaluated for the control of sudden death syndrome (SDS) on soybean in the field at Tennessee Valley Research and Education Center in Belle Mina, AL. The soil is a Decatur silt loam (24% sand, 28% clay, and 49% silt). Seed treatments were applied to GLXM02 soybeans by Valent BioSciences Corporation. Plots consisted of 2 rows, 25 ft long with a 36 in row spacing and were arranged in a randomized complete block design with five replications. Blocks were separated by a 15 ft wide alley. All plots were maintained throughout the season with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Plant stands were counted at 14 and 28 DAP. Plant vigor was rated at 28 DAP. Soybeans were harvested on 16 Oct at 163 DAP. Data were analyzed in SAS 9.4 using the Proc Glimmix procedure with $P \leq 0.05$. Monthly average maximum temperatures from planting in May through harvest in October were and 82.3, 90.1, 91.6, 88.1, 84.8, and 75.5 °F with average minimum temperatures of 60.1, 69.2, 71.7, 67.6, 63.1, and 51.6 °F, respectively. Respective rainfall accumulation for each month was 4.62, 3.48, 4.18, 2.16, 0.98, and 2.2 in, with a total of 17.62 in over the entire season.

The 2015 growth season was ideal for disease development. The rainfall was adequate in May, June, and July but became limited through the remainder of the season. Temperatures were normal for soybean development. Plant stands among the treatments ranged from 115 to 157 per 25 feet row at 14 DAP and from 104 to 158 per 25 feet row at 28 DAP. The experimental compound combination S-2399 + S-2200 + Keystone trt sol red (Trt 10) significantly ($P \leq 0.05$) increased plant stand compared with the inoculated control (Trt 2), V-10385 (Trt 3), V-10385 + S-2200 (Trt 4), S-2399 + Keystone trt sol red + Nipsit inside insect (Trt 6), and V-10385 + S-2200 (Trt 7) at 14 DAP. Plant vigor was similar among all the treatments at 28 DAP ($P \leq 0.05$). Soybean yields were not significantly different but did vary by 7.9 bu/a across all treatments. The experimental compound combination V-10385 + S-2200 (Trt 8) yielded the highest followed by S-2399 + S-2200 + Keystone trt sol red (Trt 10) and S-2399 + Keystone trt sol red + Nipsit inside insect (Trt 6).

No.	Treatment and rate ^z	14 DAP	28 DAP	28 DAP	162 DAP
		Stand ^y / 25 ft row	Stand ^y / 25 ft row	Vigor ^x	Yield (bu/a)
1	Non-inoculated control	141 abc ^w	117	8.4	53.9
2	Inoculated control	129 bcd	104	9.0	52.2
3	V-10385 3.37 fl oz/cwt	115 d	118	9.4	59.0
4	V-10385 3.37 fl oz/cwt	120 cd	123	8.6	56.0
	S-2200 0.4 fl oz/cwt				
5	V-10375 3 fl oz/cwt	133 abcd	134	8.8	56.5
	Keystone trt sol red 0.4 fl oz/cwt				
6	S-2399 0.2 fl oz/cwt	128 bcd	130	8.4	59.2
	Keystone trt sol red 0.4 fl oz/cwt				
	Nipsit inside insect 1.29 fl zo/cwt				
7	V-10385 3.37 fl oz/cwt	131 bcd	135	9.0	57.5
	S-2399 0.2 fl oz/cwt				
8	V-10385 3.37 fl oz/cwt	145 abc	152	8.6	60.1
	S-2200 0.4 fl oz/cwt				
9	V-10375 3 fl oz/cwt	153 ab	151	9.4	56.2
	S-2399 0.2 fl oz/cwt				
	Keystone trt sol red 0.4 fl oz/cwt				
10	S-2399 0.2 fl oz/cwt	157 a	158	9.0	60.0
	S-2200 0.4 fl oz/cwt				
	Keystone trt sol red 0.4 fl oz/cwt				
	LSD P=.05	25.9	37.4	0.8	7.7
^z Treatments 1, 2, 6, and 9 included a base treatment of the following fungicides: 0.3 fl oz/cwt of Intego solo and 0.1 fl oz/cwt of Sebring 318 FS.					
^y Number of seedlings in 25 ft of row.					
^x Vigor rating from 1 to 10 with 10 being the best and 1 the worst.					
^w Means followed by the same letter do not significantly differ according to analysis of variance followed by Tukey's Honest Significant Difference with $P \leq 0.05$.					

Population Surveillance in Alabama of the Fungus that Causes Soybean Sudden Death Syndrome

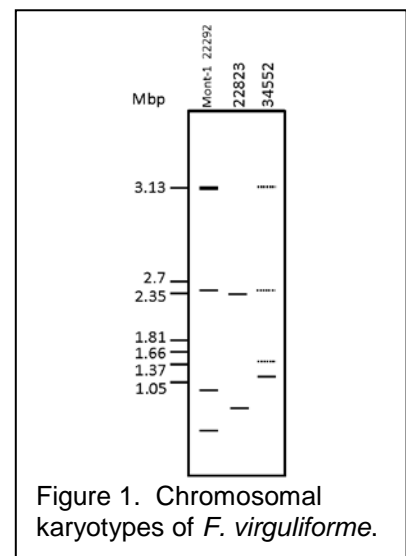
J. Coleman, E. Sikora, and K. Lawrence

OBJECTIVE: The objectives of this project was to 1) survey field isolates that are responsible for causing soybean sudden death syndrome [*Fusarium virguliforme*] in Alabama and 2) begin to investigate the genetic variability of these field isolates.

RESULTS: Identifying and understanding the genetic diversity within the population of *F. virguliforme* isolates in Alabama is important for implementing an effective disease management strategy without inadvertently selecting for more virulent strains of the fungi.

This past season 28 fungal isolates were isolated from soybean plants displaying symptoms typical of sudden death syndrome (SDS) after plating on media selective for *Fusarium* spp. These symptomatic plants were collected from Limestone and Montgomery counties. In addition to *F. virguliforme*, isolates tentatively identified as *F. oxysporum*, *F. equiseti*, and *F. proliferatum* were observed. Further analysis is underway to confirm their identification and ability to cause disease of soybean. Members of all three species have been previously reported to be associated with disease on soybean. Fewer isolates were obtained than expected, which could be due to unfavorable environmental conditions for disease development. Outbreaks of SDS usually occur under cool, wet weather conditions.

Analysis of the sizes of the chromosomes from selected isolates revealed a large degree of variability in both size and number of small chromosomes (Figure 1). While isolates of *F. virguliforme* are postulated to be clonal (all genetically similar), this variation in karyotypes demonstrates there is variability in strains of *F. virguliforme*. However, collection and chromosomal analysis of additional isolates is necessary to accurately assess if there is a specific population(s) of *F. virguliforme* that are most frequently infecting soybean crops in Alabama. Previous studies with closely related fungi have shown that host-specificity is partially due to genes that reside on small chromosomes. Due to conditions to analyze the karyotypes, chromosomes larger than 3 Mbp are not able to be accurately resolved and therefore other differences may be present for chromosomes larger than 3 Mbp.



VI. Insect Management

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

T. Reed

Materials and Methods: This study was conducted at the Brewton Agricultural Research Unit. Plots were planted in May. A total of 32 plots were planted in 4 experimental blocks with 8 plots per block. Plots were 8 rows wide and 30 feet long. Six different spray regimens were utilized to determine the optimum time(s) to treat for kudzu bugs. Insecticide- treated plots were sprayed with 6.4 oz/ac of bifenthrin. There were a total of 6 treatments with 4 or 8 replications per treatment arranged in a RCB design. Treatments were as follows: Trt 1= No Insecticide; Trt 2= Sprayed 6/18; Trt 3= Sprayed 7/1 and 7/14; Trt 4= Sprayed 7/14; Trt 5= Sprayed 6/18, 7/1, and 7/14 ; Trt 6 = Sprayed 7/29. Sweep net samples were taken to quantify kudzu bug and other insect pest numbers on 6/23 , 7/1, 7/07 , 7/15, 7/21, and 8/4. Ten sweep net sweeps were taken in each plot on each sampling date. Plots were harvested 9/24 and yields were converted to 13% moisture.

Results: Kudzu bug counts and Trt yields are presented in Table 1. Kudzu bug numbers peaked in unsprayed plots the first week in July when they averaged about 12 per 10 sweeps. This number was not sufficient to reduce yields as indicated in Table 1 (Page 2). A kudzu bug killed by the Beauveria fungus was observed in the test plots on 7/1. This fungus decimated the kudzu bug population at Brewton in 2014 and kudzu bug numbers were not able to rebound in 2015. During the sampling period which concluded after soybeans reached the R6 stage there were very few caterpillars and stink bugs found in plots.

Table 1. Mean number of kudzu bugs per 10 sweeps for different spray regimens and yields at Brewton, AL in 2015.

Mean Number of kudzu bugs per 10 sweeps

Trt #	Sample Date 6/23	Sample Date 7/1	Sample Date 7/7	Sample Date 7/15	Sample Date 7/21	Sample Date 8/4	Yield Bu/ac
1	2.8	12.5	12.3	4.5	2.8	3.5	39.7
2	0.3	3.5	6.8	6.5	3.5	1.5	38.8
3	1.25	4.8	3.8	0.8	0.3	2.0	36.1
4	1.0	7.8	8.0	0.8	0.5	0.0	38.1
5	0.3	3.3	4.5	0.3	0.5	0.3	35.1
6	1.25	10.0	10.3	5.5	1.5	0.3	37.6
P>F=	0.20	0.04	0.0015	0.0007	0.048	0.049	0.93
LSD 0.1=	-----	5.3	3.1	2.4	1.95	1.97	-----

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

T. Reed and R. Smith

This study was conducted at the Brewton Agricultural Research Unit. The study included 8 insecticide treatments and one unsprayed control treatment. Treatments are shown in Table 1. There were 4 replications of each insecticide treatment and 8 replications for the No Insecticide treatment. Plots were planted May 14, 2015 using Pioneer 67T27R2. Plot size was 6 rows X 25 feet long with a 36 inch row spacing. Plots were sprayed with 2 oz Centric/acre on 7/24 to reduce beneficial arthropod numbers. Insecticide treatments were applied on 8/7/2015 after Amdro was applied in and around test area to reduce fire ant numbers. John Deere Insecticide treatments were applied using John Deere PSL DAQ 1002 nozzles, 30 psi and 20 gpa. Plots were in the late bloom to early pod set stage. The plant height was 36 inches and the canopy was open. Plots were sampled by taking sweep net samples (10 sweeps per plot) at 3, 6, and 11 days after application (DAA). Defoliation levels were visually rated at 3, 6, 11, 20 and 47 DAA.

Results: Looper numbers per 10 sweeps, defoliation levels and yields are presented in Table 1. There was a significant treatment effect with respect to number of large + medium loopers ($P > F = 0.0000$ to 0.0004) and total number of loopers ($P > F = 0.0000$ to 0.0001) for each sampling date. All insecticide treatments gave a significant reduction in the total number of loopers each sampling date. Number of loopers was highest in the untreated plots on 8/13 (6 DAA) and then populations began a natural decline. There was a significant treatment effect with respect to per cent defoliation on each rating date ($P > F = 0.0000$). Per cent defoliation reached 30.5% in untreated plots at 11 DAA. Defoliation levels in all the insecticide treatments except Brigade at 11 DAA were similar and ranged from 6.1 to 7.9%. Defoliation in the Brigade Treatment at 11 DAA was 12.9% and was significantly greater than all the other insecticide treatments. Late season defoliation was due in part to velvetbean caterpillar larvae which averaged 4.6 per 10 sweeps in control plots at 47 DAA. SBL averaged 0.6 per 10 sweeps at 47 DAA. There was a significant treatment effect with respect to yield ($P > F = 0.08$) with untreated plots yielding significantly less than 6 of the insecticide treatments (LSD $0.1 = 3.4$). Yields ranged from 54.9 bu/ac in the Intrepid Egde@5 oz/acre rate to 48 bu/acre in the No Insecticide treatment.

Table 1. # of soybean loopers per 10 sweeps and % defoliation in soybean looper insecticide efficacy study at Brewton, AL in 2015

TRT #	TRT	3DAA SBL/10SW L + M	3DAA SBL/10SW Total	3DAA % Def	6DAA SBL/10SW L + M	6DAA SBL/10SW Total	6DAA % Def	11DAA SBL/10SW L + M	11DAA SBL/10SW Total	11DAA % Def
1	Untreated	3.75 a	15.75 a	16.0 a	3.5 a	22.8 a	19.5 a	4.3 a	10.5 a	30.5 B
2	Intrepid Edge 4 oz	0.0 d	1.25 de	7.8 b	0.0 c	0.5 d	5 d	0.5 c	2.3 bc	7.9 D
3	Intrepid Edge 5 oz	0.0 d	0.75 e	6.5 b	0.0 c	0.5 d	5 d	0.5 c	0.8 c	7.0 D
4	Prevathon 14 oz	1.0 cd	6.5 bc	7.3 b	0.3 c	3.5 cd	5.8 cd	0.5 c	1.5 c	5.8 D
5	Belt 2 oz	1.0 cd	4.25 c	7.0 b	0.5 b	2.3 cd	6.3 cd	0.8 c	2.0 c	7.0 D
6	Belt 2.5 oz	1.25 cd	3.75 cd	6.5 b	0.8 c	2.0 cd	5.8 cd	0.3 c	1.8 c	7.0 D
7	Belt 3 oz	2.0 bc	6.50 bc	7.8 b	0.0 c	0.8 cd	6.3 cd	0.3 c	0.8 c	6.6 D
8	Besiege 7 oz	0.75 cd	5.50 bc	7.3 b	1.8 b	5.8 bc	7.5 c	0.5 c	1.8 c	6.1 D
9	Brigade 6.4 oz	3.25 ab	8.0 b	7.0 b	1.8 b	9.5 b	10.0 b	2.3 b	4.8 b	12.9 C
	P>F	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000

Table 1 Continued

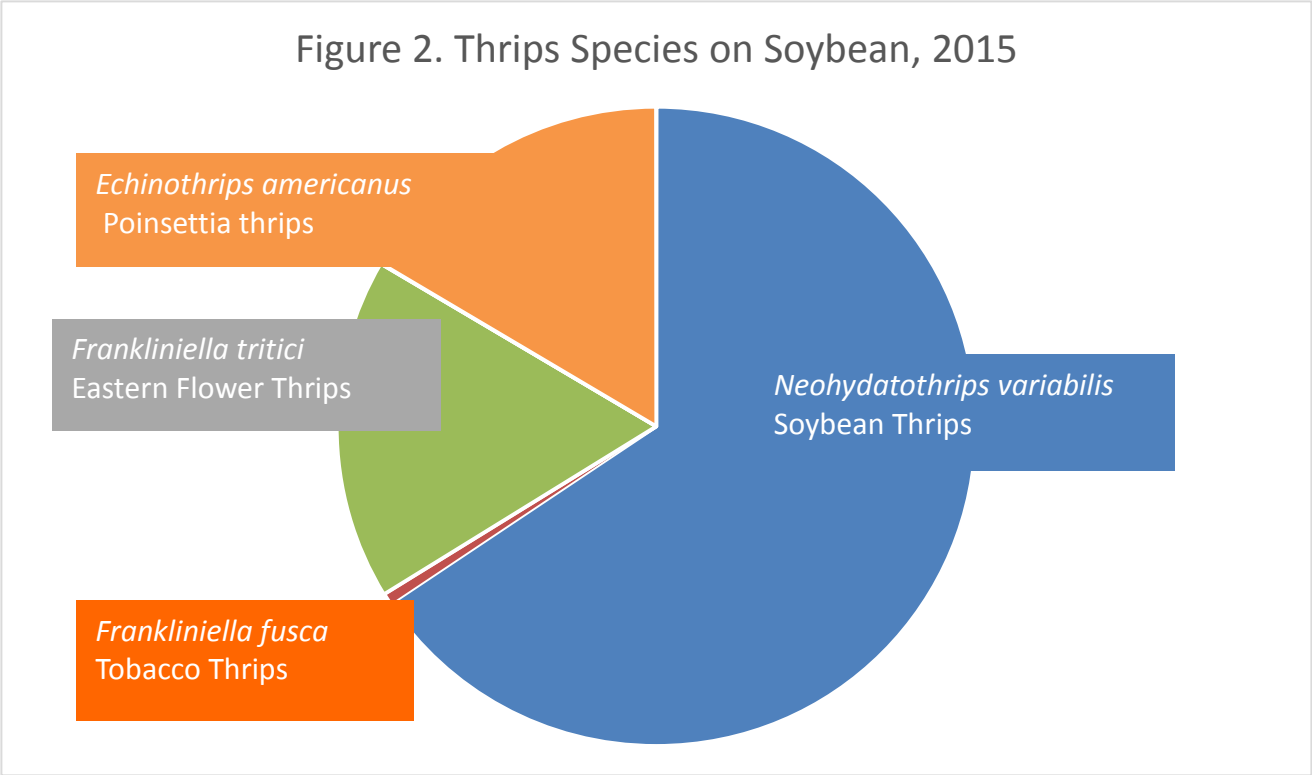
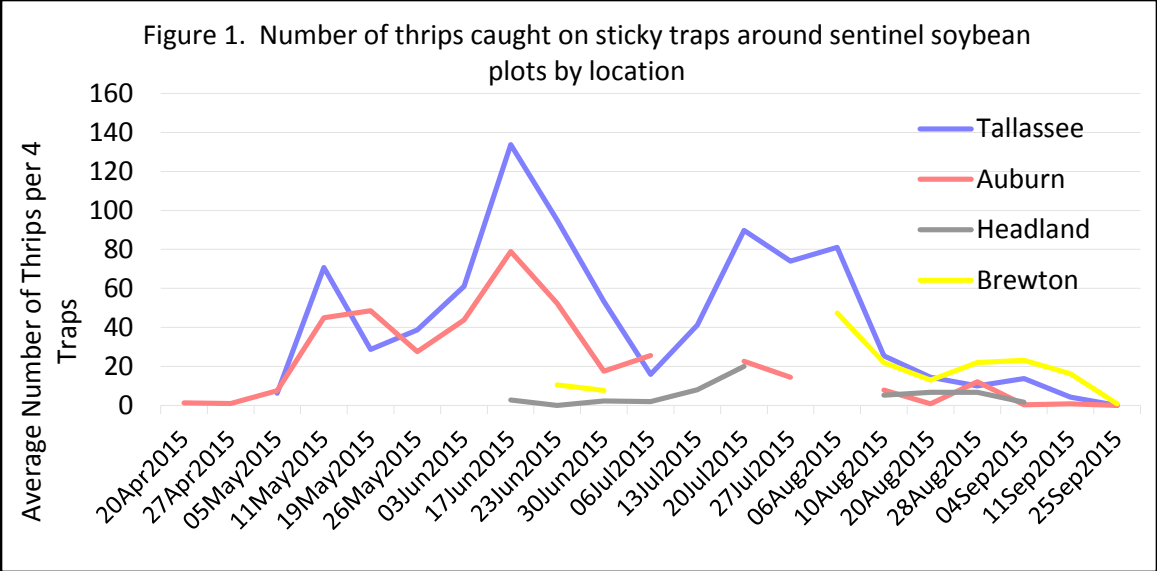
TRT #	Treatment	20DAA % Def	47DAA % Def	Yield Bu/ac 13 % Moist						
1	Untreated	36.5 a	34.8 a	50.0 c						
2	Intrepid Edge 4.0 oz	3.8 bc	6.8 bcd	51.8 ab						
3	Intrepid Edge 5.0	5.8 bc	3.3 d	54.9 a						
4	Prevathon 14 oz	4.0 bc	4.5 cd	52.1 ab						
5	Belt 2 oz	5.0 bc	5.5 cd	53.7 ab						
6	Belt 2.5 oz	3.5 c	5.3 cd	52.8 ab						
7	Belt 3 oz	4.8 bc	5.5 cd	52.8 ab						
8	Beseige 7 oz	3.5 c	7.3 bc	52.3 ab						
9	Brigade 6.4 oz	7.5 b	10.0 b	50.bc						
	P>F =	0.0000	0.0000	0.8						
	LSD. 0.1 =	3.94	3.74	3.4						

Monitoring Thrips Vectors of Soybean Vein Necrosis Virus in Alabama

A. Jacobson, E. Sikora, K. Conner

In order to better understand the incidence of the newly described tospovirus, Soybean vein necrosis virus (SVNV), more information is needed about the abundance of the thrips species known to transmit SVNV. This study was initiated to examine thrips dispersal around soybean fields, and identify the species present in fields throughout the growing season that may spread the virus to and within the crop. In 2015, thrips in Alabama soybean fields were monitored by establishing a weekly trapping program to determine the seasonal dispersal of thrips in Tallassee, Auburn, Brewton, and Headland. Thrips colonizing soybean plants were also identified from Tallassee, Auburn and Headland by collecting leaves, flowers and pods from the same fields, extracting the thrips present from plant tissue, and identifying them to species

Figure 1 shows the number of flying thrips that were caught on sticky traps placed along the outside of each edge of the soybean fields at four locations. Missing lines represent missing data if the traps were destroyed. Three peaks occurred during the season that represents high levels of thrips movement through the landscape, usually due to generation turnover, i.e. immature thrips become adults and disperse to new hosts. However, thrips were found throughout the entire growing season. To determine what species of thrips colonized the soybean fields, insects were collected from plants in these fields. Figure 2 shows the species that were collected from soybean at all locations. In this study 65% of the thrips species collected were *Neohydatothrips variabilis* (soybean thrips), 17% were *Frankliniella tritici* (eastern flower thrips), 17% were *Echinothrips americanus* (pointsettia thrips), and less than 1% were *Frankliniella fusca* (tobacco thrips). Soybean thrips is currently the only reported vector of SVNV, was the most abundant in these fields, and was collected during the entire growing season. Tobacco thrips have been shown to transmit other tospoviruses, however, there is no report of it transmitting SVNV, and it comprised a very small proportion of the thrips collected from soybean in AL. The other two thrips are known to be common in Southeastern landscapes, but have not been reported to transmit any tospovirus. This data suggests that SVNV could be spread into soybean fields throughout the entire growing season by soybean thrips. It also suggests that soybeans are at a higher risk of SVNV infection during certain periods of the growing season due to the peaks in thrips movement through the field.

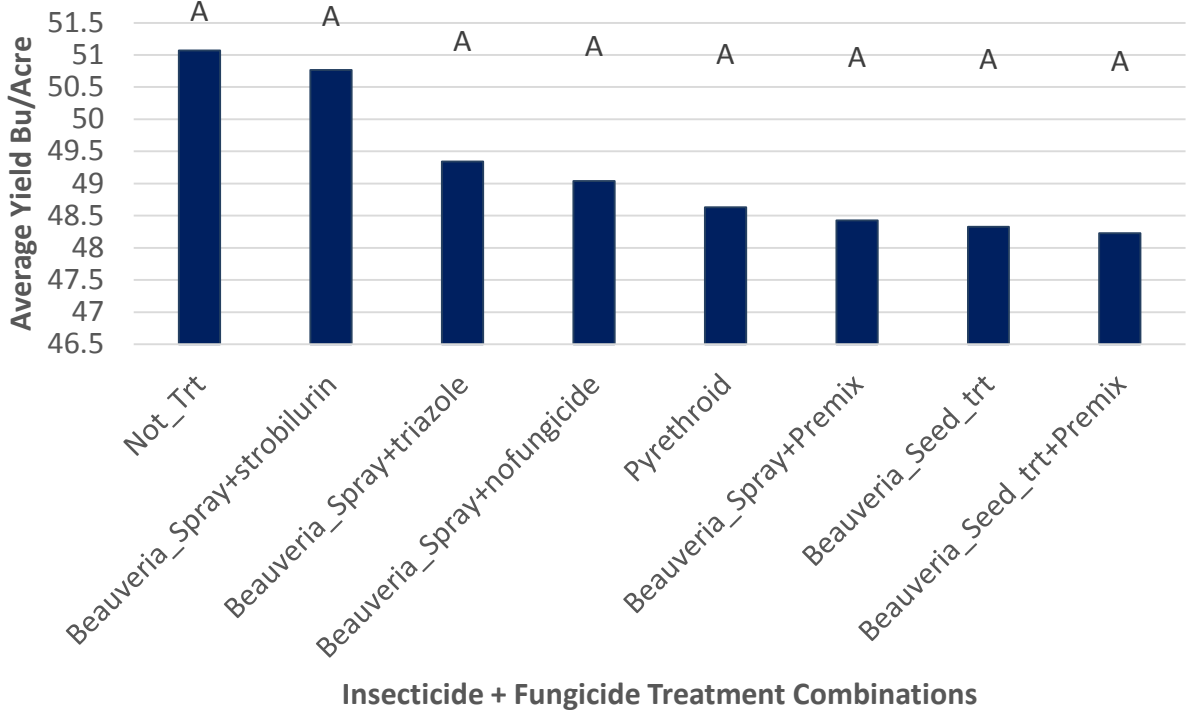


***Beauveria bassiana* as a Control Agent for Kudzu Bug in Soybeans**

A. Jacobson, K. Conner, E. Sikora, D. Delaney, M. Delaney, C. Ray

This study was conducted to examine the effectiveness of *Beauveria bassiana* for kudzu bug management. Three objectives were evaluated in this study: 1) the effectiveness of foliar applied *Beauveria bassiana* as a control agent for kudzu bug in soybean; 2) the impact of commonly used fungicides on the effectiveness of *Beauveria bassiana*; and 3) whether or not the *Beauveria bassiana* Alabama isolate is unique and specific only to the kudzu bug was assessed. For the first 2 objectives, small-plot field trials were conducted at four locations in the state, however data was only collected from the Prattville site because kudzu bugs did not infest the other three locations. Treatments included: 1) a powder formulation applied at-planting to seed; 2) foliar applied *Beauveria bassiana*; 3) a foliar applied pyrethroid insecticide; and 4) untreated controls. Fungicides evaluated were either a triazole, strobilurin, or a premix. Treatments are as follows: 1) Not-treated; 2) *Beauveria* seed treatment, no fungicide; 3) *Beauveria* seed treatment + premix fungicide; 4) *Beauveria* spray + premix fungicide; 5) *Beauveria* spray + triazole fungicide; 6) *Beauveria* spray + strobilurin fungicide; 7) *Beauveria* spray no fungicide; and 8) Pyrethroid treated plots. *Beauveria* seed treatments were applied at-plant, sprays were applied July 8, and July 17, and fungicides were applied August 3. For objective 3, bioassays were conducted in the laboratory to determine whether or not the strain of *Beauveria* that infects kudzu bugs is specific to kudzu bugs only. The number of kudzu bugs was recorded before treatment with insecticide and *Beauveria*, and the total number of kudzu bugs and number of bugs infected with *Beauveria* was recorded in late-August. Plots were harvested and yield compared among plots. Three separate bioassays were conducted using kudzu bugs and green stink bugs, a close relative of the kudzu bug. Insects were exposed either to distilled water (control), an in house grown culture of *Beauveria bassiana*, or Botaniguard (a commercial product containing *B. bassiana*). In the kudzu bug bioassays the control insects had a latent infection of *B. bassiana*. Multiple fields in several counties throughout the state were examined in order to obtain uninfected insects, however, all insects examined were positive for the fungus. In the green stink bug bioassays, approximately 30% of the insects were infested with a parasitic fly, including the controls. No statistically significant results were obtained from any of the bioassays. Results for objectives 1 and 2: Before insecticide application there were an average of 19 kudzu bugs per 3 row feet. Late-August, there were significantly more kudzu bugs in the control plot and plots treated with *Beauveria* (16-31 adults and 33-80 immature kudzu bugs per 3' row, not statistically different) compared to the pyrethroid-treated plots (average of 6 adults and no immatures per 3' row, statistically lower than other treatments). There were no statistical differences in the average number of adults or immatures that were infected with *Beauveria* among any of the treatments; 35-55% of adults were dead due to infection, and 35-80% of immatures were dead because of infection. There were no statistical differences among any of the treatments which suggests that none of the fungicides affected the efficacy of *Beauveria*. Another interesting finding was that even though there was a higher number of kudzu bugs in the *Beauveria* plots compared to the pyrethroid treated plots, there were not statistically significant yield differences among treatments, and yield was numerically higher in the *Beauveria* treated plots (Figure 1).

**Figure 1. 2015 Yields from small plot kudzu bug trials -
Prattville, AL**



VII. Nematode Management

Nematicide and Fungicide Efficacy and Yield Comparison for Management of Root-Knot Nematode on Soybean Alabama, 2015

D.J. Dodge and K.S.Lawrence

Bayer CropScience soybean variety CZ 6060 RY was treated with 3 different Bayer fungicide and nematicide packages and one Syngenta fungicide and nematicide package and compared for nematicidal activity and yield in field trials. The trial was planted at the Plant Breeding Unit (PBU) research station near Tallassee, Alabama. The Kalmia loamy sand soil at PBU is 80% sand, 10% silt and 10% clay. The trial was designed as a randomized complete block with five replications. Four row plots were 7.62 m long with 1 m row spacing. Plots were treated with herbicides and fertilizers in appropriate amounts recommended by the Alabama Cooperative Extension System. Irrigation was provided by a pivot irrigation system. Plant stands were evaluated at 22 days after planting (DAP). Four plants per plot were removed from soil 44 DAP and data were recorded for plant height, shoot weight and root weight from these samples. Root-knot nematode eggs were extracted from roots by agitation in a 6% NaOCl solution for 4 min, collected on a 500 mesh sieve and enumerated. Plots were machine harvested on 20 Oct. Mean values of data were analyzed for significant differences by pairwise Tukey's ($\alpha \leq .05$) in SAS 9.3 (SAS Institute). Average minimum temperatures per month (May-Oct) were 14.7, 19.7, 21, 20, 17.4 and 11.4° C; average maximum temperatures per month (May-Oct) were 29, 32, 33.2, 32.5, 29.5 and 25.6°C. Monthly rainfall values for May through Oct were 7.55, 3.66, 4.64, 3.23, 1.4 and 1.24 cm; totaling 21.72 cm.

Field conditions prior to planting include: moderate initial populations of root-knot nematode and a wet spring which delayed planting. Soybean stand counts at 22 DAP were similar between all treatments. The total number of root-knot nematode eggs was similar across all treatments. Syngenta treated soybeans (treatment 4) and seed treated with Bayer's Fluopyram (treatment 3) had the lowest eggs per gram of root. Bayer seed treatments 1 and 3 significantly increased yield compared to untreated soybeans; yield of treatments 1 and 3 were 24% and 21% greater than the untreated control. Overall, soybean seed treated with Poncho Votivo and Fluopyram is recommended for reduction of root-knot nematodes and increase in yield.

Table 1: The Effect of Nematicide/Fungicides on Plant Stand, Nematode Eggs and Yield

	Treatment	Dose/Unit	Stand 22 DAP	44 DAP		Yield kg/ha
				Total RKN	Eggs/gram ^z	
1	EVERGOL ENERGY	.019(mg ai/ seed)				
	ALLEGIANCE FL	.02 (mg ai/ seed)				
	GUACHO 600 FS.....	.13 (mg ai/ seed)	123 ^y a	9725 a	473 a	4128 a
2	EVERGOL ENERGY	.019 (mg ai/ seed)				
	ALLEGIANCE FL	.02 (mg ai/ seed)				
	PONCHO/VOTIVO.....	.13 (mg ai/ seed)	133 a	7818 a	289 ab	3608 ab
3	FLUOPYRAM 600 FS	.15 (mg ai/ seed)				
	EVERGOL ENERGY	.019 (mg ai/ seed)				
	ALLEGIANCE FL	.02 (mg ai/ seed)				
	PONCHO VOTIVO.....	.13 (mg ai/ seed)	134 a	5204 a	252 ab	4013 a
4	MAXIM	2.5 (g ai/100 kg)				
	APRON XL LS	3.75(g ai/100 kg)				
	CRUISER 5FS	50 (g ai/100 kg)				
	CLARIVA PN	130 (mL/100 kg)				
	VIBRANCE 500 FS	.0038(mg ai/ seed)				
	MERTECT 340F.....	14.19 (g ai/ 100 kg)	120 a	5312 a	213 b	3718 ab
5	UNTREATED	N/A	124 a	8215 a	438 ab	3331 b

^zEggs per gram root is found by dividing total the egg count by weight of root system.

^yColumns with the same letter have no significant differences at an alpha level of $\alpha \leq .05$ from pairwise Tukey's.

Soybean Variety Yield Comparison With and Without Velum Total for Management of Root-Knot Nematode Alabama, 2015

D.J. Dodge and K.S. Lawrence

Ten soybean varieties were evaluated for Root-knot nematode tolerance and yield in the presence and absence of Velum Total nematicide. The trial was planted at the Plant Breeding Unit research station near Tallassee Alabama. The soil in this location is Kalmia loamy sand (80% sand, 10% silt, 10% clay). Soybean seed were treated with Velum Total (1.6 oz/cwt Gaucho and 5.12 oz/cwt Fluopyram). Plots consisted of 2 rows, 25 ft long with 36 in. row spacing and were arranged in a randomized complete block design with five replications. Herbicides, insecticides, and fertilizers were applied based on Alabama Cooperative Extension System standard recommendations. Plots were irrigated as needed with pivot irrigation. Plant stands were recorded 14 days after planting (DAP). Samples of four plants per plot were taken 32 DAP. Plant height, shoot weight and root weight were recorded from these samples. Nematodes were extracted from roots by 4 min agitation in a 6% NaOCl solution and captured on a 500 mesh sieve for enumeration. The trial was machine harvested on 23 Oct. Data were analyzed with SAS 9.3 (SAS Institute); mean values were compared statistically using pairwise Tukey's ($\alpha \leq .05$). Monthly average maximum temperatures from planting in May through harvest in October were 84.1, 89.4, 91.8, 90.5, 85.2 and 78°F with average minimum temperatures of 58.4, 67.5, 69.9, 68.2, 63.3 and 52.5°F, respectively. Rainfall accumulation for each month was 2.97, 1.44, 1.83, 1.27, 0.55 and 0.5 with a total of 8.55 inches over the entire season.

Root-knot nematode pressure in the field was moderate; heavy rainfall in the spring delayed planting. UniSouth Genetics (75B75R) had significantly greater plant stand than all untreated varieties except Asgrow (5935) and DynaGro (56RY84) varieties; stand counts of Velum Total treated varieties were not significantly different. Analysis of eggs per gram of root indicated significant differences between treatments; varieties treated with Velum Total decreased eggs per gram of root by an average of 24%. Varieties treated with Velum Total increased yield by 2% on average. When treated with Velum Total, UniSouth Genetics varieties increased yield by 33% (75T40) and 40% (75B75R). The untreated Progeny variety 5555RY produced the greatest yield of all treated and untreated varieties.

Table 1: The Effect of Velum Total on Nematode Eggs per Gram Root and Yield of Soybean Varieties				
Variety	<i>Meloidogyne incognita</i> eggs per gram root ^z 32 DAP		Soybean Bushels/Acre	
	Untreated	Velum Total	Untreated	Velum Total
Progeny 5333 RY	86.2 ^y b	81.3 ab	64.1 a	59.4 a
Progeny 5555 RY	23.3 b	65.8 ab	66.1 a	45.6 a
Progeny 5610 RY	52.9 b	69.0 ab	50.8 abc	53.4 a
DynaGro S 56RY84	65.1 b	50.0 ab	62.0 abc	62.0 a
AGS 568RR	87.0 b	30.0 b	53.1 abc	59.6 a
Asgrow 5935	61.3 b	72.9 ab	58.8 abc	58.9 a
Schillenger 5220RC	123.2 ab	60.9 ab	62.4 ab	54.4 a
UniSouth Genetics USG 75T40	241.3 a	107.3 ab	45.8 c	60.8 a
UniSouth Genetics USG 75B75R	37.7 b	47.8 b	46.8 bc	65.3 a
Univ of Arkansas UA 5414RR	58.1 b	44.0 b	57.1 abc	59.9 a

^zEggs per gram root calculated using nematode eggs divided by weight of root system.

^yNo significant differences between columns with the same letter at $\alpha \leq .05$ from Tukey's.

VIII. Extras

Alabama Crop Production Mobile App Upgrade

B. Dillard and M. Runge



Original Features:

Original features on the Alabama Crops app include sections for: Crop Production News, Profit Profiles, Contact a Crop Specialist, Calendar, Submit a Photo/Question, and AlabamaCrops.com link. To date, the app has been downloaded over 400 times and has been advertised at many grower events throughout the state.

Recently Added:

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

Things to come:

We are working with the app developer to give the Agronomics Team the ability to set up push notifications at planned intervals for upcoming events to make farmers aware of meetings and remind them as meeting time approaches without actively having to check the Alabama Crops App calendar. IPM section that will allow farmers to access IPM guides with drop down menus. With drop down menus, growers could select the crop, then either disease, weed control, or insect control. This would bring up the ipm guide and section for that particular crop/issue. For example, a grower wanting herbicide options for soybean production could easily access the ipm section for chemical weed control in soybean.

100 Bushel Yield Challenge

M. Hall and D. Delaney

9 Entries
No Winner

Observations:

- Great-looking beans = 70-80 bu/ac.
- Unbelievable, eye-popping beans = 90 bu/ac.
- Patterning contest after corn yield contest was a mistake.
- Soybeans won't wait on a re-check.

There were no ASP monies spent since there wasn't a winner.

Restoration of Antique Frick Thresher

C. Mitchell, D. Delaney and K. Balkcom

Around 2000, the McLemore family of Montgomery, AL, donated an antique, stationary Frick Threshing machine (circa 1920s) and a circa 1946 cotton picker to the College of Agriculture and Ala. Agric. Exp. Station. Both were in very good condition and both had been stored out of the weather. They were stored under a shed at E.V. Smith Research Center until the fall of 2014. Randy and Mark Bodine of Bodine Farms in Auburn were chosen to restore the picker. Neither the College of Agriculture nor the AAES has resources to restore such equipment.

The fully restored picker was featured at Ag. Roundup on October 3, 2015, on the A.U. Campus. More than 2,000 visitors had a chance to see the picker along with a poster (next page) explaining its history and use. Unfortunately, Auburn University has no permanent place to store or display this piece of Alabama agricultural history. Ag. Heritage Park is the desired place to display it but no suitable, covered pavilion exists at the present time. It is temporarily stored at the Seed Technology Laboratory on the A.U. campus.



McLemore Frick® Stationary Thresher

(circa 1920s)



The Frick Thresher was stored under a shed at E.V. Smith Research Center before restoration in 2015.

A circa 1920 Frick Thresher powered by a Frick steam tractor is demonstrated at the Frick Company in 2003. <http://www.frickherman.org/club/projects/frame12source1.htm>

The Frick Company was established in Waynesboro, Pennsylvania, in 1852, and made steam engines and farm equipment. The Frick Thresher was popular in the late 19th and early 20th Centuries when grain harvest was a very labor-intensive operation. This thresher was manufactured in the 1920s and purchased by the McLemore family of Montgomery, Alabama. By the 1940s, commercial combines (so named because they “combined” the grain harvest plus threshing) made stationary threshers obsolete. This thresher was stored in an enclosed barn just off of the Atlanta highway in Montgomery until 2000.

This machine was donated to the College of Agriculture and Ala. Agric. Experiment Station by Tom and Charles McLemore, grandsons of the original owner, in 2000. It was restored by Randy Bodine of Auburn in 2015 and will be on permanent display at Ag. Heritage Park along with the first commercial mechanical cotton picker used in Alabama, also donated by the McLemore family. The cotton picker is still being restored.

****Funds for restoration provided by the Alabama Wheat and Feed Grains Committee., 2014.****

Unmanned Aerial Vehicle Use to Determine Crop Disease, Insect and Fertility Needs of Soybeans

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This project had a major obstacle in June when the Auburn University Provost issued a UAV “no fly” order. Two UAVs were purchased and with what little flying time we had we observed problems were quickly apparent.

- Grain carts cause soil compaction
- Uneven crop conditions within field
- Data overload is going to be a problem. UAVs won't be a procrastinator's tool

Brandon Moore didn't have any problems learning to fly.