2011
Annual
Soybean Progress Reports

December 13, 2011

DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

Submitted to Arkansas Soybean Promotional Board

2011 Soybean Research Verification Program Fields
Coordinators: Chris Grimes and Steve Kelley

County	Agent	Cooperator	Variety	Production System	Planting Date	Row Spacing	Plant Pop.	Field Size (acres)	Harvest Date	Yield @ 13%
Arkansas N	Grant Beckwith	Terry Dabbs	Halo 5:25	Double Crop Irrigated	21-Jun	30"	119 K	28	22-Oct	44
Arkansas S	Ken Adams	Tom Jacobs	Halo 5:65	Full Season-Irrigated	2-Jun	Twin Row on 32"	127 K	60	20-Oct	45
Chicot	Gus Wilson	Johnny Smith	Pioneer 94Y70	Full Season-Irrigated	8-May	38"	122 K	40	15-Sep	60
Clay	Ron Baker	Mark Ahrent	Pioneer 95Y01	Full Season-Irrigated	30-May	30"	130K	113	17-Oct	59
Conway	Kevin VanPelt	James Gregory	Pioneer 95Y01	Full Season-Irrigated	6-Jun	15"	113K	23	10-Oct	48
Craighead	Eric Grant	Chris Riggs	Halo 4:65	Full Season-Irrigated	3-Jun	8"	93K	28	20-Oct	55
Cross	Rick Wimberley	Junior Newman	Progeny 4807	Full Season-Irrigated	2-Jun	8"	117K	82	8-Oct	59
Desha	A.J. Hood	Chris Baker	Delta Grow 5300	Double Crop Irrigated	3-Jul	38"	125 K	65	8-Nov	29
Drew	Chuck Capps	Mark Abbert	Asgrow 4703	Early Season-Irrigated	13-Apr	30"	131 K	77	20-Sep	45
Faulkner	Hank Chaney	James Schaefer	Delta King 4744	Double Crop Irrigated	22-Jun	8"	85K	40	11-Nov	30
Lawrence	Herb Ginn	Ronald Cavenaugh	Pioneer 94Y91	Full Season-Irrigated	1-Jun	Twin Row on 38"	124K	70	21-Oct	64
Lincoln East	Steven Stone	Steven Walmsley	Hornbeck 5226	Double Crop Irrigated	6-Jul	Twin Row on 38"	112 K	65	1-Nov	43
Lincoln West	Chad Norton	John Allen McGraw	Halo 5:65	Full Season-Irrigated	31-May	10" Drill on 38" Beds	96 K	38	21-Oct	43
Phillips	Robert Goodson	Jim Hubbard	Ozark	Full Season-Irrigated	6-Jun	15" rows on 60" beds	127 K	36	14-Oct	47
Poinsett	Craig Allen	Larry Paul Lyerly	Armor 49V6	Full Season-Irrigated	3-Jun	8"	128K	122	24-Oct	51
									SRVP Average Yield:	**48**

Redbanded Stink Bug (*Piezodorus guildinii*) in Arkansas Soybean

Investigators: D.S. Akin and G.M. Lorenz

Production System: Full-Season Soybean Production System (FSSPS)

Status: Reporting on year 2 of 2

Date of Report: 11-30-2011

Report:
Experiments were planned and designed to verify the current action threshold for redbanded stink bug (6/25 sweeps), as well as compare feeding damage of this pest and other common stink bugs on reproductive-stage soybean. A second objective was to investigate various insecticide programs and determine the most effective and affordable options for control of redbanded stink bug. However, general observations by Akin and Lorenz in 2010 and 2011 suggest that redbanded stink bug populations were sparse during the 2010 and 2011 growing seasons, both years the project was funded. Survey data collected by Lorenz and Akin indicate that county agents, even in southern counties, had similar observations. In both years, nearly all counties reported zero redbanded stink bug in soybean, even later-planted/later-maturing fields. Only some counties (e.g., Little River, Ashley, Chicot) reported any redbandeds whatsoever, and even some of those did not report having seen this pest at all in 2011. The principal investigator believes that two ―cold snaps" that South Arkansas sustained in the winter of 2009-2010 (http://www.nws.noaa.gov/climate/) was likely the primary cause of the decline in this species in the state. Interestingly, the climate not only apparently affected populations of redbanded stink bug, but also those of southern green stink bug (*Nezara viridula*), a species well-documented to be significantly more sensitive to cold temperatures when compared to the other two historically common stink bug species—brown stink bug (*Euschistus* spp.) and green stink bug (*Acrosternum hilare*). Because of the apparent lack of both redbanded and southern green stink bug during both years of the proposed research, experiments were conducted to (1) evaluate various insecticides (both labeled and new) against field populations of green and brown stink bug, and (
2) evaluate damage potential of the same pests, apparently the only stink bug pests that were present in sufficient numbers to require treatment in Arkansas in 2010 and 2011. Because it is unknown as to when the redbanded, and perhaps even the southern green stink bug, may make a resurgence, the overall results below are valuable to growers as the green and brown stink bugs may be the only two native stink bug pests that growers may encounter in the near future.

In 2010, there were very few stink bugs overall to conduct efficacy trials. Nonetheless, trials were initiated late in the season, in hopes of potential late infestations of stink bug to arrive. However, those populations never materialized in 2010. Thus, there is no meaningful efficacy data for any stink bug species in 2010. In 2011, although overall numbers were low, many of the currently-labeled products are still highly effective against green stink bug. As expected, current products were not as effective against brown stink bug when compared to green stink bug. In cage studies comparing brown and southern green stink bug, there was no significant difference between brown and green stink bug with respect to yield, moisture, or hilum bleeding. These results support the identical thresholds for each species (9/25 sweeps). Preliminary data from research conducted during previous years of the funded research (2007-2009) are available upon request.

New Resources to Control Cercospora Diseases of Soybean in Arkansas

Investigators: Burt Bluhm and Travis Faske

Production System: FSSPS/DCSPS

Goal: To reduce the impact of *Cercospora* diseases on soybean production in Arkansas

Specific objectives:

1. Determine the extent to which fungicide resistance is present in Arkansas and assess the potential impact on production
2. Develop a rapid DNA-based assay to identify fungicide resistance
3. Define the diversity of pathogen populations in Arkansas.
4. Identify new sources of genetic resistance to FLS and leaf blight.

Results from 2011:

1. *Determine the extent to which fungicide resistance is present in Arkansas and assess the potential impact on production*. In 2011, we collected populations of *C. sojina* (cause of frogeye leaf spot) and *C. kikuchii* (cause of Cercospora leaf blight) throughout Arkansas. Frogeye leaf spot was of relatively low incidence and severity compared to some previous years, but Cercospora leaf blight was severe in the Southeastern part of the state, and much more widespread than in many previous years. Evaluations of fungicide resistance are currently ongoing.

2. *Develop a rapid DNA-based assay to identify fungicide resistance*. We have cloned and sequenced the gene targets from *C. sojina* and *C. kikuchii* involved in fungicide resistance, and developed a molecular (PCR-based) diagnostic assay to reveal whether a given strain of the pathogen has acquired fungicide resistance. We are currently refining this assay for high throughput use, and will use it in 2012 to evaluate populations for fungicide resistance.

3. *Define the diversity of pathogen populations in Arkansas*. In 2011, we confirmed that Arkansas populations of *C. sojina* are much more genetically diverse than previously believed. In 2012, we will perform similar analyses with Arkansas populations of *C. kikuchii* based on the populations that we collected in 2011.

4. *Identify new sources of genetic resistance to frogeye leaf spot and Cercospora leaf blight*. In 2011, we created GFP-expressing strains of both *C. kikuchii* and *C. sojina* – the first time this has ever been performed any where in the world for these fungi, to the best of our knowledge (Fig. 1). This step is necessary in order for us to use confocal microscopy to identify new mechanisms of genetic resistance. We are currently using these fungal strains to create a new disease-screening assay for resistance to frogeye leaf spot and Cercospora leaf blight.

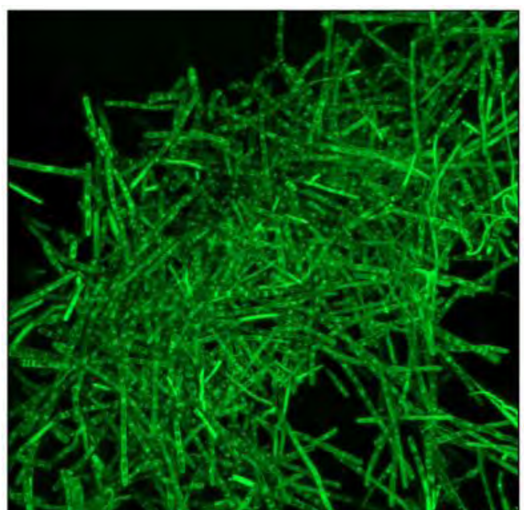

Figure 1. *Cercospora sojina* expressing green fluorescent protein (GFP).

Double-Cropped Soybean Management Alternatives and Their Long-term Effects on Crop Production, Water Conservation, and Soil Quality

Principal Investigator: Dr. Kristofor R. Brye (CSES)

Production System: Doublecrop Soybean Production System (DCSPS)

Status: Reporting on Year 1 of 3

2011 Annual Report:

Wheat was harvested using a plot combine on 6 June 2011. Wheat grain samples were collected, air-dried, and sub-samples were oven-dried for yield determinations. Just prior to wheat harvest, soil samples were collected for bulk density and soil chemical analyses from the 0- to 10-cm depth interval, which are currently still in the process of being analyzed. Wheat residue samples were collected in all plots to determine the mass of wheat residue returned to the soil and into which soybean would be planted. Residue samples were oven-dried and weighed. Significantly different mean surface residue masses were achieved, as planned, between the high- (8293 kg residue ha^{-1}) and low-residue (4561 kg residue ha^{-1}) treatments. Following residue sample collection, the residue burning treatment was imposed as planned and grab samples of ash from the 24 burned plots were collected for later chemical characterization. The burned plots have now been successfully burned in eight (8) out of ten (10) years. After residue sampling and burning, the tillage treatment was implemented. Three passes with a tandem disk were made to a depth of 4 to 6 inches followed by three passes with a Do-All to prepare the seedbed. On 13 June, 2011, a glyphosate-resistant soybean cultivar (Armor 53Z5) was drill-seeded at approximately 181,000 seeds per acre with a 7.5-inch (19-cm) row spacing. The study area was sprayed with glyphosate to control weeds. A levee was constructed around the dryland half of the study to exclude furrow-irrigation water. Within one week of soybean seedling emergence, soil respiration measurements began. Soil respiration was measured nine times throughout the soybean growing season, concluding approximately one week prior to harvest. Soil samples were collected on 28 August for assessment of treatment effects on soil bulk density and water-stable soil aggregation in the top 10 cm. Samples for water-stable aggregation were sieved through a 6-mm mesh screen and air-dried in preparation for wet sieving and subsequent carbon and nitrogen analyses of soil aggregates in five aggregate size classes. Soybeans were harvested on 17 October using a plot combine. Wheat was subsequently bulk-planted to the study area on 27 October as in previous years.

Averaged across all other treatment combinations, results showed that soil respiration was at least numerically greater from the conventional tillage than from the no-tillage treatment on six of the nine measurement dates. Similarly, Averaged across all other treatment combinations, soil respiration was at least numerically greater from the no-burn than from the burn treatment on six of the nine measurement dates. Averaged across all other treatment combinations, residue level had no significant effect on soil respiration on any measurement date. Averaged across all other treatment combinations, soil respiration was also at least numerically greater from the irrigated than the dryland treatment on seven of the nine measurement dates. Compared to results obtained from the first three years of this long-term study, results from after 10 years of consistent management clearly indicate that residue and water management practices can affect soil carbon cycling and the potential long-term sustainability of the wheat-soybean, double-crop production system.

In 2011, averaged across all other treatment combinations, neither residue level, tillage nor burning by themselves significantly affected soybean yield. As expected, averaged across all other treatments, the mean irrigated soybean yield (47.7 bu/acre at 13% moisture) was near twice that from dryland soybean (26.0 bu/acre at 13% moisture).

Newly Emerging Soilborne Diseases in Early Production Systems in Arkansas

INVESTIGATORS: Cliff Coker and Dr. Scott Monfort, University of Arkansas, Division of Agriculture, Plant Pathology Department, Cooperative Extension Service.

PRODUCTION SYSTEM: EARLY SEASON SOYBEAN PRODUCTION SYSTEM

STATUS: New (First of Three Years)

GOAL: Improving soybean profitability. Direct value since the findings from this project could have a noteworthy positive economic effect on production cost by increasing yields and lowering production costs.

OBJECTIVES:

1. To determine the distribution of Neocosmospora Rot and Black Root Rot and other newly developing soilborne diseases throughout the production areas of Arkansas.

2. To improve economically sustainable early soybean production systems for Arkansas soybean producers utilizing refined disease management recommendations for newly emerging soilborne diseases which contribute to profitable soybean production.

3. To evaluate crop management and economic impact of newly emerging soilborne pathogens, ie. Neocosmospora and Theilaviopsis upon Arkansas early season soybean production system recommendations.

JUSTIFICATION:

Hundreds of thousands of acres of production ground has shifted to soybeans from fields previously farmed "forever as cotton ground" in the last few years. Plant Pathologists in Arkansas have documented two ―ifst identifications" of soilborne fungal pathogens during 2008. The diseases Neocosmospora Rot and Black Root Rot were identified in numerous fields in twelve counties this past season (Ashley, Chicot, Clay, Crittenden, Poinsett, Lee, Lonoke, Monroe, Phillips, Drew, Desha and Jefferson). Yield loss was estimated by producers to range from 1% to 40% of total production in fields affected by these diseases. The distribution and effectiveness of disease control by variety selection needs serious refinement or is unknown. Improvements in control methods would minimize yield and quality losses due to newly emerging diseases and increase profits as much as $300 per acre in severely affected fields.

Many questions surfaced about managing these diseases:

How widespread are these diseases in Arkansas? What varieties, if any, are resistant? Do nematodes influence disease severity? Are cultural control practices effective? Which fungicide seed treatments are best or are seed treatments even an option for managing these diseases? These soilborne diseases are in Arkansas and seriously limiting yields.

In summary, research on this problem can be justified because 1) these diseases are causing economic yield loss on soybean each year; 2) we need more and better data to support recommendations for control and 3) Arkansas growers and county agents are currently requesting help on this problem through research.

PROGRESS: Soybean varieties (116) were screened at 4 known, heavily infested fields identified during 2010 and 2011. Seed treatment plots were established to determine if current seed treatments are effective against these diseases. Neocosmospora Rot and Black Root Rot infected plants were collected from fields in most soybean producing counties in Arkansas.

The unseasonably warm soil temperatures events this growing season were not conducive to severe Black Root Rot widespread development and did not significantly impact yields. All test seed treatments showed no significant disease control advantages over the untreated checks and disease incidence and disease severity remained low at plot locations throughout the growing season. Significant yield increases were not supported in the data. Yet, Neocosmospora Rot and BBR showed serious yield impacts in scattered fields around the state.

Thielaviopsis basicola is a cool weather disease that infects the roots of soybeans and causes premature death of soybean plant. To optimize soil conditions for infection, a temperature-controlled soil bed was constructed at the Lonoke Extension Center greenhouse at Lonoke County, Arkansas. Soil from a field infested with *T. basicola* was autoclaved and artificially infested with *T. basicola* chlamydospores at ~100 propogules per gram of soil. Fifty soybean varieties grown in Arkansas were planted and allowed to grow for 35 days after emergence. Seed treatment fungicide efficacy trials were also conducted in the temperature-controlled soil bed and artificially infested with *T. basicola* chlamydospores at ~100 propogules per gram of soil. Four Delta Grow soybean varieties (DG4880, DG4970, DG4975, and DG5160) were evaluated with several fungicides to determine the efficacy of fungicide seed treatments on black root rot. Fungicide seed treatments consisted of 1.) Untreated, 2.) Experimental Fungicide (0.06 fl oz/CWT), 3.) Apron Max (5 fl oz/CWT), 4.) Apron Max (5 fl oz/CWT) + Experimental Fungicide (0.06 fl oz/CWT). Plants were removed from soil, roots cut from each plant and washed for 20 minutes under running water, and surface disinfested in 0.5% NaOCl for 1.5 minutes. Once disinfested, roots were plated on a carrot-based medium for two weeks at 21^{o}C in a dark location and then assessed for percent root colonization.

The results from the greenhouse screen indicated the temperature-controlled seed bed provided consistent and adequate soil temperatures for *T. basicola* infection and damage on soybean. Plant roots were found to have brown discoloration and *T. basicola* chlamydospores present on damaged tissue as early as two weeks after planting. All soybean varieties tested were susceptible to moderately susceptible to *T. basicola* with average root colonization ranging from 35 to 70%. In the fungicide seed treatment efficacy trial, *T. basicola* root infection was 100% with root colonization ranged from 70 to 86% across all four varieties and fungicides tested. There were not significant differences observed among varieties or fungicide seed treatments. Based on the results of the efficacy trial, there is little to no activity of the tested fungicides on reducing root infection and colonization by *T. basicola* on soybean.

Value to Producers: Direct value since the findings from this project could have a noteworthy positive economic effect on production cost by increasing yields and lowering production costs. Currently, even in a warmer than normal year, significant Neocosmospora Rot and BBR showed serious yield impacts in various fields around the state.

Time Table: 2011 and Continuing

Late Season Foliar Diseases (Anthracnose/Pod & Stem Blight) and Cercospora sp. Diseases (Frogeye Leaf Spot/Cercospora Leaf Blight) Management in Full and Double Crop Production Systems in Arkansas

INVESTIGATORS: Cliff Coker and Dr. Scott Monfort, Cooperative Extension Service. Plant Pathology Department

PRODUCTION SYSTEM: FULL SEASON & DOUBLE CROP SYSTEMS

STATUS: New (One of Three Years)

GOAL: Improving soybean profitability. Direct value since the findings from this project could have a noteworthy positive economic effect on production cost by increasing yields and lowering production costs.

OBJECTIVES:

1. To determine the application threshold and the most economical timing and rate for foliar applications of currently labeled fungicides to control the late-season diseases: Anthracnose/Pod & Stem Blight and Cercospora sp. diseases: Cercospora Leaf Blight and Frogeye Leaf Spot.

2. To verify if the integration of biological fungicides to control the late-season diseases are effective in control strategies concerning recently documented resistance to ―strobilurin" fungicides.

3. To improve economically sustainable full season & double crop soybean production systems for Arkansas soybean producers utilizing refined late-season diseases and Cercospora sp. disease management recommendations which contribute to profitable soybean production.

4. To evaluate crop management and economic impact of Anthracnose, Pod & Stem Blight, Cercospora Leaf Blight and Frogeye Leaf Spot pathogens upon Arkansas full season & double crop soybean production systems recommendations.

JUSTIFICATION:

Environmental conditions that favor high yields during Arkansas' soybean production seasons are also the conditions that favor the development of two endemic, annually occurring diseases caused by Cercospora sp. (*C. kikuchii* and *C. sojina*). Cercospora Leaf Blight/Purple Seed Stain and Frogeye Leaf Spot can be very detrimental to yield and seed quality. Wet environmental conditions during seed fill and Arkansas' soybean harvest are detrimental to yields because these conditions favor the development of yield and quality robbing late-season foliar diseases i.e., Anthracnose and Pod & Stem Blight. Management for profitable soybean production continues to become more intense and growers have to push for higher yields and top quality. Late season diseases and Cercospora sp. diseases annually rob growers of 8-10% of their yields in Arkansas and up to 50% during unusually, wet harvest seasons. Yield losses of 20 to 30 bu/A were reported in 2010 and some fields were not harvested due to high incidence of Anthracnose and Pod & Stem Blight. During 2011 high incidence of Cercospora Leaf Blight/Purple Seed Stain was reported to have seriously impacted yields and quality across the soybean production areas of AR., MS., LA., MO., TN., and AL. The reliability and effectiveness of currently labeled foliar soybean disease control products pertaining to Cercospora sp. diseases and late-season diseases needs refinement or is unknown.

Biological disease management product (BDMP) manufacturers claim to be redefining the agri-chemical industry with the introduction of effective, value-enhancing, innovative biological, low-chemical and environmentally responsible disease control products. Are those products effective? Which, if any BDMP's are effective against late-season diseases in Arkansas? Would the use of BDMPs aid in disease control strategies concerning the recently documented resistance to ―strobilurin" fungicides? The short answer is no, not when applied alone, without tank mixing with other fungicides.

Which fungicide MOA's are effective against late-season foliar diseases i.e., Anthracnose, Pod & Stem Blight or Cercospora Leaf Blight? What rate of fungicides is most economical for Arkansas conditions? When should fungicides be applied to realize the most ―bang for the buck"? In other words, should high rates be applied early in the plant/disease development or can one wait until just prior to R5 before an application. Are multiple applications of same MOA or tank mixes of different MOA's better? Improvements in late-season disease control strategies would minimize yield loss and quality losses due to these diseases and easily increase profits as much as $100 per acre in moderately affected fields.

In summary, research on this problem can be justified because 1) these diseases are causing economic yield loss on soybean each year; 2) we need more and better data to support recommendations for control of late-season diseases; 3) we need data to support or repress various manufacturer's claims that the biological products are effective soybean disease control tools; and 4) Arkansas growers and county agents are currently requesting help on this problem through research.

PROGRESS: Soybean FSPS plots were planted on May 12 at Rohwer to a 4.7 maturity soybean and DCPS plots were planted on June 20 to a 5.6 maturity soybean. The plots relied upon natural infestation with the diseases endemic to the area. The rainfall events until the last half of July along with the high relative humidity within the canopy and natural inoculum levels allowed Anthracnose, Pod & Stem Blight, and Frogeye Leaf Spot development until the beans were approaching R2. Dry weather from mid-July until late-August stopped Anthracnose, Pod & Stem Blight, and Frogeye Leaf Spot disease development at R3in all fungicide tests and with the lack of rainfall around harvest Anthracnose and Pod & Stem Blight did not significantly impact yields. Environmental conditions were ideal for Cercospora Leaf Blight this growing season. None of the currently labeled fungicides slowed the development of this disease regardless to timing of application, fungicide rate, or number of applications. Natural infestation levels of diseases were monitored weekly from early flower (R1) to maturity (R8) for incidence and severity. None of the test treatments at R3, R5 or R3+R5 provided significant Cercospora Leaf Blight disease control advantages over the untreated checks even though disease incidence and or disease severity remained well above threshold levels only through R7. Significant yield increases were not supported in the data. Green stem, delayed maturity and other abnormalities showed no differences or no adverse effects because of the fungicide application to the crop.

Value to Producers: Direct value since the findings from this project could have a noteworthy positive economic effect on production cost by increasing yields and lowering production costs. Currently, even in a year when minimal disease pressure showed up on an FSPS and DCPS soybeans the data continues to support the IPM approach: fungicide use in absence of disease or during unfavorable disease development conditions is not recommended and will not significantly increase yields. Automatic fungicide sprays based only upon crop growth stage and yield potential should be avoided when diseases are not present or conditions are not favorable for disease development. Data supports the belief that none of the currently labeled foliar soybean fungicides provide adequate protection against Cercospora Leaf Blight.

Time Table: 2011 and Continuing

Optimizing Lime Requirements and Variable Rate Applications in Soybean

Investigators: Leo Espinoza, -- Soils Specialist

Status: Reporting on year 1 of 1

Date of report: December 1, 2011

REPORT

I).Lime rate studies were established at the Lon Mann Cotton Station at Marianna and the South East Research Station at Rohwer. A new site was initiated at Marianna where the soil pH was artificially lowered with the application of elemental sulfur. The Rohwer location received sulfur 4 years ago and it appears like the pH is coming up again, in part due to the irrigation water that is of alkaline nature. Yields observed during the 2011 season showed no significant difference among treatments. Results of this effort have been communicated at local and regional meetings, including the 2011 Soybean Conference.

II).After extensive testing, in collaboration with the manufacturers, we have been able to calibrate the on-the-go soil pH sensor. This unit, when properly used, can efficiently characterize soil pH variability across a field by collecting up to 20 samples per acre. This approach reduces the risk of over liming and the induction of zinc deficiencies when soybean is rotated with rice. It can also result in significant savings in lime amounts due to the more intensive soil sampling.

IV). We were also able to calibrate a spreader with variable rate capabilities and become familiar with Amer. Soc. of Ag. Engineers' standard protocol for spreader calibration. Information gained through these efforts should allow us to assist commercial fertilizer applicators in the proper calibration of their equipment.

III).During the beginning of the 2011 season we were able to sample 2 fields in Mississippi County and 1 field in Lee County at 0.5, 1.0, 2.5 and 5.0 acre-grids, with the help of Agrobotics and Jimmy Sanders. Although the fields showed no significant variability to justify variable rate application of potassium, which is the nutrient of interest, each sampling approach appeared to present a different result. We had intended to sample more fields, but the weather experienced during the beginning of the season did not allow us to do so. We plan on increasing the number of fields sampled next year.

IV). We continue taking soil samples at a 2-3 week interval at selected locations to characterize the variability in nutrient concentration across time. Nutrient levels tend to be affected by drastic changes in soil moisture and temperature. This fluctuation appears to be affected, in part, by the type of clay minerals present.

Soybean Enterprise Budgets and Production Economic Analysis

Investigator: Dr. Archie Flanders
Assistant Professor - Economics

Status: Reporting on Year 1 of 3 Years

Date of Report: December 13, 2011

Accomplishments:

The Program Associate position has been filled. The starting date was for the new employee was November 16, 2011.

Existing budgets were utilized for economic analysis of 2011 soybean research verification data.

The computational program has been revised and updated for use in 2012 crop enterprise budgets. Specific revisions include features for 1) transferring data to the Whole Farm Planning Guide and 2) report writing.

Crop enterprise budgets for 2012 will be released in December 2011.

The crop enterprise budgets are applied to develop weighted average production functions for soybeans. Weights are determined by irrigation type and state average yields are utilized to estimate production costs and net financial returns. Input costs indexes are used to develop economic measures for a time series. Table 2 presents costs and returns for soybeans during 2006-2011. The year with the greatest production costs is 2011. Costs had a sharp increase in 2008 and declined for the next two years before increasing in 2011. Net returns in 2011 for soybeans exceed net returns in any of the other years.

Table 2. Weighted Average Net Returns, per Acre, Arkansas Soybeans, 2006-2011

Expense	2011	2010	2009	2008	2007	2006
Average Yield (bu.)	37.0	35.0	37.5	38.0	36.0	35.0
Price Received	12.48	11.30	9.66	9.64	9.02	6.41
Operating Costs	258.49	240.53	243.70	248.29	197.71	186.40
Returns to Operating Costs	**203.27**	**154.97**	**118.55**	**118.03**	**127.01**	**37.95**
Fixed Costs	55.34	53.25	51.40	48.39	44.22	42.14
Total Costs[1]	313.82	293.79	295.10	296.68	241.93	228.54
Net Returns to Land & Management	**147.94**	**101.71**	**67.15**	**69.64**	**82.79**	**-4.19**

[1]Does not include land cost.

Improving Yield and Yield Stability for Irrigated Soybean

Investigators: Paul B. Francis, Leo Espinoza, M. Ismanov

Production System: applicable to all systems

Status: Reporting on year 1 of 3

Date of Report: 11-22-2011

A comparison of the Arkansas Irrigation Scheduler computer model, Pennmann-Monteith reference evapotranspiration model, soil-water tensiometers, a commercially available atmometer method (ET Gage™), and a prototype open-pan method, the ‗Arkansas Tub Gauge' (ATG), were evaluated for a full-season and double crop system on a silt loam, and a full season system on a clay soil. Each of the on-site scheduling methods were compared to the computer generated Arkansas Irrigation Scheduler. Generally, irrigation scheduling events of the four methods coincided within 5 days or less and there were no yield differences between irrigation scheduling methods at any site or cultivar. The deficits measured by the ATG were often less than the Scheduler, however, the pan and crop coefficients used in the ATG will be revised for 2012. Soil tensiometer readings were highly variable and generally ineffective and time-consuming. Atmometer deficits corresponded well to potential evaporation rates calculated from the Scheduler and an on-site weather station using the Pennman-Monteith equation. At 90% canopy coverage, or R2 growth, whichever comes first, soybean moisture use approaches potential evaporation rates and direct readings from the atmometer can be used to determine the moisture deficits. Deficit coefficients for the new methods under Arkansas conditions at other growth stages will be determined.

Irrigation scheduling demonstration sites were established in the following counties: Chicot (1), Lincoln (2), Crittenden (1), and Lee (3). Soybeans of different maturity groups were planted in the demonstration sites. Soil types at the sites included silty clay, silt loam, and sandy loam, and include fields ranging in size from 25 to 80 acres. During the 2011 season, approximately 98 fields were irrigated using an atmometer, with the total acreage affected being close to 11,000 acres. All our collaborators were positive about the potential for this tool to help them decide when to water. They will continue/expand the use of the atmometers during the 2012 season.

Developing a New Threshold for Corn Earworm, Helicoverpa zea

Investigators: Gus Lorenz, Glenn Studebaker, and Scott Akin

Production System: DCSSP

Status: New (Year 1 of 3)

Date of Report: Dec. 1, 2011

Report on Work Accomplished in 2011

While natural infestations were extremely common in Arkansas in 2010 and 2011, we have discovered just how hard it is to establish infestations artificially in our plots. Several states including MS, LA, and TN are also working on refining current recommendations on CEW in soybean. However, all of us have had difficulty in getting establishment in plots. First we tried raising the CEW on artificial diet and transferring them to soybean. This resulted in total failure at all 7 locations: 3 in AR, one in TN, 2 in MS, and one in LA. Next we tried collecting from fields of natural infestation and transferring to our plots. Again we had a total failure in establishment. We have continued to work through the process and are now going to erect cages and cage moths to establish natural infestations. Preliminary trials indicate a better level of success with this approach. We have purchased the cages for next year and would like to continue the work in 2012. So, basically we spent a year to develop our technique. We also conducted 8 efficacy trials on CEW, testing existing standards and some new insecticides, including Belt, Prevathon, and Beseige. The latter products may prove to be extremely effective for CEW control than all currently labeled products. We also documented control failures behind pyrethroid applications and sent larval samples to USDA for assay to determine resistance levels. I would like to put a graduate student on this project next year.

Integrated Management of Nematodes in Soybean in Arkansas

Investigators: Scott Monfort, Terry Kirkpatrick

Cooperators: Jeremy Ross, and Don Dombek

Production Systems: All systems

Status: Year 1 of 3

Progress :

Objective 1. The extensive flooding in Eastern Arkansas precluded us from establishing reniform nematode yield loss estimate plots (Telone vs no Telone) . This work will be attempted again in 2012. Field plots were, however, established in Ashley Co. in a reniform field to look at various seed treatment nematicides and in a root-knot infested field in Jackson Co.

Objective 2. The flooding also kept us from establishing our field comparisons of SCN, root-knot, or reniform resistant cultivars this year. However, we screened 65 new breeding lines and selections from Dr. Chen‘s program in greenhouse trials for root-knot resistance.

Objective 3). Dr. Monfort, who has expertise in precision agriculture technology, left us in June to move to Clemson University. Consequently, we were unable to initiate the precision ag objective of this project. Since Dr. Monfort is no longer working on this project, we will likely eliminate this objective in future years.

Objective 4. We completed a survey of the nematodes that were present in 100 soybean fields in the state. All soybean-producing counties in the state were represented in the survey. Assays are now being completed. SCN will be isolated where it was detected and characterized by race.

Objective 5. We initiated a corn/soybean rotation sequence in plots infested by root-knot nematode. Three corn hybrids that we identified as relatively poor hosts and 3 hybrids that are extremely good host (high nematode reproduction) were planted in large plots. Next year, the plots will be divided with one-half the plot planted to a resistant soybean cultivar and one-half to a moderately resistant cultivar. In year 3, a susceptible cultivar will be planted across the entire area to measure the importance of growing resistant soybean cultivars in corn/soybean cropping systems.

Defining the Spatial Distribution and Movement of Inoculum of Rhizoctonia Solani AG1 for the Precision Management of Aerial Blight on Soybean

Investigator: Craig Rothrock

Production system: Full season

Status: Reporting on year 2 of 3

Date of Report: 12/1/2011

In 2011, 2 producers' fields, one near Hazen and one near Stuttgart were used for the research. The field near Stuttgart was the same field used in 2009 and 2010. For each field 96 GPS locations were assigned to represent the fields in 2011. For the field near Stuttgart, 48 GPS locations were continued from 2009 with 48 more added to allow for comparisons between years. In each field, soils were assayed at each location for populations of *R. solani*. In addition, plants were sampled from each GPS location for the two fields during the vegetative stage and disease was assessed late in the season. This data will be used to develop spatial maps of distribution of the pathogen, disease, and yield.

Due to problems with contaminating fungi in initial methodology testing, a new growth medium was developed and used to continue testing of methodologies in 2011. Various methodologies were explored to determine the most efficient means to quantify inoculum of *Rhizoctonia* species in the soybean / rice fields. The four methods tested were: the multiple pellet soil sampler, elutriation of soil organic matter, suspension of surface organic matter in selective media, and the toothpick baiting method. Of the four methods, it was determined that the toothpick baiting method offered the most efficient means of recovery of isolates of interest. This methodology was favored due to the ability to rapidly assay a larger amount of soil than the other methods with little expense. It has also been determined that toothpick baiting allows the approximation of activity through a 5 cm depth of the soil for recovered *Rhizoctonia solani* isolates. Previous testing revealed the need to control soil moisture to encourage saphrophytic growth of the fungus to attain colonization. Because of the need to control soil moisture and have a uniform soil environment for each sample, soil samples taken by GPS position in each field were brought back to the lab to be assayed as opposed to the field assay previously conducted. From this research a standardized protocol for population assessment has been developed to map populations in fields for subsequent work.

While dry conditions similar to 2010 persisted, the new protocol to control soil moisture allowed for ample colonization of toothpicks and recovery of *R. solani*. Isolations of *R. solani* AG1 and *Rhizoctonia solani* AG11 increased dramatically over the previous two years with total isolations of *Rhizoctonia* spp. resulting in over 3000 isolates. Aggregation of inoculum of *R. solani* AG1 and AG11 in fields was documented. These fungi were recovered from toothpick baiting in both fields in May and from plants in late June sampled during the vegetative stage, indicating the progress of plant colonization by *R. solani*. Recovery of *R. solani* AG1 was higher during plant sampling. Additionally, *Rhizoctonia solani* AG11 was found at high levels throughout the sampling areas of both fields. This population of *R. solani* has been shown to be weakly pathogenic to soybeans and rice but its importance, possible influence, or involvement in the sheath blight / aerial blight pathosystems in unclear. Aerial blight did not develop past the initial colonization of plants early in the season in the fields assessed in 2011. The importance of early-season colonization of the soybean crop on aerial blight is being investigated further.

Defining the Spatial Distribution and Movement of Inoculum of*Rhizoctonia Solani* AG1 for the Precision Management of Aerial Blight on Soybean

Investigator: Craig Rothrock

Production system: Early Soybean Production System

Status: Reporting on year 2 of 3

Date of Report: 12/1/2011

In 2011, 2 producers' fields, one near Hazen and one near Stuttgart were used for the research. The field near Stuttgart was the same field used in 2009 and 2010. For each field 96 GPS locations were assigned to represent the fields in 2011. For the field near Stuttgart, 48 GPS locations were continued from 2009 with 48 more added to allow for comparisons between years. In each field, soils were assayed at each location for populations of *R. solani*. In addition, plants were sampled from each GPS location for the two fields during the vegetative stage and disease was assessed late in the season. This data will be used to develop spatial maps of distribution of the pathogen, disease, and yield.

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Rotation of Roundup Ready and Conventional Soybeans Varieties from Sources with Different Soybean Cyst Nematode Resistance Reactions

Investigators**:** Robert T. Robbins and Terry Kirkpatrick

Cooperators**:** Roger Eason, Rick Cartwright

Production System**:** Full Season Soybean Production System

Status: Reporting year 2 of 3

Date of Report: 11-30-2011

Report:

The two SCN rotation experiments located at the Pine Tree Experiment Station, one using conventional the other using round-up ready varieties planted on June 2, 2011. Soil samples were taken at the time of planting to determine the overwintering SCN survival and also at harvest to determine the SCN race after complete rotation cycles. Roundup ready plots were harvested and sampled October 18, 2010 (RR) and the second conventional October 21, 2010 due to rain delay. Due to problems with the combine the conventional test yields were not accurate having unacceptable variation. For the conventional rotation plots being rotated with the 3 resistant varieties had the least SCN reproduction with Anand having the least nematodes followed by AG 5501 and Manokin with the susceptible Hutcheson and HBK 4924 having the most nematodes. All continuously planted resistant varieties had higher numbers than the rotations with Anand and AG5501 and were about equal to those with Manokin the rotation variety The 40 foot alleys between replications had been fallow for 9 years and the SCN level in them were very low to not detectable. Eggs in SCN cysts are known to be able to survive for over a decade.

The second experiment was at a different area of the Pine Tree experiment station and was for the third year of a 3 year rotation cycle. The SO2 3934RR (derived from Anand) gave the best yield and also had low SCN numbers along with HBK R4946 CX. During 2008 evidence was found in these plots of an unknown type control of the nematodes. It 2009 the unknown control became much more prevalent with one half the plots having no nematodes detected and only two out of 40 plots having an increase in nematode numbers. In 2010 90% of the plots had no nematodes. During 2011 the nematodes had reestablished into about 50% of the plots with most re-establishing in the AG 5501 and susceptible having over 95% reestablishment whereas the other 2 resistant varieties had very little reestablishment. These plots present a unique situation to follow the progression of this control agent. A separate and new proposal was submitted and funded in part to identify and study this control agent or agents.

Investigating Efficacy of Inoculants and the use of Winter Cover Crops to Improve Soybean Performance

Investigators: T.L. Roberts and W.J. Ross

Production System: Full Season Soybean Production System

Status: Reporting on year 1 of 3

Date of Report: 11/23/2011

Report:
Research trials were conducted this year to assess the relationship between nitrogen (N) availability to soybean either through biological N fixation, native soil N or N fertilization and the resultant impact on soybean yield. Understanding the dynamics of N fertility in soybeans may play a key role in increasing overall soybean yield and performance across the state of Arkansas. In addition to investigating the N dynamics in soybean production research was initiated during the fall of 2011 to determine how winter cover crops could enhance soybean emergence and growth following rice or other crop rotations.

Each year producers are inundated with new products claiming to enhance soybean growth and yield, with little to no unbiased research at their disposal. To better understand the impact of soybean inoculation on soybean performance and yield, a series of research trials were implemented on both clay and silt loam soils with a MG IV and MG V soybean variety. Included in the study were 7 different commercially available inoculants, 2 experimental inoculants and an untreated control where no inoculant was used. In most cases there were no significant yield benefits from the use of an advanced inoculant and in many situations the untreated control yields were not significantly different than any of the treatments receiving inoculation.

Establishment of winter cover crops was completed in October and November of 2011 and included treatments with tillage radish, winter rye, wheat, winter pea, fallow and winter flooding. These treatments followed both rice and soybean in rotation to compare the establishment and performance of the cover crops. A series of different planting dates were included for the tillage radish as this is a relatively new crop to Arkansas and little is known about the optimum planting window. During the following year soybean will be planted in rotation with these cover crops to evaluate the impact of cover crops on soybean growth and yield. Initial results suggest that research is needed on land preparation following rice to ensure that winter cover crops can be properly sown and established.

Nitrogen response trials were initiated at several locations throughout the state to determine if specific soils or management practices could potentially benefit from the addition of N fertilizer to soybean. The sites selected for the study had a wide range of native soil N, and results indicated that on soils with extremely low native N soybean yield could be increased with the addition of N fertilizer. Although soybean yields were increased by the addition of N fertilizer in some specific soil and management scenarios, the amount of N added was not economical and yield increases were only slightly significant.

Investigating Emerging Production Recommendations for Sustainable Soybean Production using the Early Season Soybean Production System

Investigators: Jeremy Ross, Gus Lorenz, and other select Extension Soybean Commodity Committee Members

Production System: Early Season Soybean Production System

Status: New (Year 1 of 3)

Stated Goal: To investigate new and untested management inputs to improve soybean production using the Early Season Soybean Production System.

Specific Objectives:

1. Continue to initiate test demonstrations for controlling economically damaging insect pests that often impact the Full Season Soybean Production System. These pest complexes include Dectes Stem Borer, Grape Colaspis, Thirps, Potato Leaf Hopper, Soybean Looper, and Stink Bug.

2. Continue to investigate optimum seeding rates and planting methods of soybean under a wide range of geographic regions and soil textures for the Early Season Soybean Production System.

3. Examine the potential of using new and innovative production factors, and how they influence soybean yields and profitability. Detail research is needed to advise producers in the use of plant growth regulators, alterative fertilizer sources (poultry litter) and other soybean production inputs currently not being tested in Arkansas for soybean production sustainability with the Early Season Soybean Production System.

Results/Progress:

1. The entomology group conducted a total of 8 insecticide seed treatment trials. New products are coming on the market and will soon be competing with the current standards. These products need to be compared to our standards to determine their value to growers. These insecticides include several currently not labeled that expand control to include caterpillar pests and may provide early season control of problematic pests such as armyworms, garden webworm, and early season corn earworm. We are currently conducting a Regional IST trial with colleagues in MS, TN, LA, and MO. We plan to develop a factsheet on the results for use by growers and consultants. We also conducted 3 trials on stink bugs on grower fields at Faulkner (green stink bug), Dumas (brown stink bug) and Marvell (green and brown stink bug) to establish control of new insecticides compared to standards. Results indicate premixes and tank mixes consistently give the best control of mixed populations and brown stink bug. We conducted 10 trials on corn earworm, increasing our experience with new insecticides such as Belt and a new product not currently available called Prevathon and Besiege (premix of pyrethroid and prevathon). Both of these new products indicated control of bollworms for up to 32 days after treatment. In 3of these trials we also were able to collect threecornered alfalfa hopper data. Finally, we also had our first observation with Bt soybeans. The data is promising.

2. Due to record rainfall during April and May, no early soybean plots were established. We will attempt to continue this work during 2012.

3. One location to evaluate LibertyLink varieties was established. Plant stands, emergence dates, and other measurements were taken and the test has been harvested. Analysis of all the measurements is currently being conducted.

Investigating Emerging Production Recommendations for Sustainable Soybean Production using the Full Season Soybean Production System

Investigators: Jeremy Ross, Gus Lorenz, and other select Extension Soybean Commodity Committee Members

Production System: Full Season Soybean Production System

Status: New (Year 1 of 3)

Stated Goal: To investigate new and untested management inputs to improve soybean production using the Full Season Soybean Production System.

Specific Objectives:

1. Continue to initiate test demonstrations for controlling economically damaging insect pests that often impact the Full Season Soybean Production System. These pest complexes include Dectes Stem Borer, Grape Colaspis, Thirps, Potato Leaf Hopper, Soybean Looper, and Stink Bug.
2. Continue to investigate optimum seeding rates and planting methods of soybean under a wide range of geographic regions and soil textures for the Full Season Soybean Production System.
3. Examine the potential of using new and innovative production factors, and how they influence soybean yields and profitability. Detail research is needed to advise producers in the use of plant growth regulators, alterative fertilizer sources (poultry litter) and other soybean production inputs currently not being tested in Arkansas for soybean production sustainability with the Full Season Soybean Production System.

Results/Progress:

1. The entomology group conducted a total of 8 insecticide seed treatment trials. New products are coming on the market and will soon be competing with the current standards. These products need to be compared to our standards to determine their value to growers. These insecticides include several currently not labeled that expand control to include caterpillar pests and may provide early season control of problematic pests such as armyworms, garden webworm, and early season corn earworm. We are currently conducting a Regional IST trial with colleagues in MS, TN, LA, and MO. We plan to develop a factsheet on the results for use by growers and consultants. We also conducted 3 trials on stink bugs on grower fields at Faulkner (green stink bug), Dumas (brown stink bug) and Marvell (green and brown stink bug) to establish control of new insecticides compared to standards. Results indicate premixes and tankmixes consistently give the best control of mixed populations and brown stink bug. We conducted 10 trials on corn earworm, increasing our experience with new insecticides such as Belt and a new product not currently available called Prevathon and Besiege (premix of pyrethroid and prevathon). Both of these new products indicated control of bollworms for up to 32 days

after treatment. In 3 of these trials we also were able to collect threecornered alfalfa hopper data. Finally, we also had our first observation with Bt soybeans. The data is promising.

2. One seeding rate test was established at the Pine Tree Branch Station to investigate optimum seeding rates. Stand counts and plant growth have been recorded. Other measurements have been recorded and the test has been harvested. Analysis of all the measurements is currently being conducted.

3. Two locations to evaluate seed applied inoculants were established. Plant stands, emergence dates, and other measurements were taken and the tests have been harvested. Analysis of all the measurements is currently being conducted. Two locations to evaluate LibertyLink varieties were established. Plant stands, emergence dates, and other measurements were taken and the tests have been harvested. Analysis of all the measurements is currently being conducted. One location to evaluate maturity group, seeding rate and planting date was established. Plant stands, emergence dates, and other measurements were taken and the tests have been harvested. Analysis of all the measurements is currently being conducted. Three locations to evaluate sugar application and herbicides to reduce plant height were established. Plant stands, emergence dates, and other measurements were taken and the tests have been harvested. Analysis of all the measurements is currently being conducted.

Investigating Emerging Production Recommendations for Sustainable Soybean Production using the Double Crop Soybean Production System

Investigators: Jeremy Ross, Gus Lorenz, and other select Extension Soybean Commodity Committee Members

Production System: Double Crop Soybean Production System

Status: New (Year 1 of 3)

Stated Goal: To investigate new and untested management inputs to improve soybean production using the Double Crop Soybean Production System.

Specific Objectives:

1. Continue to initiate test demonstrations for controlling economically damaging insect pests that often impact the Full Season Soybean Production System. These pest complexes include Dectes Stem Borer, Grape Colaspis, Thirps, Potato Leaf Hopper, Soybean Looper, and Stink Bug.
2. Continue to investigate optimum seeding rates and planting methods of soybean under a wide range of geographic regions and soil textures for the Double Crop Soybean Production System.
3. Examine the potential of using new and innovative production factors, and how they influence soybean yields and profitability. Detail research is needed to advise producers in the use of plant growth regulators, alterative fertilizer sources (poultry litter) and other soybean production inputs currently not being tested in Arkansas for soybean production sustainability with the Double Crop Soybean Production System.

Results/Progress:

1. .The entomology group conducted a total of 8 insecticide seed treatment trials. New products are coming on the market and will soon be competing with the current standards. These products need to be compared to our standards to determine their value to growers. These insecticides include several currently not labeled that expand control to include caterpillar pests and may provide early season control of problematic pests such as armyworms, garden webworm, and early season corn earworm. We are currently conducting a Regional IST trial with colleagues in MS, TN, LA, and MO. We plan to develop a factsheet on the results for use by growers and consultants. We also conducted 3 trials on stink bugs on grower fields at Faulkner (green stink bug), Dumas (brown stink bug) and Marvell (green and brown stink bug) to establish control of new insecticides compared to standards. Results indicate premixes and tankmixes consistently give the best control of mixed populations and brown stink bug. We conducted 10 trials on corn earworm, increasing our experience with new insecticides such as Belt and a new product

not currently available called Prevathon and Besiege (premix of pyrethroid and prevathon). Both of these new products indicated control of bollworms for up to 32 days after treatment. In 3 of these trials we also were able to collect threecornered alfalfa hopper data. Finally, we also had our first observation with Bt soybeans. The data is promising.

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Control of Seedling Disease by Fungicide Seed Treatment, CultivarSelection and Plant Population Across Soybean Production Systems

INVESTIGATORS: John Rupe, Craig Rothrock, Plant Pathology, Pengyin Chen, Crop Soils and Environmental Sciences, Michael Popp, Agricultural Economics and Agricultural Business.

OBJECTIVES:

1. To determine the effectiveness of current chemical seed treatments on soybean stand establishment and yield.
2. To determine the nature of resistance to *Pythium* spp. by identifying molecular markers, seed exudates and other plant responses involved in resistance.
3. To determine the effect of seed treatment, seeding rate, and environment on stands and yields using high and low vigor soybean seed.

RESULTS: Tests were planted in May, and June at Keiser and, Stuttgart in April, May and June at Rohwer. Wet weather prevented early planting at Keiser and Stuttgart this year.

Fungicide Comparison: The initial analysis of the fungicide comparison data showed that there were significant increases in stand in the April, May and June plantings at Rohwer and the June planting at Stuttgart. Yields will be taken.

Table 1. The effect of seed treatments on four week stands (plants/40ft of row) and yields at Rohwer in Early May, May and June plantings and in Stuttgart in a June planting 2011.

Cultivar	Rohwer-Early May	Rohwer-May	Rohwer-June	Rohwer-June Yield	Stuttgart-June
Allegiance	120 bc	118abcd	122ab	33 bc	116 b
Maxim	148a	106 cd	110abc	36ab	131a
PCNB+Vitavax	136ab	136ab	112abc	29 c	121ab
Trilex2000	138ab	130abcd	104 bc	31 c	119ab
Trilex2000+Gaucho	128abc	132abc	122ab	39a	127ab
ApronMaxx	136ab	118abcd	110abc	33 bc	116 b
ApronMaxx+Dynasty	146a	140ab	108abc	34 bc	121ab
ApronMaxx+Dynasty+Cruiser	132ab	113 bcd	98 bc	33 bc	129ab
Syngenta 1641BC	130ab	142a	134a	34 bc	119ab
Untreated Control	112 c	106 d	92 c	31 c	94 c

Seed Treatment and Plant Population: Two cultivars, a late MG 4 and an early MG V, each with a high and a low quality seed lot were planted at three planting rates with and without an AopornMaxx seed treatment at Keiser, Stuttgart, and Rohwer at the same time as the seed treatment tests. Four week stand counts showed significant effects of quality and planting populations on stands at all locations and planting dates. Fungicide seed treatment significantly improved stands at Keiser in May and June with both seed lots and in Stuttgart with the bad seed lots in June. At Rohwer, seed treatment was only effective in April. Only yields in the June planting at Rohwer had significant differences between treatments. The highest yields were with Trilex 2000 + Gaucho and Maxim. Trilex 2000 without Gaucho and yields equal to the untreated control. Yields in the June planting at Stuttgart were not quit statistically significant, but Trilex 2000 + Gaucho and ApronMaxx + Dynasty+Cruiser had the highest yields (50 and 52 bu/A, respectively) and were higher than the untreated at 42 bu/A.

Seed Exudates and Pythium Resistance: Seed exudates of the susceptible cultivar Hutcheson had significantly higher sugar concentrations than those of the resistant cultivar Archer, although sugar levels in the seed were similar. Of the sugars in the exudates fructose and glucose increased mycelia growth of *Pythium*, but only fructose stimulated spore germination. Seed germination in the presence of Pythium was not affected by seed exudates from Hutcheson applied to Archer seed, but Archer seed exudates did increase germination of Hutcheson seed. Isoflavone levels were higher in Archer seed than Hutcheson and one of the predominate isoflavones, genistein, did reduce growth of *Pythium*. Future work examine peptides and proteins in exudates of these cultivars

.

Seed Quality, Seed Treatment, and Planting Population: There were effects of plant population, seed quality and seed treatment on stand at Rohwer, Stuttgart, and Keiser on most planting dates. When there was an interaction between seed treatment and planting population, the greatest improvement in stand was in the high populations. Likewise with seed quality, the higher quality seed lots responded to seed treatment more than the low quality seed lots. Significant differences in yields occurred in four of the 13 comparisons. In all cases, higher yields were tied to higher plant populations.

Effects of Genotype on Severity of Charcoal Rot and Yield in Soybean

INVESTIGATORS: John Rupe, Craig Rothrock, Plant Pathology, Richard Cartwright, Cooperative Extension Service

PRODUCTION SYSTEM: Full Season Production system.

OBJECTIVE:

1. To determine the effect of cultivar on charcoal rot development and yield in artificially infested, nonirrigated fields.
2. To develop a greenhouse screening procedure to determine soybean cultivar reaction to charcoal rot.

RESULTS:

Three tests were planted at the Lon Mann Cotton Branch Station, Marianna, AR. There are two cultivar tests each with 15 entries: maturity group 4 and maturity group 5. All plots were inoculated with the charcoal rot pathogen, *Macrophomina phaseolina*. The level of inoculum was much lower than in previous years and is similar to that in the USB regional charcoal rot test. There was no affect on stand. The test was monitored for disease development and reflectance data was taken with GreenSeeker during reproductive development to determine plant stress.

An irrigation study was begun with four cultivars, inoculated like the cultivar tests or not inoculated. Plots are being furrow irrigated either all season, until R5 or not irrigated. Disease development was visually assessed during the season and reflectance data taken with GreenSeeker.

With both tests, plants were sampled at harvest and stems and root are being split to visual assess disease development. This is a technique used in the USB charcoal rot project and is effective in assessing disease. We anticipate finishing the disease assessment in February. Yields were also taken and the data is being analyzed

A Team Approach to Weed Management in Soybean

Investigators: R.C. Scott, N. Burgos, K.L. Smith, and J.K. Norsworthy

Production System: All Soybean Production Systems

Status: Reporting on year 2 of 3

Over 100 soybean weed control trials were conducted in the 2011 growing season. These included locations at almost all delta research stations and the station at Fayetteville. In addition, three locations specifically dealing with the control of glyphosate resistant Palmer pigweed were established at Newport, Keiser and an on-farm location near Marvell, Arkansas. Due to a special interest in Palmer pigweed control this year, a field day was held at the Marvell Location, with a follow-up field day at Keiser 2 days later. In all, we estimate that over 400 people visited these sites in 2011. The Jackson county field day and company field days also accounted for over 350 people viewing the plots at Newport. This year this research project had a tremendous out-reach and educational component on this issue.

Research highlights for the year include the further development of recommendations for the Liberty Link soybean production system and Ignite herbicide. Major conclusions on this system include the need for early application timing of Ignite for most weeds, the need for sequential applications and the value of the use of residual herbicides for full season weed control. Yield trials continue to indicate that many Liberty Link soybean varieties will produce comparable yields to Roundup Ready. There continues to be a need for Extension out-reach with this technology as many farms still have Palmer amaranth even after adoption of the Liberty Link Technology.

Recommendations for Palmer pigweed control in Roundup Ready and Conventional soybean have been further refined. A good residual program followed by a fomesafen (Flexstar, Rhythm, Flexstar GT, etc.) application applied to 2 – 3 inch Palmer pigweed is an effective program. Again, it is obvious from the many failures around the state that more Extension outreach is needed in this area.

KIH 485 (pyroxysulfone) is a new residual product being brought to market under several trade names in late 2011. These include Zidua (pyroxysulfone), Anthem (Zidua + Cadet) and Fierce (Zidua + Valor). This herbicide has been evaluated for several years under this project. One new product, Fierce, from Valent company combines the grass and broadleaf control of KIH 485 with Valor. This has been an excellent, long lasting residual treatment for soybean in our research.

Over 40 weeds have been screened for glyphosate resistance as well as resistance to other families of chemistry in our testing program in 2011. So far, other than ryegrass, no new resistant weeds have been evaluated. However, we are still screening several populations of barnyardgrass, johnsongrass and goosegrass, for glyphosate resistance. The resistance mechanism for these johnsongrass populations has been identified and publication of results is underway. In addition a paper was published documented glyphosate resistant ryegrass in Desha County, as well as 5 other counties. A total of 45 populations of glyphosate resistant ryegrass have now been confirmed in Arkansas, mostly occurring along the Mississippi River.

Efforts to manage soil seed bank for elimination of pigweed populations continue. A number of projects are in place to evaluate the —zero tolerance” concept for pigweed management. Early results indicate that growers can have a significant impact on soil seed bank of pigweed after just one year.

All trials from 2011 have been evaluated and will be harvested soon. The data from these trials will incorporated into the 2011 MP-44 and other Extension publications and presentations.

Fertilization of Soybean

Project Leader: Nathan Slaton - Professor/Director of Soil Testing

Production System &Status: Double Crop Soybeans, Year 1 of 3

Objectives:

1. Evaluate P and K fertilization strategies for wheat and double-cropped soybean production.
2. Determine the effect of wheat production on the P and K requirement of soybean.
3. Determine whether soybean responds differently to fall and spring applied P and K.
4. Continue to build databases regarding wheat and soybean response to soil-test P and K levels for correlation and calibration of soil-test based fertilizer recommendations.

Research Results

Phosphorus and potassium field trials were planted to Berretta wheat in fall 2010 at the Pine Tree Research Station and the Lon Mann Cotton Research Station (LMCRS). Wheat was grown 1) as a cover crop (no N fertilizer) and killed with gylphosate in March 2011 or 2) for grain with normal N fertilization practices. Phosphorus and K fertilizer was applied either 1) in the fall before wheat harvest or 2) late spring after wheat harvest at four rates including 0, 50, 100, or 150 lb K_2O/acre or 0, 40, 80, and 120 lb P_2O_5/acre. Following wheat harvest, soybean (Armor 48-R40) was planted into the wheat stubble (no tillage or burning) in 15-inch rows at the PTRS or as twin rows on 38-inch wide beds at the LMCRS. Soil test K was ‗Medium' (107 to 112 ppm K) at both sites and soil test P was ‗Very Low' (13 ppm) at PTRS and ‗Medium' (34 ppm, near Optimum) at LMCRS.

Wheat yields were excellent with the average yields at both sites ranging from 84 to 87 bu/acre at LMCRS and 97 to 100 bu/acre at PTRS. Surprisingly, wheat yields were not affected by P and K fertilization at either site. The average soil test P in plots receiving no P fertilizer fluctuated by only 3 (LMCRS) to 5 (PTRS) ppm across three soil sampling times (October 2010, March 2011, and June 2011) resulting in little or no changes in P fertilizer recommendations. In contrast, soil-test K declined by 43 to 63 ppm at the PTRS from October 2010 to June 2011, while little or no change was observed at the LMCRS site. Soil mineralogy may play important roles in the different soil-test K trends observed between sites.

Overall, soybean yields were excellent averaging 71 bu/acre at LMCRS and 57 bu/acre at PTRS. Soybean yields were affected significantly only by how the wheat crop was managed (cover crop or fertilized with N and harvested for grain). The influence of wheat crop management on soybean yields in this no-till management system was consistent across nutrient trials (P and K) and sites (PTRS and LMCRS), but the magnitude of difference was greater at the LMCRS. Soybean following wheat produced for grain produced yields that were greater by 1.5 to 2.0 bu/acre at the PTRS and 3.5 to 5.0 bu/acre at LMCRS than soybean following wheat grown as a cover crop. Averaged across nutrient rates, fertilizer application time had no effect on soybean yield. Application rate at the PTRS, the site with the lowest soil fertility levels, showed that the highest P and K fertilizer rate applied produced the greatest yields, especially when applied in the fall. Results from this first year lead us to the preliminary conclusion that fertilizer rate is the single most important aspect of fertilization on low fertility soils. Tissue analysis is not yet complete, but should provide information regarding nutrient uptake as affected by wheat production and fertilization strategy.

Fertilization of Soybean

Project Leader: Nathan Slaton - Professor/Director of Soil Testing

Production System & Status: Full-season Production System, Year 1 of 3

Objectives:

1. Evaluate soybean growth (vigor) and yield to Fe and Mn fertilization via seed treatments and/or foliar applications on high pH soils that may be prone to these nutrient deficiencies
2. Continue P and K fertilizer rate trials established at Pine Tree Branch Station in 2000 (PTBS) and Rice Research Experiment Station in 2007 (RREC)
3. Correlate soil-test P alone or in combination with other soil chemical properties with soybean yield and trifoliate leaf responses to P fertilization
4. Evaluate soybean yield and nutrient uptake response to P and K fertilizer application time (e.g., fall vs late winter vs spring applications)

Research Results

Greenhouse trials were initiated in late winter of 2011 to evaluate the effect of seed applied Fe and Mn on soybean germination and early season growth. Seed-applied Fe and Mn sometimes reduced soybean germination and/or emergence. Based on these detrimental effects we did not try to evaluate Fe and Mn seed treatments in field trials. Three field trials, two at Pine Tree Research Station (PTRS) and one in a Poinsett County soybean field were established to evaluate foliar application of Fe, Mn, or both. No ‗flash' symptoms occurred in the PTRS trials and growth and yield were not benefited by Fe and/or Mn application. No differences were measured at the Poinsett County trial.

Soybean yields at the PTRS in 2011 were the best we have ever recorded. In 2012, the 12th year of our long-term K fertilization trial, soil receiving no K fertilizer produced soybean (Armor 48 R10) yields of 55 bu/acre compared to yields of 68 (40 lb K_2O/acre/yr) to 74 (160 lb K_2O/acre/yr) bu/acre for soybean receiving K fertilizer. The 5th year of long-term P and K fertilization plots at the Rice Research Extension Center showed positive yield responses to both P and K. Soybean fertilized with 80 to 160 lb K_2O P_2O_5/acre/yr each produced 3.1 bu/acre greater yields than soybean receiving no P or K.

A time of P and K fertilization trial was established at the PTRS in fall 2010 and was fertilized and soil sampled. However, the plots were abandoned after replanting four times due to deer damage or poor stand establishment. Soil test results in April showed that only 11 to 16% of the P and 35 to 37% of the applied K fertilizer was recovered by the soil test 1 to 6 months after application.

To date we have 45 site-years in our soil test P database for soybean with yield being significantly affected at 12 site-years. Soil test P explains only 30% of the variability in soybean yield indicating that it is not a highly accurate indicator or soybean response to P fertilization. However, soil test P has shown to be the soil test parameter most highly correlated with soybean yield response to P fertilization. Including other soil test measurements (like pH, organic matter, and/or soil test Ca or Fe) has not improved its accuracy. A critical mass of soils that show consistent responses to P fertilization is needed before soils samples can be more intensively examined for important chemical properties that may indicate P deficiency. The analysis suggests 20 ppm (95% CI = 13 to 28 ppm) as the critical level. Trifoliate leaf P concentrations were less accurate predictors of soybean relative yield than soil test P.

Economic Analysis of Soybean Production Practices

Current Investigator: Dr. C. Robert Stark, Jr.

2011 ACCOMPLISHMENTS AND PROGRESS TO DATE: (by objectives)

(1) *Conduct an economic analysis of production practices used in the Arkansas Soybean Research Verification Program that impact profitability and verify Extension recommendations. (J. Ross, C. Grimes, & S. Kelley)*

Economic data collection has been completed. Coordinators Grimes and Kelley have submitted field data sheets on the sixteen fields signed up statewide. Individual field files have been developed for each cooperating producer/county agent and data entries are being checked for completeness and clarity. Analysis is being conducted using the Excel program developed by UA-AEAB faculty.

(2) *Standardize the economic analysis by integrating the 2010 verification data with data from previous years. This will document the long-term benefits of the Arkansas Soybean Research Verification program. (J.*

Ross, C. Grimes, & S. Kelley) Economic data from the 2010 fields has been added to the 1983-2009 data set with summary statistics recalculated. The full set of economic tables is being revised to use a Oct. 1-Dec. 31 state average price for the past six years and will be published on the UA-CES website.

(3) *Provide economic assistance and interpretation for determining yield response by planting date using database created from previous Arkansas Soybean Research Verification Program annual reports (T. Griffin) Annual* reports data was utilized to develop a chemical use database. Results showed patterns and nature of chemical use and were presented at the 66th Annual International SWCS Conference on July 19. Slides are available at the 2011 Conference website with a CES fact sheet to be released. Interest in similar studies using cotton and rice verification program data has been generated and these databases are being added in consistent manner to the soybean database.

(4) *Develop and analyze a historical economic database for commercial soybean production at the Rohwer*

Research Station. (L. Earnest) Database development continues to be compiled with current year fields. Time constraints and the variation between years have complicated analysis of this study.

(5) *Provide economic assistance and interpretation of agronomic results for the following and other similar projects previously funded or proposed for funding by the Arkansas Soybean Promotion Board.*

"Improving Technology Transfer of Profitable and Sustainable Soybean Production." (J. Ross). Arkansas Market Reports publications were moved to the UA-CES Arkansas Crop Update weekly newsletter and are still posted at http://www.uaex.edu/depts/ag_economics/publications/soybean_news/default.htm. Forty six weekly

market reports have been released to date in 2011. Weekly cash/forward market price averages are calculated across all NASS Arkansas soybean reporting locations and summarized statewide. Two selected papers were generated: ―Identifying Quantity Trends in Agricultural Chemical Use for Soybean Production Using State Research Verification Program Historical Data," July 19, 66th International Annual Conference of the SWCS in Washington, DC and ―Searching for the Golden Grail: An Optimal Soybean Marketing Frequency Strategy," February 2011 Southern Agricultural Economics Association Meeting, Corpus Christi, TX. A 2010 SAEA paper was developed into a UA-CES Fact Sheet, *Seasonal Price Patterns for Arkansas Soybeans*, FSA5. I attended the Rice Expo Field Day at Stuttgart on August 4 to gather new soybean research information and confer with other project faculty.

"Improving Yield and Yield Stability for Irrigated Soybean." (P. Francis). This study on delayed starting of the irrigation system builds represents a three year expansion of a previous related study. Economic analysis is being initiated on the full data set provided by the study. Findings will be published in extension and professional journal outlets. A poster was coauthored with Dr. Ross, ―Estimating Yield Potential by Planting Date Utilizing Observed Data from the Rice and Soybean Research Verification Programs." Dr. Ross presented the poster to the American Society of Agronomy in October, 2011.

(6) *Finish adapting the Nalley portfolio analysis concept for rice variety selection to soybean using Arkansas Soybean Performance Trial data. (L. Nalley).* Data entry is complete and econometric analysis has been conducted. Complications specific to soybean such as the large number of varieties used in a single year and the accelerated turnover of available varieties in successive years are being addressed. Result interpretations should be finished by January 2012 with a journal submission and CES newsletter articles to follow.

Commercialization and Discovery of Biocontrol Agents for Soybean Nematodes

Investigator: Amy Thomas, Robert Robbins, Burt Bluhm, Terry Kirkpatrick, and Rick Cartwright

Production System: Full Season Soybean Production System

Status: Year 2 of 3

Date of Report: 12-1-2011

Report:
Using phylogenetic analyses, it has been determined that ARF18 is indeed a previously unidentified fungus. It is an Ascomycete in the family Orbiliaceae and in the genus Brachyphoris.

During the summer of 2011, a TaqMan probe was designed and confirmed to function in qPCR. A method to extract genomic DNA from soil was also established. By using the DNA extraction method and qPCR, we should be able to identify the presence of ARF18 in a soil sample. This is still being tested for accuracy.

All SCN samples collected at harvest in 2010 were examined for the presence of ARF18 during the winter and early spring of 2011. Many of the SCN eggs were infected with TN14 which correlated to lower SCN populations in the treated plots.

Field trials were conducted at the Southwest Research and Extension Center (Hope) and University of Arkansas Farm (Fayetteville). The two sites at Fayetteville had been inoculated with ARf18 (isolate TN14) during the 2010 season. The plots were reinoculated at planting with TN14 pellets in 2011. One site at Hope was used the 2010 and was reinoculated with both TN14 pellets and SCN eggs in 2011. The other Hope site was newly established this year by inoculating with TN14 and SCN eggs. Soil samples were collected at harvest to be examined for the presence of TN14 both in the soil and on the SCN eggs.

Finding the cause of declining SCN numbers in an ongoing experiment at the Pine Tree Station has proven to be elusive. Additional attempts will be made this winter on cysts from plots inoculated with high numbers of SCN at planting.

Breeding Soybean Cultivars with High Yield Potential and Local Adaptation

Pengyin Chen …….. Soybean Breeder, University of Arkansas

Ozark and Osage continued to perform well in AR and remain to be popular conventional cultivar choices. The Arkansas Foundation Seed Program sold 3,391 units of Ozark and 3,605 units of Osage foundation seed in 2010-2011. In 2011, we grew 50 acres of Ozark, 72 acres of Osage, 57 acres of our new cultivar UA 4910, and 1 acre of our future new MG 5 release (UA 5612). UA 5612 has great yield potential as compared to check cultivars in USDA trials, and will be an excellent MG 5 cultivar for Arkansas farmers.

RR2 trait has been incorporated into Ozark, UA 4805, Osage, UA 4910 and many other high-yielding conventional lines. In 2011, we evaluated 99 RR2 lines and selected 186 new RR2 progeny lines with diverse genetic backgrounds. We expect to have high-yielding RR2 lines on the market by 2013. In addition, we increased six high yield RR1 lines, one of which will be released in 2012.

We evaluated two high protein lines in the 2011 Regional Quality Trait Test for MG 5. We tested a total of 236 high protein lines and 36 advanced low phytate/low stachyose lines. We are trying to incorporate low phytate/modified sugar trait into high protein lines. For that purpose, we screen for low-phytate and suitable sugar profile in our preliminary lines, and advance only lines having the desired trait combinations.

We released R99-1613F, R01-2731F, and R01-3474F as germplasm lines with diverse pedigree in 2011. They were derived from crosses with exotic soybean germplasm and expected to contain unique genes of interest for our breeding program. All three lines showed great (>90%) yield potential, as compared to check cultivar AG4403, Dillon, and 5601T, respectively.

We have also selected lines with high oil content or modified fatty acids for crushing and biodiesel. We have a total of 22 advanced lines with high oil concentration ranging from 22 to 25%. In 2011, we tested 36 low linolenic acid advanced lines, and 16 advanced lines with either mid-oleic or low saturated fats. We evaluated two mid-oleic lines, two low linolenic lines, two low saturated fat lines, and one high oil line in the 2011 Regional Quality Trait Test for MG 5. We are trying to improve yield of modified oil lines, combine these unique fatty acid traits, and incorporate modified oil traits into high protein lines. We screen for modified fatty acid profile and high protein in our preliminary lines.

We evaluated a total of 9 and 29 of the most advanced lines in the Arkansas Soybean Performance Tests and the USDA Regional Tests, respectively. We also tested 81 advanced, 137 intermediate, 368 preliminary conventional lines, 27 advanced RR1, 165 preliminary RR1 lines, 126 genetic diversity lines, 35 stink bug resistant lines, and 193 drought tolerant lines. In addition, we selected 1850 progeny rows and advanced 783 breeding populations in 2011. For food-grade soybean, we evaluated 140 large-seeded lines and 405 small-seeded lines. In addition, we purified 4 acres of our best large-seeded line, R08-4002. We will grow 15 acres of R08-4002 in our winter nursery this winter season, and seed will be available to farmers interested in edamame production in 2012.

Screening Soybean Germplasm and Breeding Soybeans for Flood Tolerance

Pengyin Chen Soybean Breeder, University of Arkansas

Advanced Lines

We evaluated a total of 60 advanced lines for flood tolerance in a 6-rep test at Stuttgart in 2011. These lines were selected based on their extreme responses in a preliminary screening. Some of flood tolerant lines are Anand, Manokin, NC Roy, Ozark, Osage, Young, R01-2731F, R08-2496, and PI 587619. Some of flood sensitive lines are Musen, PI 67629A, PI 567657, PI 567682B, N96-6755, R01-4353, and R02-6268F. The objective of this study was to confirm genotypic response to flood stress. Plants were subjected to flood condition for two weeks at R2 growth stage. Visual ratings for flood damage were taken weekly after the removal of flood water for four weeks. At maturity, number of healthy and dead plants was counted for each line.

We also screened 29 high-yielding MG4-5 lines in a flood test with 3 reps, 3 of which appeared to be flood tolerant. These lines have been entered in the 2011 USDA uniform / preliminary tests. Some of these lines will be released as cultivar of germplasm lines in the future. In addition, we screened 25 drought tolerant lines in a flood test with 3 reps to see their response to flooding stress and relationship with drought tolerance. Four of these lines turned out to be flood tolerant.

Preliminary Lines

We evaluated 14 preliminary lines in non-replicated trials at two locations in 2011. Some of these lines may have slow-wilting trait as well. In addition, we conducted flood screening at Portageville, MO and Stuttgart, AR for two breeding populations in 2011, including 148 lines from 5002T x 91210-350 and 150 lines from RA-452 x Osage in a 2-rep test. Twenty two lines from RA452 x Osage appeared to be flood tolerant.

Progeny Rows and Plant Populations

We have a total of 163 lines from 4 populations specifically developed for flood tolerance project in progeny rows at Stuttgart, AR in 2011. These populations are PI 471931 x 91210-350, RA 452 x 91210-350, RA 452 x Osage, and RA 452 x PI 471938. We also have a total of 120 lines from 2 other populations (PI 471931 x PI 471938 and R01-52F x N97-9658) that can be used for flood tolerance study. In collaboration with University of Missouri, we screened 75 lines from a Missouri genetic population in a 3-rep test for gene mapping purposes; 13 lines appeared to be flood tolerant. In addition, we advanced 2, 4, 5, and 7 populations in F_4, F_3, F_2, and F_1 nursery, respectively, at Fayetteville, AR in 2011.

New Crosses and populations

In summer 2011 we made five new cross combinations (R04-342 X 91210-350, Lee 68 X Clark, S-100 X Clark, Dare X Lee 68, and Dare X S-100). The new plant populations will be used to study flood tolerance genes and markers as well as salt tolerance.

Soybean Germplasm Enhancement Using Genetic Diversity

Pengyin Chen ***Soybean Breeder, University of Arkansas***

One of the important aspects of the U of A soybean breeding program is to develop diverse germplasm that will broaden the genetic background and improve the southern soybean gene pool. The following are a few highlights of our research accomplishments in 2011:

Genetic Diversity for Yield Improvement

In order to broaden the genetic background while maintaining or increasing yield potential, we made 17 new crosses in summer 2011. Crosses were made among our high yielding lines with diverse pedigrees, or between our high yielding lines and lines from other state or from other countries. We took data on yield, maturity, height, lodging and overall agronomic ratings to select the best lines from advanced and preliminary diversity tests. We selected 670 single plants from early generation materials with diverse pedigree for 2012 diversity progeny rows.

Disease Resistance

We made 5 new crosses for Phomopsis Seed Decay (PSD) and 3 crosses for Southern Death Syndrome (SDS) in summer 2011. We selected 5 best lines from a PSD genetic population and 1 best line from PSD progeny rows. And we selected 150 best lines from 7 different SDS genetic populations and 9 best lines from an Asian Soybean Rust genetic population. All these selected best lines will be advanced to 2012 Arkansas Preliminary Test. We selected 20 single for 2012 SDS progeny rows and 60 single for 2012 Asian Rust progeny rows.

Sugar Profile

We made 13 new crosses for the sugar project. High sucrose/low stachyose lines were crossed with high yielding lines to improve yield potential, while high sucrose/low stachyose lines were crossed with large seed lines to develop food-grade lines. High sucrose lines were crossed with high protein lines to combine the desired traits for food and feed purposes. We selected 14 best lines from one sugar genetic population and 10 best lines from sugar progeny rows. All these selected best lines will be advanced to 2012 Arkansas Preliminary Test. We will measure the sugar content of 27 entries in 2011 vegetative soybean test to select the best lines for edamame production. We selected 30 single plants for 2012 sugar progeny rows. We also pulled 185 single plants for 2012 progeny rows with sugar combined with other traits.

Food-Grade Soybean

We made 6 new crosses for developing vegetative soybean lines. We also selected 4 best lines from vegetable soybean progeny rows. All these selected lines will be advanced to 2012 Arkansas Preliminary Test. We also selected 120 single plants for 2012 vegetative soybean progeny rows.

Development of Germplasm with Drought or Water-Logging tolerance

We made 12 new crosses for drought tolerance and 2 crosses for flood tolerance breeding. We selected 55 best lines from 4 different flood-tolerance genetic populations and 12 best lines from flood tolerance progeny rows. We selected 113 best lines from drought tolerance progeny rows. All these selected lines will be advanced to 2012 Arkansas Preliminary Test. We pulled 330 single plants for 2012 drought tolerance progeny rows and 55 single plants for 2012 flood tolerance progeny rows.

Assessment of Soybean Varieties in Arkansas for Sensitivity to Chloride Injury

Investigators: Dr. Steven Green; (Cooperators) – Matt Conatser, Dr. Rick Cartwright, Dr. Pengyin Chen, Don Dombek, and Dr. Jeremy Ross

Production System: None – Variety Testing

Status: Ongoing (year 3 of 3, current cycle)

Date of Report: 11-17-2011

Report:

The number of chloride tests performed was up for 2011 with more than 2,600 plants screened for individual chloride reaction compared to roughly 2,000 in 2010. The University of Arkansas Variety Testing Program submitted 255 soybean cultivars for chloride reaction screening; the results from that test as reported by mean percentage reaction by maturity group, are listed in Table 1. This program also tested 88 soybean breeding lines from private seed companies in 2011. All chloride screenings were conducted and reported accurately and promptly.

As shown in Table 1, maturity group four (MG4) soybean cultivars in the University of Arkansas Variety Testing Program FST4 test continue to be deficient in available chloride excluder genetics. This low percentage of chloride excluder cultivars poses a problem due to the flexibility and popularity of MG4 soybean varieties in Arkansas, combined with the continual increase of chloride affected land in our state. Future testing and research is needed to develop soybean cultivars tolerant to high levels of chloride salts for the future security and productivity of Arkansas soybean producers and those around the world.

The Principal Investigator and Cooperators involved with this program would like to thank the Arkansas Soybean Promotion Board and Arkansas soybean producers for their continued support.

Table 1

2011 mean percentage chloride reaction by maturity group

Test	% Excluder	% Includer	% Mixed
FST4	18	66	16
FST5	51	33	16
NRR4	16	53	31
NRR5	36	53	11

Comprehensive Disease Screening of Soybean Varieties in Arkansas

T.L. Kirkpatrick & Kimberly (Hurst) Rowe, U of A Southwest Research & Extension Center, Hope.

R.T. Robbins, Devany Crippen- UAF – Dept. of Plant Pathology.

W.S. Monfort & Michael Emerson, Cooperative Extension Service, RREC & Lonoke.

All of the 260 Roundup Ready and non-Roundup Ready cultivars entered in the 2011 OVT, as well as the EPT, were screened for resistance to root-knot nematode at the SWREC in Hope and Soybean Cyst Nematode races 2, 3, 5, and 14 at UAF. New cultivar entries were screened for reniform nematode response at UAF.

The foliar disease portion of this program is being conducted at various locations throughout the state. Screening for frogeye leaf spot was conducted at the Newport station. The first inoculum was applied during the second week of July under the center-pivot irrigation system, and the disease pressure was sufficiently uniform and severe to allow a good evaluation. The Aerial blight screen was attempted but data were not consistent due to the extremely hot, dry growing season and were therefore, not reported for 2011.

Data were transferred to Jeremy Ross and used to develop the 2011 Soybean Update and revision of the SOYVA programs by our stated goal of November 15. Our screening results data tables are too large to list in this summary, but can be obtained at: www.arkansasvarietytesting.com, or by contacting

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Terry Kirkpatrick (870) 777-9702, ext. 111; tkirkpatrick@uaex.edu

Impact:

In 2011, Arkansas produced approximately 100 million bushels of soybeans worth over 1 billion dollars. Estimates of yield losses in Arkansas are around 17% annually according to recent surveys by the Southern Soybean Disease Workers. If even half of these losses are prevented in the coming year by selecting an appropriate resistant cultivar, a conservative estimate would be about 10 million additional bushels of soybeans for sale by our soybean producers, a potential gain of approximately 81 million dollars into the state's economy. The output from this project allows our growers to make better cultivar selection choices by providing a current and comprehensive database on the susceptibility or resistance of new cultivars to our major diseases.

Streamlining the Disease Screening Effort by Relocation of the Existing Stem Canker Screen to Newport and Developing a Technique for Screening for SDS-Summary 2011

T.L. Kirkpatrick & Kimberly (Hurst) Rowe, U of A Southwest Research & Extension Center, Hope.
W.S. Monfort, Cooperative Extension Service, RREC & Lonoke.

All of the 260 Roundup Ready and non-Roundup Ready cultivars entered in the 2011 OVT, as well as the EPT, were screened for resistance to stem canker at the Newport station using the toothpick inoculation technique. Plots were planted the second week in May and were inoculated in early-July. Disease symptoms began emerging in mid-August and ratings were taken and proved to be consistent among replications. Since the relocation was done successfully, the stem canker-portion of this project will be reintegrated into the Comprehensive Disease Screening project.

Data were transferred to Jeremy Ross and used to develop the 2011 Soybean Update and revision of the SOYVA programs by our stated goal of November 15. Our screening results data tables are too large to list in this summary, but can be obtained at: www.arkansasvarietytesting.com, or by contacting
Kim Rowe (870)777-9702, ext. 106 krowe@uaex.edu
Terry Kirkpatrick (870) 777-9702, ext. 111; tkirkpatrick@uaex.edu

Protocol development for the SDS screening technique was attempted using a culture of *Fusarium solani* obtained from Dr. John Rupe at UAF. The inoculum was generated on sterilized millet seed and was applied into the soil at planting in the temperature-controlled beds at the Lonoke greenhouse facility. Although, SDS-like symptoms appeared on the leaves several weeks after planting, it was determined by Dr. John Rupe that the disease was not sufficiently present within the plants to produce a foliar response upon his examination of the roots. In 2012 efforts will continue, beginning with reisolation of the pathogen to generate a more virulent inoculum. The temperature-controlled beds will be adjusted to increase the soil temperature, and different methods will be researched and attempted.

Impact:

In 2011, Arkansas produced approximately 100 million bushels of soybeans worth over 1 billion dollars. Estimates of yield losses in Arkansas are around 17% annually according to recent surveys by the Southern Soybean Disease Workers. If even half of these losses are prevented in the coming year by selecting an appropriate resistant cultivar, a conservative estimate would be about 10 million additional bushels of soybeans for sale by our soybean producers, a potential gain of approximately 81 million dollars into the state's economy. The output from this project allows our growers to make better cultivar selection choices by providing a current and comprehensive database on the susceptibility or resistance of new cultivars to our major diseases.

Arkansas Biodiesel Promotion and Education Project: Phase III (2011-2012)

Investigators: Don W. Edgar, Donald M. Johnson, George W. Wardlow, and Leslie D. Edgar

Status: Reporting on year 1 of 2

I. Year 1 Results to Date Report

II.

A. **Curriculum & Handout Review -** Development of project curriculum towards an adult audience was accomplished. Curriculum was reviewed and revisions were made based on evaluation by the panel of experts before implementation.

B. **Project Field Test -** The demonstration uses a three cylinder Kubota diesel engine mounted on a trailer to travel to locations for presentation. The engine was outfitted with a *Land and Sea* dynamometer to record horsepower and torque. Further information is presented towards efficiency and emissions of biodiesel. Positive impacts have been seen as a result of this project resulting in implementing and testing of the project goals.

C. **Project Demonstrations & Travel -** Project demonstrations have proved valuable and are progressing. To date, three demonstrations to adult audiences have occurred. The project was able to present a 6 hour workshop to the North East COOP center for agricultural science instructors. Project personnel were also able to present at the Biomass Conference in Little Rock, AR to extension group personnel. A further demonstration was held at the C.A. Vines 4-H Center at Ferndale on October 7, 2011. Another event involved youth from an area school about alternative energy performance.

D. **Preliminary Results -** The project has been presented to three workshops and a conference with audiences of nearly 500 participants. Additionally, the project has disseminated curriculum to all interested participants about biodiesel performance and emission. It should be noted that an additional facet of this project has led investigators to develop a perceptions of biodiesel instrument to collect data targeting an adult audience. Current dialog is underway with state personnel in the AR CES organization to identify producers and farmers to target for dissemination of the instrument. Data has currently been gathered from post secondary students at the University of Arkansas, Texas Tech University, and Utah State University (N = 275) with an additional 100 participants expected from Illinois State University. Project personnel are excited about the impact that this data will reveal towards understanding consumers and producers about biodiesel. Further audiences reached through popular publications such as news articles and magazines have resulted in six stories being written about biodiesel towards the performance and emission qualities in local, regional and state distribution areas.

E. **On-going Evaluations -** The curriculum and performance aspects of this project are currently evaluated based on the needs and interests of the clientele served. Project investigators believe it is extremely important towards the adoption of this innovative and sustainable fuel source to increase knowledge and positively affect public perceptions. The impact of this project is an on-going analysis of participants knowledge and perceptions but one that is held to believe can and will be changed. The ability to see real-time results that are technologically proven through the demonstration unit impact perceptions and knowledge held by participants.

Bioactive Peptides Prepared from High Oleic Acid Soybean Lines

Investigators: Navam Hettiarachchy and Pengyin Chen

Production system: Full-season soybean production system (FSSPS)

Status: Reporting on year 3 of 3

Date of Report: 11-28-2011

Report:

Based on the amino acid profile and protein content, two high oleic (N98-4445A, S03-543CR) and one high-yielding, high-protein (R95-1705) lines that are grown in Arkansas were selected for preparing the bioactive peptides (protein fragments). The meals from the three lines were used to prepare the peptides and were tested with laboratory simulated gastro-intestinal (GI) juice to emulate GI environment resistance. The GI resistant protein fragments (peptides) were separated based on molecular size into different (<5, 5-10 and 10-50kDa) fractions which were then tested for anti-cancer activity on multiple sites involving human colon, liver, lung, blood, breast and prostate cancer cells.

Significant inhibition (65-70%) of liver, lung, colon, blood, breast and prostate cancer cell growth was demonstrated by the gastro-intestinal resistant protein fractions derived from the high oleic acid and high protein soybean lines. The protein fractions from high oleic acid line showed more potency, specifically, the 10-50kDa fraction from the high oleic N98-4445A soybean line. Furthermore, three single peptides were isolated from the fraction and one pure peptide was studied for enhanced (ranging between 75-80%) anti-cancer effect on colon and liver cancer cell lines. A research paper for publication has been submitted based on the anti-cancer activity of the peptide fractions.

The <5kDa and 10-50kDa protein fractions from N98-4445A also showed significant (59-61%) anti-hypertensive (ability to reduce blood pressure) activity. The 10-50kDa was further purified using separation techniques and three pure single peptides were obtained. Presently the single pure peptide with highest anti-cancer activity is being prepared in larger amounts and being tested for anti-Alzheimer‘s and anti-Obesity activity which will be completed by 3/31/12.

Research highlights and impact: Production of gastro-intestinal resistant multi-site anti-cancer protein fragments (peptides) that can pass freely without any degradation through the gastro-intestinal tract (when ingested) has been documented for the first time using high oleic acid soybean lines grown in Arkansas. Positive results from this study will revolutionize the concept of preparing peptides with significant bioactivities against human chronic disease. We have selected the best soybean lines, extracted the protein with highest purity (approximately 93%), prepared GI resistant molecular size protein fragments, determined anti-cancer activity and purified the single peptides from the fraction with highest multi-site anti-cancer activity. This has commercial interest in utilizing the soybean meals from high oleic acid lines for their nutraceutical potential that would be economically advantageous to both Arkansas soybean growers and the soybean processing industry. Using these promising data proposals will be written at national level to investigate the bioavailability and stability of these protein fragments for value added uses in food products.

A Comprehensive Approach to Assessing Soybean Varieties for Chloride Toxicity

Investigators: K.L. Korth and P. Chen

Production System: Full Season (FSSPS)

Status: Reporting on year 3 of 3

Date of Report: 12-1-2011

Report:

Salt damage to soybeans in Arkansas continues to be a growing problem. We have developed a standardized and consistent greenhouse method for testing chloride toxicity as one of the major accomplishments of this project. Using this technique, we get rapid and highly reproducible results which identify salt-tolerant and -sensitive lines. Leaf symptoms of salt stress, such as chlorosis and leaf scorching, are clearly visible after 7-10 days on salt-treated chloride ―includer" lines. The visual scoring of varieties correlates very well with mineral analysis, *i.e.*, lines that accumulate highest levels of chloride in leaves after 7-10 days of salt treatment show the most severe symptoms. In addition to visible screening of treated plants, we developed a simple measurement of chlorophyll levels in salt-treated lines. The chlorophyll data clearly show that salt-treated chloride excluders (*e.g.*, Lee68 and S-100) accumulate more chlorophyll than includer lines (*e.g.*, Clark and Dare). Using these methods and measurement of chloride uptake, we completed a thorough screen of 81 lines and varieties that are part of the University of Arkansas soybean breeding program.

A second objective of this work was to develop genetic populations of soybean that can be useful in identifying molecular markers for breeding salt tolerance. In an effort to analyze quantitative trait loci (QTL) for salt tolerance, populations have were produced via crosses between chloride includers and excluders, specifically *cv.* Dare x Lee 68 and *cv.* Williams x S-100. These populations will be expanded in future studies to the F_3 generation to generate enough seed and plant material for molecular marker studies.

Lines and varieties identified in the screening process as highly tolerant or susceptible to chloride stress have been the focus of mechanistic studies to determine the reason(s) behind enhanced salt tolerance. We have measured expression of candidate genes that were proposed to be involved in plant stress responses. We identified a gene whose expression is strongly enhanced following salt tolerance. It turns out that this gene seems to be equally induced in both includer and excluder lines tested. We conclude that although they do not show equivalent plant performance or symptoms in response to salt, both includer and excluder lines respond to high-salt conditions in some similar ways at the molecular level. We have also gathered evidence to suggest that salt damage results from transport that is occurring prior to salt entry into leaves. This result suggests that the mechanistic target for chloride toxicity is found in the roots or at least within the plant vascular system. We hope to pursue this finding in future work.

Salt tolerance in soybeans is often described in terms of chloride uptake to foliar tissues. We screened soybean lines with two forms of salt solution, NaCl and $CaCl_2$. We have found, as is the case in many plant species, that Na^+ is also particularly damaging to soybean plants, as compared to the Ca^{++} form of salt. These results need to be considered as we pursue improved plant lines, and as growers search for ways to manage increasing salt levels in the field.

Intensification of Protein Content in Soybean Meals

Investigator: Ruben O. Morawicki

Production System: No specific

Reporting year: 2 of 3

Approach and results

The first objective of year 2 was to study the effect of temperatures higher than 100°C (212°F) on the removal of carbohydrates from soybean meals to ultimately increase their protein content. In order to maximize the extraction of carbohydrates the best combinations of temperature, time, and acid concentration were studied using a central composite rotatable experimental design (CCRD).

We tested three temperatures (105°C, 120°C; and 135°C), tree concentration of sulfuric acid in water (0.5; 1.25; and 2%), and three hydrolysis times (15, 30, and 40 min). Experimental runs were performed in a laboratory autoclave in order to generate temperatures under pressure above the boiling point of water at atmospheric pressure.

The type of experimental design used, CCRD, allowed the combination of the levels efficiently for the 3 factors and at the end generated responses that produce the same level of protein at different temperatures, times, and concentration of acid. Starting with a soybean meal containing 48% protein, the highest increment in protein content was achieved for the combination 120°C, 0.5% acid, and 45 min of hydrolysis. These treatments boosted the protein content from 48 to 58 %. Similar results were obtained for temperature-time-concentration combination of 105°C, 1.25% acid, and 30 min, and 135°C, 0.5% acid, and 15 min.

Samples treated as described in the above experiment were taken a step further by treating them with enzymes capable of hydrolyzing cellulose. High pressure treated soybean meal with acid concentrations of 0.5%; 1.25%; and 2% at 135ºC (32 PSI) during 45 minutes were used for this experiment, plus a control that was treated with the same conditions of temperature and time but without acid. Enzymes used for this experiment were cellulase, beta-glucosidase, and cellulase plus beta-glucosidase for 8 hours at 25°C: at a concentration of 0.02 ml of enzyme /ml solution. The beta-glycosidase solution was prepared from a solution with 10 mg enzyme (>6 units/mg solid) /ml buffer acetate pH 5.0. The Cellulase solution was prepared directly from the aqueous solution presentation (≥700 U/g).

For the control, we observed a moderate increase in protein concentration of 5 points, thus boosting the protein content from 48 to 53%. The use of enzymes, though, showed a marginal effect at increasing the protein content of treated samples with high temperature and pressure.

Improving Technology Transfer for Profitable and Sustainable Soybean Production

Investigators: Jeremy Ross, Chris Grimes, Steve Kelley, and other select Extension soybean commodity committee members

Production System: Alternative Research

Stated Goal: To ensure that improved production practices for soybean production in Arkansas are distributed in a timely manner.

Specific Objectives:

1. **To ensure timely development and distribution of the Soybean Update publications (Early-Planted and Conventional/Doublecrop Production Systems) as well as the *SOYVA* computer assisted variety selection program.**
   The data for the 2011 Soybean Updates is being compiled, and an electronic form of the Updates should be distributed by the middle of December, 2011. SOYVA will be updated and released soon after the 2011 Updates are released.

2. **To improve the rate of technology transfer and adaption by the implementation of educational programs that impart critical decision-making information at advisory and producer level for improved profitability for sustainable soybean production systems (non-irrigated and irrigated), including the use of weekly electronic soybean reports (e-mail and web versions) and timely newsletters such as Arkansas Weekly Soybean Report, Soybean Notes, and Arkansas Soybean Rust Working Group Update.**
   Weekly newsletters were distributed on a weekly basis during the 2011 growing season. Newsletters were sent electronically using the Arkansas Soybean list server, which contains 1000+ email addresses.

   Continue to coordinate state and regional meetings to facilitate the latest soybean production updates. These will include the Arkansas Soybean Research Conference, Tri-State Soybean Forum, as well as other events deemed necessary by emerging production problems.

   The 2011 Arkansas Soybean Research Conference will be held at the Grand Prairie Center in Stuttgart on December 13. Research talks covering how stress effects soybean, soybean breeding program, double-crop research, maximum yield research, and herbicide project. 250+ growers, consultants, industry personal, and county agents are expected attended this conference. The University of Arkansas was also represented at the Tri-State Soybean Forum on January 6, 2012. Two talks were given by University of Arkansas personal.

3. To increase the awareness of county extension agents, consultants, agribusiness representatives, concerned producers of the status, direction, and value of current soybean research and Extension efforts.

With the increase in use and marketing of soybean inoculants, several strip trials were established across the soybean growing region of Arkansas. With the help of county agents and soybean producers, these trials showed little difference in use of soybean inoculants compared to untreated plots. Updated on soybean seed quality, soybean rust, LibertyLink soybean, and the 2011 soybean progress were given at several county field days, research station field days, and industry field days.

Developing a Disease Screening Protocol for the Evaluation of Cultivars for Resistance to Phytophthora Sojae in Arkansas

Investigators: Craig Rothrock, John Rupe, Terry Kirkpatrick

Production system: Alternative

Status: Reporting on year 2 of 3

Date of Report: 12/1/2011

The goal is to develop an efficient reproducible protocol for the evaluation of cultivars, similar to development of protocols for other diseases. Cultivars included in the early planted and fully-season and double crop variety trials will be evaluated to provide disease reactions to Phytophthora root and stem rot. The soil bioassay technique used in year 1 for soil collected from the Rohwer Research Station and the Northeast Research and Extension Center, Keiser will be limited to collection of isolates and characterizing populations in Arkansas because interpretation of results was complicated by seedling disease pathogens and inoculum variability. A new inoculum-layer technique that can screen for race specific resistance and race non-specific resistance, field resistance was developed in year 2. This procedure is currently using isolates (races) collected in 2010 by a student in John Rupe‛s lab. The inoculum-layer technique has been developed using vermiculite with a rice inoculum layer. The inocula consist of ratios of three races of *P. sojae*(that had been grown separately) or individual isolates. After two weeks, data, which include stand counts, root ratings (done as a group from each pot), and root dry weights are collected for the cultivars planted. In addition, research in year three will include the root scanning software WinRhizo to examine differences in root development among the cultivars tested to Phytophthora root and stem rot. The protocol has been limited to the evaluation of two susceptible cultivars of soybean, ‗Bedford‛ and ‗Hutchison,‛ and one resistant line, an isoline with the 1K gene. Only selected soybean cultivars have been evaluated at this time. However in year 3 as the level of rice inoculum needed to get repeatable results is finalized the cultivars in the variety testing program will be evaluated using the inoculum-layer technique using rice inoculum from several isolates of Phytophthora sojae from Arkansas. One problem that we have encountered is the fungicide seed treatments on many of the soybean cultivars. Currently, seeds are soaked in water and rinsed, but trace amounts of fungicide may be affect the results. This technique for cultivar evaluation will avoid the long soil incubation period and allow a more consistent determination of cultivar reaction. The protocol will be repeated with representative isolates found in Arkansas. By the end of the project's third year, the technique should have been used to evaluate the disease reaction of cultivars grown in Arkansas to existing races of *Phytophthora sojae* within the state and to characterize the nature of the cultivars' resistance to the disease. A technique for screening the cultivars will be available for the soybean disease screening program. In 2011, two field studies were conducted at Southeast Research Station at Rohwer and Northeast Research and Extension Center at Keiser using isolines with different resistance genes for Phytophthora root and stem rot. The trials were planted late and little disease pressure was evident. As a result, yields were similar among the lines. These trials are designed to examine yield losses associated with Phytophthora root and stem rot and characterize Phytophthora populations

Detection of Soybean Cyst, Reniform and Root-Knot Nematodesin Soil Using Multiplex Real-Time PCR

INVESTIGATORS: Ronald J. Sayler, Terry Kirkpatrick (Cooperator) – Bob Robbins

Background: This project was initiated in May 2009 to develop effective PCR detection methods for soybean cyst (SCN), root knot, and reniform nematodes, first individually and then in multiplex. The ultimate goal of this work is to assist the extension personal in processing the large numbers of soil samples. Due to changes in the soybean seed industry, growers are required to make variety selections earlier than ever before, so that they may obtain seed before inventories are depleted. A more rapid detection method will reduce turn-around in reporting of nematode population numbers and will assist growers in making these important decisions concerning seed purchases.

Reniform nematode detection: I have developed the first conventional and real-time PCR methods for reniform nematode detection and quantification. A publication on this assay will be submitted to the journal Plant Disease in early December. For the first time, molecular diagnostic methods have been developed for reniform nematode, one of the three economically important pests on soybean. In addition, the real-time PCR method is the first unbiased method for estimating reniform nematode numbers on plant roots and is a new research tool that will benefit plant breeders, plant pathologists and other researchers. I have incorporated the conventional PCR assay into a multiplex diagnostic assay for all three of the most important nematodes in Arkansas soybeans.

Multiplex assay: A multiplex DNA based PCR has been developed for soybean cyst, root-knot and reniform nematodes. The multiplex assay has been effective in detecting reniform, soybean cyst and root-knot nematode species individually. In addition, universal primers that detect all nematodes have successfully been used to check the effectiveness of our high throughput DNA extraction methods for DNA quality suitable for PCR detection. These universal primers will reduce the number of false negatives in the multiplex assay.

DNA extraction: We have compared the Rapid DNA extraction method to the Worm Lysis buffer (Figure 1). The Rapid DNA extraction method appears to provide more robust amplification and is faster and less expensive than the Worm Lysis buffer. However, sample DNA's are much more stable over time for PCR amplification in the worm lysis buffer. Sugar density centrifugation was the most reliable method for obtaining nematode samples suitable for accurately determining nematode species by multiplex PCR.

Additional deliverables: Thielaviopsis root rot, caused by the fungus *Thielaviopsis basicola* is one source of yield loss in soybeans. A conventional PCR detection method has been developed for this pathogen.

Summary: The multiplex assay has been developed on schedule and CSES personnel have received training. This assay is currently being validated using field samples with known nematode populations. Modifications to the DNA extraction and PCR assays have been investigated which would allow greater tolerance of soil in the nematode samples so as to speed processing time. The addition of bovine serum albumin and polyvinyl pyrolidone was found to improve amplification.

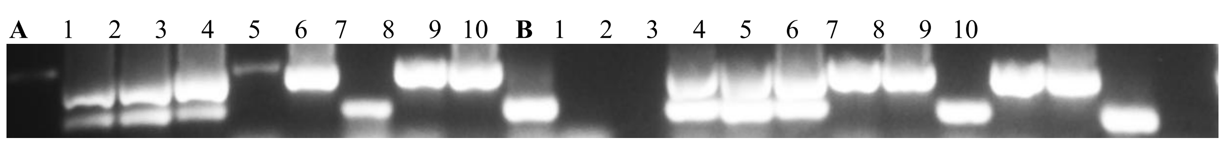


Figure 1. Comparison of DNA extraction methods including **A**. Worm lysis buffer and **B**. Rapid DNA extraction methods comparison. Lane 1. RKN (5), SCN (25), REN (25); 2 RKN (25), SCN (5), REN (25); 3. RKN (25), SNC (25), REN (5); 4. RKN (5); 5. SCN (5), 6. REN (5); 7. RKN (25); 8. SCN (25); 9. REN (25); 10. No template control. Number of worms extracted is listed in parenthesis.

Soybean Real-Time Weed and Disease Alerts

Investigators: Bob Reynolds and K.L. Smith

Status Report

December 2, 2011

Report:

Thirty-one soybean podcasts have been produced and posted to date, with five more, focusing on laboratory research, having been shot and are being edited for posting. Podcasts are posted through the Division of Agriculture web site and on YouTube, and the number of hits and visitors continues to grow.

The number of hits from January through December 2010 was 236,890 compared to January through November 2011, totaling 306,211. The number of visitors for the 2010 calendar year reached 44,682, compared to 55,717 for January through November 2011. An IP address for tracking is consider as a single visitor, and because a single IP address may have more than one user. See attachment for titles, dates and data on hits and visitors since 2009.

The soybean promotion board approved a full-time position in early 2011, and the position was filled August 8, 2011, later than proposed and anticipated, which resulted in a slowdown of podcast production May through July 2011. The individual hired, Ross Macartney, has extensive experience in video production and has been assertive in meeting specialists and producers, in gathering suggestions for podcasts and in producing podcasts in a timely manner. This year, we have added podcasts that report on laboratory research projects. Five have been taped and are being edited for posting beginning early next week.

Communications has compiled a fairly comprehensive list-serve of soybean producers notified each time a podcast is posted. Communications will be adding promotional podcasts after January 1, 2012, directed at producers to encourage greater participation in signing up for notification of podcast postings.

Soybean Podcast Web Stats Report

2011

1. 2010 Soybean Price Report - January 2011
2. Soybean Research Verification Program - January 2011
3. Tailwater Recovery System Incentives - January 2011
4. Tailwater Recovery System Advantages - January 2011
5. Don't Guess, Soil Test - February 2011
6. MP 144 Insecticide Recommendations for Soybean - February 2011
7. Irrigation Efficiency - February 2011
8. Choosing the Best Bean Variety - March 2011
9. Root-Knot Nematode Precautions - March 2011
10. Properly Calibrate Manure Spreaders - March 2011
11. "Niche Market" Edamame Vegetable Soybean - March 2011
12. Crop Rotation to Control Soybean Cyst Nematode - March 2011
13. 2011 Soybean Seed Issues - March 2011
14. Controlling Spring Annuals - March 2011
15. Fertility in Soybean Fields - March 2011
16. Planter Preparation - April 2011
17. Soybeans Today - May 2011
18. Which Herbicide Should You Use? - August 2011
19. Effective Crop Rotation for Managing Palmer Pigweed - August 2011
20. Pigweed and Reducing Seedbanks - August 2011
21. Bollworm Influx - August 2011
22. Soybean Loopers - September 2011
23. Arkansas Edamame - September 2011
24. Effective Crop Rotation Part 2: Rice - September 2011
25. Soybean Breeding Program in Arkansas - Part 1 - October 2011
26. Edamame: A New Industry Coming to Arkansas - October 2011
27. Nematode Extractor - October 2011
28. Soybean Disease Screening Program - October 2011
29. Soil Sampling - November 2011
30. Soybean Breeding Program in Arkansas - Part 2 - November 2011
31. Soybean Breeding Program in Arkansas - Part 3 - November 2011

Web Stats for 2011

	Number of Podcasts posted	Number of Hits	Number of Visitors
January	4	30,112	3,984
February	3	30,671	3,827
March*	8	33,220	4,845
April	1	26,655	4,501
May	1	26,778	4,472
June	0	22,850	4,804
July	0	26,790	5,603
August	4	29,062	6,070
September	3	29,679	7,438
October	4	25,279	5,162
November	3	23,337	4,749
December*		1,778	262
TOTAL	**31**	**306,211**	**55,717**

*These stats were compiled at 10:52 a.m. on December 2, 2011

2010

1. Pigweed Control in Liberty Link Soybean - December 2010
2. Hand Hoeing to Control Resistant Pigweed - December 2010
3. Soybean Supply/Demand Report - November 2010
4. Checkoff Funds Help Producers - November 2010
5. Soybean Checkoff Funds - November 2010
6. Insecticide Treated Seed - October 2010
7. Soybean Harvest Update - October 2010
8. Combine Reminders - September 2010
9. 2010 Soybean Crop Report - September 2010
10. 2010 Soybean Update - September 2010
11. Heat Stress in Soybean - August 2010
12. Soybean Disease Update - August 2010
13. Pigweed Control - August 2010
14. When to End Soybean Irrigation - August 2010
15. Arkansas Soybean Update - August 2010
16. Controlling Bollworm in Soybean - August 2010
17. 2010 Soybean Crop Update - July 2010
18. Herbicide Programs for Pigweed Control - July 2010
19. Spray Timing Critical for Pigweed Control - July 2010
20. Resistant Pigweed Field Day - July 7, 2010
21. UA4910 - A New Soybean Variety - Arkansas Agricultural Experiment Station
22. Sampling for Pests with a Sweepnet - June 29, 2010
23. Glyphosate Resistant Pigweed in Round-up Ready Soybean - June 21, 2010
24. Liberty Link Ignite - June 14, 2010
25. Soybean seed quality - June 7, 2010
26. Soybeans emerging ahead of last year, five-year pace - May 18, 2010
27. Conventional soybeans will always have a niche - May 18, 2010
28. Controlling Pigweed Seed before Germination - May 12, 2010
29. Reducing Nematodes in Soybean - April 19, 2010
30. Controlling Ryegrass in Spring - March 30, 2010
31. Controlling Horseweed in Wheat before Soybean - March 23, 2010
32. Burndown Herbicide Program in Soybean - March 10, 2010
33. 2010 Arkansas Soybean Quality and Availability - February 22, 2010
34. Potassium Fertilization Trends in Soybean - January 12, 2010

Web Stats for 2010	**Number of Podcasts posted**	**Number of Hits**	**Number of Visitors**
January	1	14,215	3,251
February	1	11,694	3,099
March	3	16,624	3,624
April	1	16,606	4,104
May	3	18,401	4,698
June	5	17,896	3,682
July	4	18,753	3,299
August	6	21,675	3,885
September	3	24,440	4,239
October	2	22,233	3,469
November	3	26,044	3,615
December	2	28,309	3,717
TOTAL	**34**	**236,890**	**44,682**

2009

1. Soybean Fertilization Research Results - December 14, 2009
2. Arkansas Soybean Harvest Update - November 18, 2009
3. Redbanded Stink Bug - November 9, 2009
4. Pest Pressures in Soybean 2009 - November 3, 2009
5. Using Molecular Markers in Soybean Breeding - October 26, 2009
6. Osage Seed Variety and Foundation Seeds Farm - October 19, 2009
7. Conventional Soybean Varieties - October 13, 2009
8. Pre-emerge Herbicides Can Control Resistant Pigweed - October 5, 2009
9. Reducing Next Year's Weed Pressures - September 28, 2009
10. Understanding Nematode Sample Test Results - September 17, 2009
11. Soybean Rust *Spray Advisory* - September 16, 2009
12. Soybean Rust Update - September 8, 2009
13. How to Test Soil for Nematodes - August 26, 2009
14. Comparing Liberty Link and Round-Up Ready Soybeans - August 17, 2009
15. Current Pest Problems in Arkansas Soybean - August 10, 2009
16. Arkansas Soybean Rust Monitoring Program - August 5, 2009
17. Round-Up Resistant Pigweed - July 22, 2009
18. Horseweed: A Major Problem in Soybean Following Wheat - July 15, 2009
19. Effective Treatment of Pigweed in Soybean - July 8, 2009
20. Impact of Late Planted Soybeans - June 25, 2009
21. Black Root Rot in Soybeans - June 18, 2009
22. Effects of Storage and Handling Conditions on Soybean Seed Quality - June 4, 2009
23. Horseweed in Wheat: A Major Problem in Soybean - June 1, 2009
24. Soybean Seed Quality - May 22, 2009

Web Stats for 2009*

	Number of Podcasts posted	**Number of Hits**	**Number of Visitors**
January			
February			
March			
April			
May	1	929	100
June	4	4,442	1,150
July	3	6,938	1,728
August	4	9,453	2,056
September	4	11,583	2,426
October	4	16,138	2,838
November	3	13,205	2,681
December	1	11,869	2,690
TOTAL	**24**	**74,557**	**15,669**

*Podcasts did not start until May 2009

Identification of the Factors That Cause Soybean Green Bean Syndrome

Investigators: Dr. Ioannis Tzanetakis and Dr. John Rupe, University of Arkansas
Cooperators: Dr. Marites Sales, University of Arkansas; Dr. Sead Sabanadzovic, Mississippi State University, Dr. Rodrigo Valverde

Green bean syndrome (GBS) is an elusive disorder that can have a major effect on yields. For example, in 2008, an 80-acre field in Prairie County was almost a total loss. We have focused on all aspects that can cause the disorder, both biotic and abiotic (physiological).

The GBS phenotype points to hormonal imbalance, something that phytoplasmas are known to cause. Actually, a report from Louisiana some 30 years ago provided some evidence that phytoplasmas are associated with GBS symptoms. Drs. Sabanadzovic, Valverde and Tzanetakis labs (Mississippi, Louisiana, and Arkansas) have processed at least 100 samples collected from about 10 fields in the three states showing typical GBS symptoms. It may be that a few scattered plants are infected with phytoplasmas but our results prove that GBS, in the scale we observed it in the field, **is not caused phytoplasmas**.

After eliminating the phytoplasma factor, we evaluated three other potential causes of GBS:
A. Stink bug feeding
B. Virus infection
C. Pod removal at different growth stages

The above experiments have been run in the last two years and we have good evidence of the role of those factors on the onset of the disorder.

A. Stink bug feeding
Two soybean varieties at V2 stage were placed in cages (treatment plants) whereas control plants remained on the greenhouse bench. A total of 116 - 166 green stinkbugs (*Acrosternum hilare)* were introduced to treatment plants over a one-month period. Pod size reduction was apparent in treatment plants compared to control plants (Fig. 1).

Fig.1. Effects of green stinkbugs (*Acrosternum hilare*) on soybean pod size. Cages with stinkbugs (left and middle) have smaller pod sizes than control plants of the same variety (right).

The affected plants are being grafted onto seedlings to determine if the disorder is caused by a graft-transmissible agent. If so, we will process the plants further to identify the agent.

B. Virus infection

We tested the ability of *Bean pod mottle virus* (BPMV) and *Tobacco ringspot virus* (TRSV) to cause symptoms. BPMV can cause green stem syndrome but not GBS, unlike TRSV infection that can clearly cause the disorder (Fig. 2).

Fig. 2. Effects of bean pod mottle (BPMV) and tobacco ringspot (TRSV) infection on soybean pod size. BPMV- green stem (left), TRSV - green bean (right).

C. Pod removal at different growth stages

A pod removal study was conducted this year with four cultivars: two indeterminate and two determinate cultivars that were late maturity group 4 and maturity group 5. Flowers were removed at R2 and pods were removed at R4, R5 and R6. When flowers were removed at R2, there was a slight delay in maturity, but by R5 all plants caught up and senesced at the same time. Removing pods at R4 delayed maturity throughout the season with the depodded plants remaining one to two growth stages behind the control plants. Depodding at R5 delayed maturity even more with most of the depodded plants only reaching R5 by the first frost. Depodding at R6 delayed maturity even further with plants reaching R4 and then not developing further. Plants depodded at R5 and R6 and several small pods at each node along with the more developed pods. This study showed that the later depodding occurs, the less likely the plants are to recover and produce mature seed. Some of these symptoms were similar to what was observed in fields affected by GBS.

Fig. 3. Left: Depodding study showing green plants that were depodded at different growth stages. Right: Plants depodded at R5 with a mixture of pods with developing seed and clusters of small pods.

Epidemiology of Soybean Vein Necrosis Virus

Investigator: Dr. Ioannis Tzanetakis, University of Arkansas

Soybean vein necrosis virus (SVNV) was first detected in Arkansas in mid-July this year. The late planting has obviously altered the timing of the disease and vectors. Notwithstanding, it appears that symptoms are becoming progressively more prominent in Arkansas, Missouri and Illinois where we collaborate with state and university scientists that scout routinely from SVNV symptoms.

We now have single thrips colonies in the genus *Frankliniella* and *Sericothrips* which are being used for virus transmission. The first round of experiments indicate that SVNV is indeed transmitted by a member of the two genera but taxonomical verification of the vector is pending.

A total of 24 plant species belonging to four families (Chenopodiaceae, Compositae, Leguminosae and Solanaceae) have been inoculated with SVNV and tested by RT-PCR for infection. All potential alternative hosts reported here were confirmed with two sets of specific SVNV primers and sequencing of the products. Among them, at least seven species other than soybean have been confirmed as SVNV hosts through mechanical transmission. The list includes: Tobacco (three species), morning glory, cowpea, pumpkin and chrysanthemum.

We have applied a new protein-nucleic acids hybrid technique (this is a new technique that is developed in the Tzanetakis lab and no additional information can be provided until published or patented) that makes detection simpler and minimize the time of testing to only few hours. We also have experiments under way where we evaluate the reaction of elite material to early infection to the virus. At this point all material appears susceptible to the virus although the vast majority of the available genotypes are yet to be evaluated.

Characteristics of Profitable Arkansas Crop Farms, 2000-2000

Investigators: Bruce L. Ahrendsen and Bruce L. Dixon

Production System: Project applies to all three systems and is not specific to one

Status: Reporting on year 1 of 3 of new project

Date of Report: 12-1-2011

Report:
The Agricultural Resource Management Survey (ARMS) annual data for 2000-2009 have been used to compute means of financial characteristics for soybean and other crop farms. Arkansas crops were divided into four farm types: soybeans, rice, cotton, and general and other cash grain. Eight financial variables are compared: gross cash farm income, government payments; net cash farm income, farm equity, current ratio, debt-to-asset ratio, operating expense ratio, and net working capital expense ratio. Analysis has: (1) compared financial characteristics of the four farm types, (2) compared Arkansas soybean farms with non-Arkansas Delta (NAD) and non-Arkansas U.S. (NAU) soybean farms, and (3) computed impact of the proposed $250,000 adjusted gross income (AGI) cap on soybean farms for receiving government payments.

Preliminary results indicate that cotton was the most profitable farm type of the four types. Cotton had both the highest mean gross cash farm income and net cash farm income, followed by rice, general and other cash grain, and soybeans for gross cash farm income. Cotton was the top recipient of mean government payments, followed by rice, general and other cash grain, and soybeans. Analysis indicates gross cash farm income and net cash farm income grew over 2000-2009 for Arkansas soybean farms. Rice had the highest mean farm equity (net worth), followed by cotton, general and other cash grain, and soybeans. Debt-to-asset ratios indicate rice farms were the most leveraged, followed by cotton, general and other cash grain, and soybean farms.

Arkansas soybeans were more profitable than both NAD and NAU soybeans, with NAD soybeans exceeding the profitability of NAU soybeans. This is indicated by the values of both the gross and net cash farm income. Arkansas soybean farms also received the highest government payments, followed by NAD and NAU. For farm equity, however, NAU soybean farms exceeded both the Arkansas soybean and the NAD soybean farms, with Arkansas soybean farms higher than NAD soybean farms. NAU soybean farms were the most liquid, followed by NAD soybean and Arkansas soybean farms as indicated by the calculated aggregate current ratio values. Leverage was comparable for all three, as indicated by debt-to-asset ratios although Arkansas soybeans had a slightly higher ratio. All results above are preliminary and will be subjected to tests of statistical significance by appropriate statistical inference.

In response to a Division of Agriculture inquiry, the impact of the proposed reduction of eligibility for government payments from the current $750,000 to $250,000 AGI was investigated. Our analysis showed that on a percentagewise basis, Arkansas farm operators would be among the most affected. U.S. soybean farmers would have lost roughly an estimated 26 percent of their payments in 2010 and 2011.

Production and Evaluation of Novel Prebiotic Fibers from Soy on the Digestive Microbiota

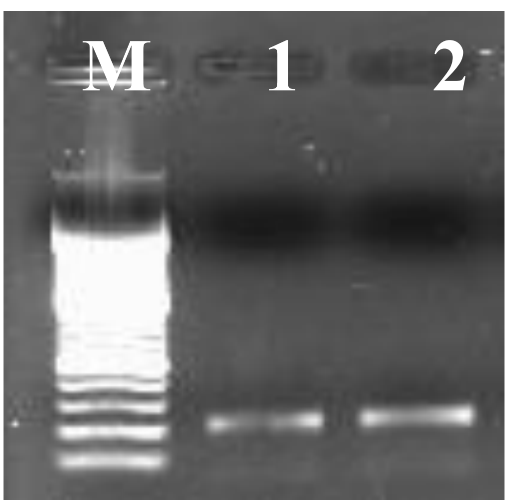
Investigators: Sun-Ok Lee, Phil Crandall and Steve Ricke, U of A
Cooperators: Tim Bowser and William McGlynn, OSU

Production System: N/A
Status: Reporting on year 1 of 1
Date of Report: 12-1-2011
Report:
The project was conducted to characterize functional fibers from soybean and commercial dietary fibers, to characterize these fibers on pure culture of good gut bacteria, and to identify the microflora in human feces and fermentation pattern of these fibers.

Investigators at OSU were trained in the laboratory and pilot plant extraction phases, they completed the laboratory scale extraction, have secured and tested all of the pilot plant equipment. To date, they have made two pilot plant scale extraction of the pectin from soybean hulls.

The beneficial gut bacteria responses to these fibers under condition that stimulate the human gastrointestinal tract have been investigated. Results are underway.

The project was approved by the Institutional Review Board of University of Arkansas. Two subjects were recruited to provide their fresh fecal samples. Fecal samples for each were immediately frozen after collecting for identification of their microbial population. The microbial DNA band patterns obtained after PCR-DGGE (Polymeras Chain Reaction-Denaturing Gradient Gel Electrophoresis) (Figure 1). These bands will be used to identify the corresponding species using BLAST (Basic Local Alignments Searching Tool) program.



1% agarose gel, 100 V, 20 min

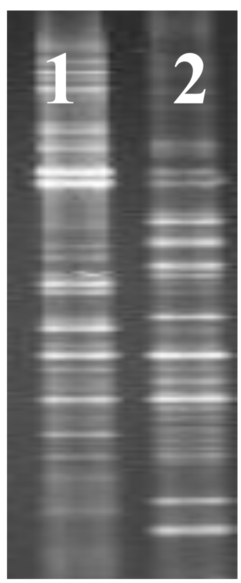


Figure 1. Polymerase chain reaction (PCR)-denaturing gradient gel electrophoresis (DGGE)

M: marker

Two-gram feces were added to anaerobic media tubes and tubes were placed at 37°C for the fermentation pattern of both the insoluble and water-soluble fibers. The production of short chain fatty acids will be measured in duplicate samples from each tube at 0, 6, 12, 24, and 30h. All samples will be analyzed and then the final report will be prepared.

Commercialization of Conjugated Linoleic Acid(CLA) Rich Soy Oil Production and Use

Investigator: Andrew Proctor, Department of Food Science

Priority Area: Alternative Research

Status: Year 1 of 3

The most significant hurdle to commercialization CLA-rich soy oil is an industrial means of iodine catalyst removal from the oil after CLA production. When this is achieved we can then create high quality oil-based food/pharmaceutical products. To address these issues effectively, we need working relationships with companies interested in commercialization of CLA rich soy oil, while also maintaining the ethics related to any confidential disclosure agreements (CDA) developed. These contacts are invaluable for advice and industrial input. Such input may redirect or refocus our objectives to more effectively achieve the goal of CLA rich soy oil commercialization.

Progress:
Iodine removal studies: Our experience using membrane separation techniques to remove iodine from soy oil provided us with the idea of using simpler techniques. We have converted iodine in the oil to water-soluble iodide salts that could be easily washed from the oil. The iodine was extracted from the oil with acetone and converted to water soluble salts by reaction with potassium iodate in solution, followed by oil deodorization. Initially, 50% of the iodine was removed from the oil and we are now optimizing the process. This process uses simple washing and centrifugation methods that are commonly used in oil processing operations, so current oil processing equipment could be used.

We are also using thiosulfate solution with acetone, instead of potassium iodide, to more rapidly convert iodine in the oil to water soluble iodide salts. This was removed in a water wash. The conversion of iodine in the oil to water soluble salts is more rapid than when using potassium iodide and totally removes the iodine color from the oil. This process seems very promising but we need to further replicate the study on a larger scale and complete iodide analysis of the oil and washing water. Since thiosulfate remains in the water there is no oil contamination.

Enhancing CLA processing yields: We have found that 1400pm of mixed soy oil tocopherols added to soy oil before processing increased CLA yields by 20%, thus producing more CLA and also providing protection against oxidative rancidity.

CLA rich oil oxidation quality: Our recent study showed a slight increase in the tendency of CLA-rich soy oil to oxidize relative to regular soy oil, but oils with increasing CLA levels did not have a corresponding increase in tendency to oxidize.

Industrial contacts: We currently have confidential disclosure agreements (CDA) with three US companies who are providing input and exploring the commercial opportunities. A Minnesota based soy company is providing analytical support and advice regarding processing and nutritional impact. We have a CDA with a major Arkansas soy oil processor who are providing input and discussing business opportunities. An Iowa company has secured a CDA with a view to exploring CLA production from its oil products. We have also had recent serious inquires from a major Texas snack food company and also been in discussion with ADM for a number of years.

2011 Publications:
Kadamne, J., Castrodale, C. and Proctor, A. 2011. Measurement of conjugated linoleic acid (CLA) in CLA-rich potato chips by ATR-FTIR spectroscopy. J. Ag. Food Chem., 59:2190–2196.
Yettella, R.R., Henbest, B., and Proctor, A. 2011. Effect of antioxidants on soy oil conjugated linoleic acid production and its oxidative stability. J. Ag. Food Chem. 59:7377-7384.
Yettella, R.R., Castrodale, C. and Proctor, A. 2011. Oxidative stability of conjugated linoleic acid rich soy oil. J. Am. Oil Chem. Soc. In press.

Achieving Maximum Yield Potential in Soybean

<u>Investigators:</u> Larry C. Purcell, Lanny Ashlock, and Nathan Slaton

<u>Status:</u> Year 1 of 3

<u>Stated Goal:</u>
Soybean producer Kip Cullers in SW Missouri has reported yields of 139 (2006), 155 (2007), and 161 bushel/acre (2010), and these yields are substantially greater than any other reported maximum yields. We hope to implement some of the production practices used on the Cullers' farm and to identify limitations to high yields that Arkansas producers may be facing.

<u>Specific objectives:</u>

1. Characterize environmental conditions and crop growth at Kip Cullers' record yielding production field.
2. Evaluate specific management practices and inputs that are used on the Cullers' farm to determine their effectiveness in defined experimental conditions in Fayetteville.
3. Demonstrate at University Experiment Stations the effects of intensive, high-management strategies on soybean performance and yield relative to recommended soybean production practices.

<u>Status:</u>

Objective 1

- Environmental data and crop performance data taken from Mr. Cullers' contest field season long.
- Plant samples, including a non-nodulating variety established within this field, were taken periodically during the summer and are being processed and analyzed.
- Replicated yield estimates from Mr. Cullers' contest field ranged from 79 to 106 bu/A.

Objective 2

- One field experiment at Fayetteville evaluated 14 varieties from Pioneer, Monsanto, and Syngenta for yield and growth characteristics in a maximum yield environment. A second experiment evaluated individual management treatments including: thinned evenly vs. uneven intra-row spacing, lactofen (Cobra) and lactofen+crop oil applied at V4 vs. none, a high rate of Optimize® 400, Accolade-(P)®, and Bio-Forge® seed applied together vs. alone vs. none, and prevented lodging vs. normal lodging.
- Replicated yields of the variety trial ranged from 58 to 81 bu/A and suffered from a severe spider mite outbreak. Varieties that performed best at Mr. Cullers' farm did not necessarily do well in Fayetteville.
- Individual management practices did not significantly influence yield overall due to high variation despite replicated yields ranging from 73 to 91 bu/A. Further investigation into these management practices is needed.

Objective 3

- Demonstration blocks were established at Rohwer, Pine Tree, and Marianna and included recommended production practices and enhanced management practices. Enhanced management included addition of chicken litter (2-3 tons/ac) prior to planting, lower tolerance for insect control treatments, decreased soil-moisture deficit for triggering irrigation, and preventative fungicide treatment at R2 and R5. For both the standard and enhanced management blocks, two varieties were used UA4910 (all locations), Cropland RC 4877 (Rohwer, Pine Tree) or GoSoy 4910LL (Marianna).
- Yields were disappointing. Averaged across varieties and treatments yields were 43 (Rohwer), 51 (Marianna), and 49 (Pine Tree) bu/ac. Averaged across locations and varieties the standard management yield was 47 bu/ac and the enhanced management yield was 48 bu/ac.

Drought Tolerance Research - Developing Rapid Screening Methods

Investigators: Larry C. Purcell and Vaughn Skinner

Status: Year 1 of 3

Stated Goal:

To develop remote-sensing tools that can rapidly screen large numbers of soybean lines for drought tolerance traits in field environments.

Specific objectives:

1. Identify soybean lines that have cool canopies during drought using aerial-thermal imaging and associate canopy temperature with ground-based wilting ratings.
2. Use aerial photography to determine soybean lines with prolonged N2 fixation during drought from the association of dark green leaf color and shoot N.
3. Characterize differences in seedfill duration among lines in response to drought by aerial color imaging.

Status:

Objective 1

- Approximately 50 hours were spent on a training program to learn how to fly the ‗Oktokopter'. It was received at the end of July.
- A line source experiment was established at Fayetteville that consisted of five varieties, four irrigation treatments from fully irrigated to rainfed, and four replications. These genotypes differed in their shoot N concentration.
- The Oktokopter had to be returned because three of the motors overheated. Once returned, there was little time left in the season for measurements.
- The Oktokopter was successfully flown several times with the infra-red camera and differences among genotypes in canopy temperature were clearly evident.
- We are currently analyzing these images to quantify these temperature differences.

Objective 2

- The color camera that the manufacturer suggested for use with the Oktokopter was not effective for our uses. We have identified a camera that we will be using this coming season.

Objective 3

- An experiment was established at the main experiment station in Fayetteville under fully irrigated and drought conditions. One variety each from maturity groups 2, 3, 4, and 5 was planted early June. When the maturity group 2 variety was in mid-seed fill, we began making digital images from the ground about twice per week to measure greenness. We also measured leaf N concentration and seed moisture throughout seedfill.
- Data and samples are being processed and analyzed. We will use the methods that we develop this year from the ground on the association of crop greenness with N concentration and seed moisture in measurements that we make next year from the Oktokopter.

Stand Establishment, Soybean Seed Quality Assessment and Education in Arkansas

Investigators: John Rupe, Pengyin Chen, Larry Purcell, Navam Hettiarachchy, Terry Siebenmorgen, Scott Monfort – Research

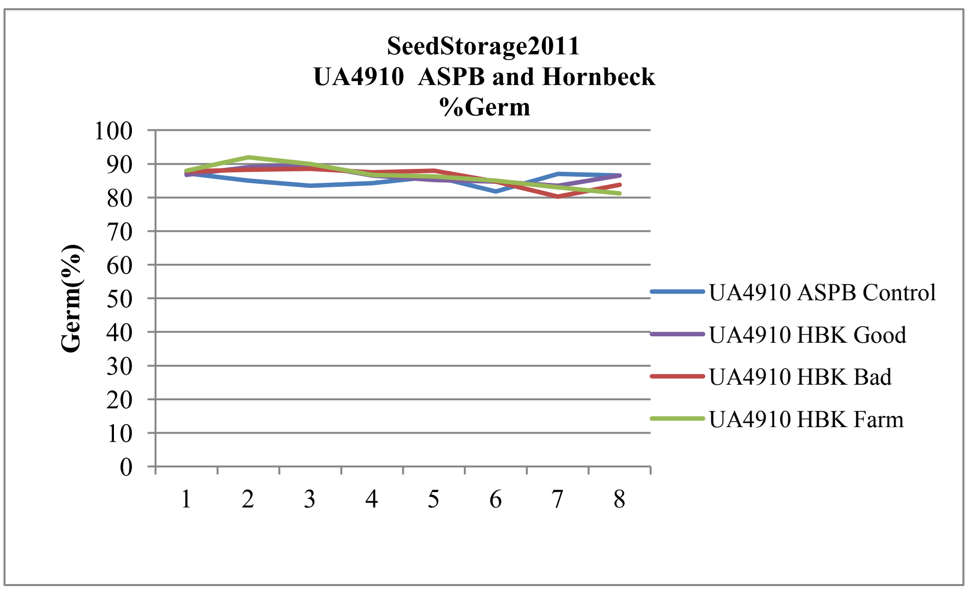
Jeremy Ross, Don Dombek – Extension and Education

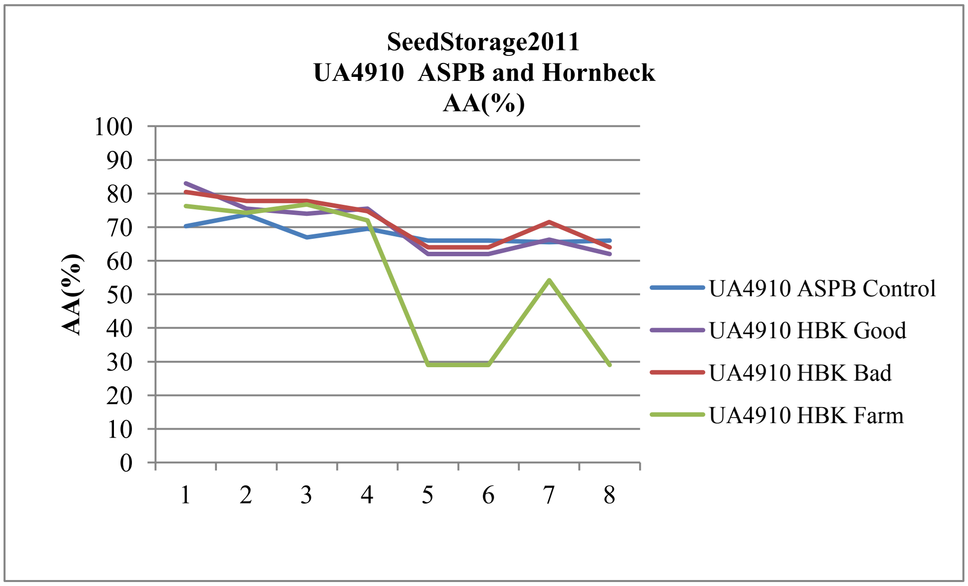
Specific Objectives

4. To determine the effect of storage conditions on soybean seed quality.
5. To determine the effects of foliar fungicides, fungicide timing and harvest timing on seed quality, seed infection, and test weight of soybean.
6. To determine the relationship between stinkbug damage and seed quality
7. To determine the economic feasibility of using fungicide seed treatments to protect stands and yields with reduced plant populations.

RESULTS:

Seed Storage: Seed of two cultivars, UA4905 and Osage, were stored at three commercial warehouses and at good, bad and on-farm locations at each warehouse. Seed were sampled every two weeks and assessed for germination accelerated aging, and SVIS. Seed from one warehouse is also being planted at the Vegetable Station, Kibler, AR, and in growth chambers and stand counts taken.





Above is data from Hornbeck's warehouse with UA4910. As in past years, germination was constant across sample times, but accelerated aging (AA) declined over time. The biggest drop in AA occurred in the middle of June in the on-farm storage location. This is earlier than last year. Stands in the growth chamber of these sampled seeds show the losses in stand occurred toward the end of the season at all temperatures. Stands in the field were highly variable and very dependent on the field environment. These data are continuing to be analyzed.

Foliar Fungicides: Osage was planted at Kibler and were treated with fungicides at the R5 growth stage. The fungicides tested represent all of the labeled active ingredients available to growers. Plots were harvested twice: as soon as the plants were mature and then three weeks later. During this period, the plots were regularly irrigated with overhead irrigation to increase seed infection. Yields were determined and are being analyzed. Seed will be plated and evaluated for infection and germination.

Arkansas Discovery Farm

Investigator: Mike Daniels

Summary: The Arkansas Soybean Promotion Board granted the University of Arkansas' Division of Agriculture $17,000 in 2011 to assist with the funding a Row-Crop Discovery Farm Technician. Along with contributions from the Rice Research Promotion Boards at $17,000 per year and the Corn and Grain Sorghum Board at $5,000 has allowed us to fill the position with Pearl Daniel in mid July. The Arkansas Discovery Farm program is currently collecting data from three row crop farms, one in Arkansas County near Stuttgart and two in Cross County near Cherry Valley. Data is being collected from four rice fields, one soybean field and one corn field this year and will change next year depending on crop rotations.

New Technician

The University of Arkansas' Division of Agriculture's Discovery Farm Program hired Pearl Daniel as the new row-crop Discovery Farm Technician. Pearl is a 2011 graduate of the University of Arkansas' Crop, Soil, and Environmental Science Department with a degree in Environmental, Soil, and Water Science. She began on July 11, 2011. She is maintaining and servicing our water quality monitoring equipment on our row crop Discovery Farms in Eastern Arkansas. Pearl will be located in the State Extension office in Little Rock and can be reached at (501) 671-2230 or via e-mail at pdaniel@uaex.edu

Discovery Farm Progress:

We have installed 13 automated water monitoring stations around the State. **At Stuttgart on Terry Dabbs' farm**, we monitored three rice fields, one corn field and runoff from 1,200 acres of cropland. **At Cherry Valley**, we monitored water inflow and outflow on the **Clements farm** in a 65-acre rice field. However, flooding delayed the planting of our soybean field on the **Mike Wood** farm. The soybean field is instrumented and we have collected samples from two irrigation events.

Addition of a Cotton / Corn Discovery Farm:

With funding from the State in 2011, we are in the process of installing a cotton and corn Discovery farm in Desha County with Steve Stevens. We have visited the farm and identified four fields where we will monitor the quality and volume of inflow and outflow of each field. Depending on crop rotations, it will most likely have two-paired cotton fields and two paired corn fields. A fifth sampling station will be installed to monitor the outflow of runoff from land currently enrolled in the Conservation Reserve Program. We will be installing equipment during the next three months so that we are ready to monitor before any extensive field and soil work begins.

Evaluating Proposals that Modify the Price and Income Safety Nets of the 2008 Farm Bill

Investigators: E. J. Wailes, K. B. Watkins, and V. Karov

Production System: N/A

Status: Reporting on year 1 of 1

Date of Report: 12/01/2011

Report:
The 2008 Farm Bill will expire in 2012, and the intellectual debate on how to modify the 2008 legislation and maintain a safety net for producers is currently underway. The debate is being driven by the prospects of reduced funding due to large Federal budget deficits, relatively high crop prices and agricultural incomes, and WTO constraints. Hence, the need to examine the impacts of alternative safety net programs has emerged. This year, three policy studies were conducted at the crop enterprise level by employing the Arkansas representative panel farms framework. Ten-years of historical data were used to simulate farm-related variables (e.g., prices, yields, expenses) for the period 2012-2016 using SIMETAR.

The first study estimated the effects of a complete removal of direct payments for the 2012 Farm Bill. The goal was to determine what adjustment in loan rates and target prices would be meaningful for maintaining a safety net for producers. The results suggest rice receives the largest per acre direct payments on average followed distantly by cotton for the years 2012-2016. Complete removal of direct payments results in two of the five panel farms having a negative net income on average for the 2012 to 2016 period. The soybean loan rate would have to be increased by nearly 150% and the soybean target price by nearly 120% before Arkansas producers can receive any loan-deficiency payments or counter-cyclical payments, respectively.

The second study examined the impacts of full continuation of current crop insurance programs on Arkansas producers during 2012-2016. The main goal was to shed light on why current policies fail to be effective for Arkansas farmers. The results suggest that since most crop production across the panel farms is irrigated, indemnities are less likely to be received. Second, in cases when indemnities are received, there is a large chance that farmer-paid premiums will outweigh indemnities. Third, projected prices are positively correlated with both farmer-paid premiums and government-paid premium subsidies. Hence, higher crop prices result in a more expensive crop insurance program in terms of Federal budget outlays, and lower net indemnities for participants.

The third study estimates the effects of a full continuation of the ACRE program during the 2012 Farm Bill on Arkansas producers. The goal is to examine why ACRE participation rates in Arkansas have remained low since the 2008 legislation was introduced. The results suggest that the probabilities of receiving an ACRE payment during the period 2012-2016 are low across all farm-crop pairs. For soybeans in particular, such probabilities are in the 18%-43% range. The ACRE framework has been developed to look at modifications to this type of shallow loss program for Arkansas soybean producers.

The Promotion of Edamame and other Specialty, Soybeans in Arkansas

Investigators: Hank Chaney, Lanny Ashlock, Kelly Cartwright and County Extension Agents in the Ozark District

Production System: Alternate

Status: Year 1 of 2

Stated Goal:

Soybean producers in the Arkansas River Valley (ARV) and Western Arkansas have somewhat different production and marketing options and/or constraints compared to other regions of the state. Due to these constraints, the opportunity to produce a specialty crop such as Edamame (vegetable soybean) may be more appealing than their Eastern Arkansas counterparts. With the development of two Edamame lines by the University Arkansas soybean breeding program conducted by Dr. Chen (with funding by the Arkansas soybean check-off program) there now exists an opportunity to establish a commercial Edamame industry in the ARV that may possibly incorporate these lines into the commercial venture. Funding is needed to further educate ARV soybean producers regarding the production and processing of this potential new soybean product.

Specific objectives:

1. Establish Extension Demonstrations in select ARV counties to evaluate production concerns and product utilization.
2. Organize and conduct county and area-wide field days to inform ARV soybean producers regarding Edamame production and marketing.
3. Develop educational materials (production fact sheets and budgets, etc.) relative to Edamame production in the ARV.

Status:

Objective 1

Extension variety and pest control demonstrations were established in Faulkner County, Conway, Pope and Yell counties (lower ARV). In addition seed production was accomplished at 2 different ARV locations as well as on the Pine Tree Research Station. All seed was processed at the Foundation Seed facility at StuttgartPlant

Objective 2

Over 200 growers were able to learn first-hand regarding edamame production from the Vegetable Experiment Station Field Day on June 30, 2011. Additionally, an Edamame Field Day was also conducted at Kibler on Sept. 19, 2011 with 50 growers and UA faculty present. Finally, an area-wide field days/crop tour was conducted on Sept. 20, 2011 in Pope and counties with approximately 18 growers in attendance.

Objective 3

From the knowledge and experience obtained by evaluating research conducted at the Vegetable Station and from the multiple County Extension demonstrations an edamame guideline publication have been developed as well as an initial edamame production budget to inform potential producers relative to the economic challenges and /or opportunities associated with Arkansas edamame production.