ANNUAL REPORT

COTTON INSECT PEST MANAGEMENT
Agreement 10-648TN
Scott Stewart, The University of Tennessee

Funding for this project was used to partially support general extension activities such as scout training, moth trapping, insect damage surveys, resistance monitoring, and insecticide testing and on-farm evaluations of various insect control technologies and treatment thresholds. In addition, funds were also used to help support several regional projects as described herein.

1) Moth Trapping. Despite the use of Bt-transgenic cotton on over 95% of the acreage in Tennessee, bollworm and tobacco budworm still compose an important pest complex. Bollworms may cause significant economic damage to Bt cotton fields, and the bollworm/budworm can be even more damaging to non-Bt cotton. More importantly, the threat of tobacco budworm infestations results in high adoption of Bt cotton. Resistance to pyrethroid insecticides in tobacco budworm populations makes distinguishing between budworm and bollworm infestations very critical in non-Bt cotton. Using a pyrethroid insecticide on a "worm" infestation which contains a significant percentage of tobacco budworms often results in serious economic losses.

Area-wide monitoring remains a valuable tool in predicting the occurrence and size of pest populations. Pheromone trapping programs for bollworm, tobacco budworm, and beet armyworm provide insight into the timing and intensity of moth flights. For example, unusually high trap catches for a particular species can alert consultants and producers to the potential for impending outbreaks. When performed on a regional level and over a number of years, moth trapping can indicate historical and geographical patterns in the distribution of pest populations. Moth monitoring improves the decision making process, helping crop managers in the selection of insecticides and to indicate the need for intensified sampling efforts. This ultimately helps to minimize control costs and/or yield losses incurred by producers. Traps can also be used to collect moths used in assays for resistance to pyrethroid insecticides.

Pheromone moth traps for corn earworm (CEW or bollworm), tobacco budworm (TBW), and beet armyworm (BAW) were run on a weekly basis from early May through mid August. Traps were located in cotton growing areas of each county and were usually placed on the borders of cotton fields. All pheromone lures were obtained from Great Lakes IPM (Vestaburg, MI) and were changed at two week intervals. At least one, and usually two, sets of bollworm and tobacco budworm traps were run in each of the following 12 counties in West Tennessee: Carroll, Crockett, Dyer, Fayette, Gibson, Hardeman, Haywood, Shelby, Tipton, Lake, Lauderdale, and Madison. One beet armyworm trap was located in each of the above counties.

Outcomes: Moth catches for each trap were reported weekly on the UTcrops News Blog (http://news.utcrops.com/) which was distributed to agents, cotton producers, consultants and other agricultural professionals. The UTcrops News Blog was launched in February of 2011 and has successfully replaced the IPM newsletter format that was used previously.

Tobacco budworm moth catches were high compared to previous years. Most tobacco budworm moths were caught in Lake County, and to a lesser extent, Shelby County during late June and early July (Figs. 1 and 2). Few if any fields of cotton were treated for tobacco budworm considering the low acreage of non-Bt cotton. It is believed that these moths originated from non-cotton hosts, and moth catches were relatively low for the remainder of the season. The highest single-trap capture was recorded in Lake County (Ridgely area) where 300 moths were caught the week preceding June 30.

Catches of corn earworm (i.e., bollworm) moths in pheromone traps were higher than tobacco budworm, particularly during late July and August (Fig. 1). Statewide average moth catches peaked at the highest level observed since 2004 (Figs. 1, 4). The bollworm is Tennessee's most significant caterpillar pest in cotton because this species is able to cause economic injury to Bt cotton which composes the vast majority of the acreage. A peak of moth activity was observed in June with a much larger moth flight occurring in August. Some areas experience sustained bollworm pressure beginning in mid July and continuing until mid August. With the exception of moth traps at the West TN Research and Education Center in Madison County, most moths were caught in traps located in the Mississippi River Bottoms (i.e., Lauderdale and Lake County, Fig. 3). The highest single trap catches in these counties ranged from 250-300 moths per week during early and mid August. Very few beet armyworm moths were caught in 2011 with no week averaging more than 0.4 moths per trap across West Tennessee (Fig. 1).

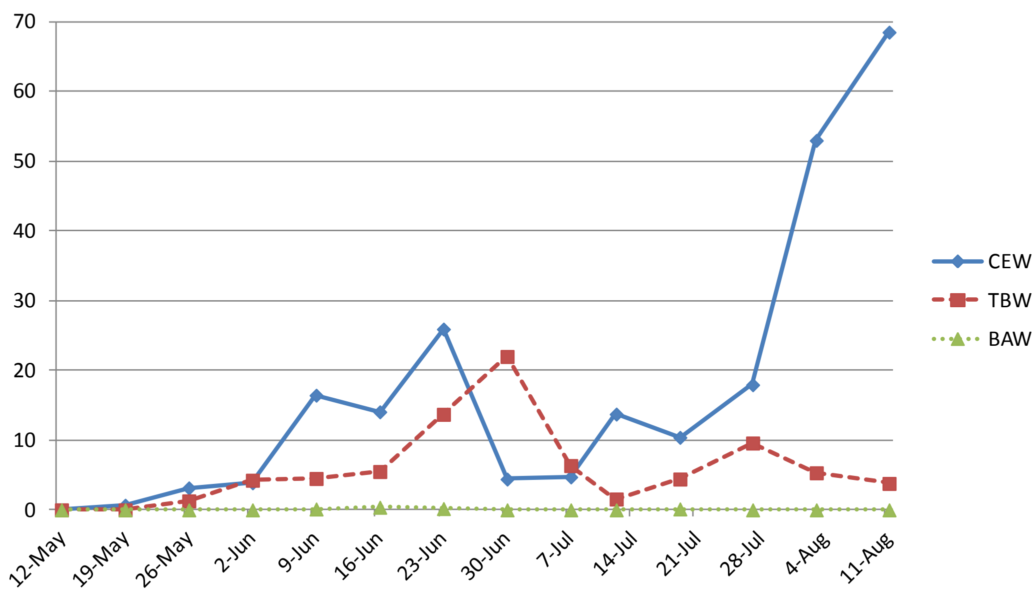

Figure 1. Average number of tobacco budworm (TBW), corn earworm (CEW), and beet armyworm (BAW) moths caught per trap in pheromone traps across West Tennessee (2011).

Trapping did not necessarily reflect all local variations in pest densities observed in cotton fields, in part because trap density was not high and because other factors influence oviposition and survival of these pests in cotton. However, the pheromone trapping program did an excellent job of predicting the relatively high populations of corn earworm (i.e., bollworm) populations observed in the Mississippi River Bottom, including serious infestation observed in soybean.

Flooding in these same areas prevented planting of many cotton fields, thus reducing the impact of bollworms. However, most cotton fields required at least one insecticide application in these areas.

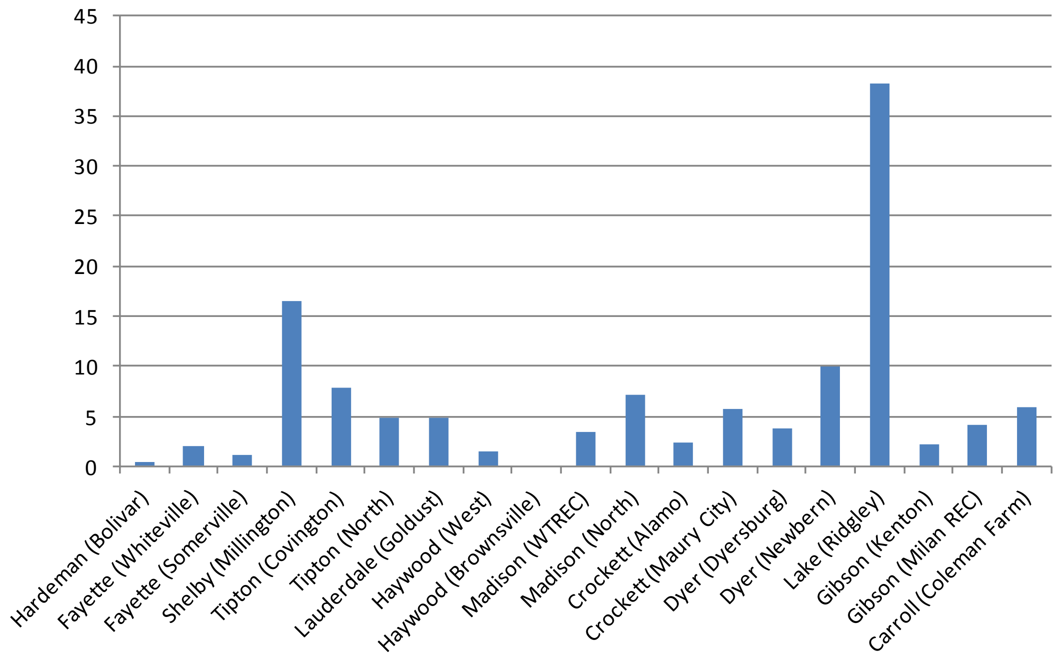

Figure 2. Seasonal average number of tobacco budworm moths caught per trap per week in each county during 2011.

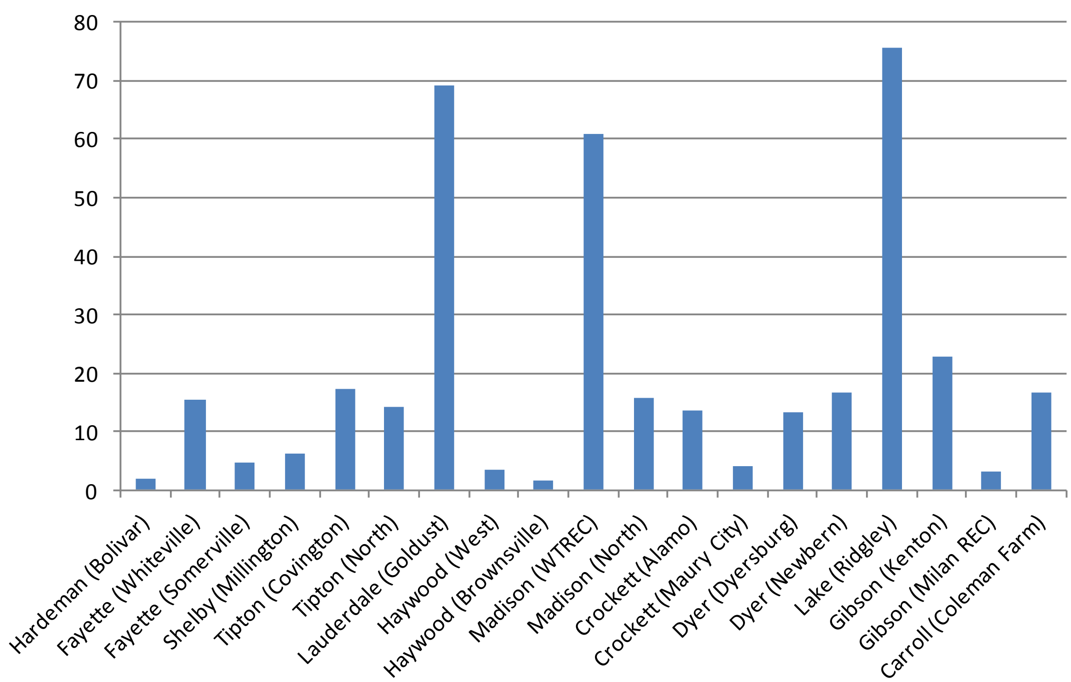

Figure 3. Seasonal average number of corn earworm (bollworm) moths caught per trap per week in each county during 2011.

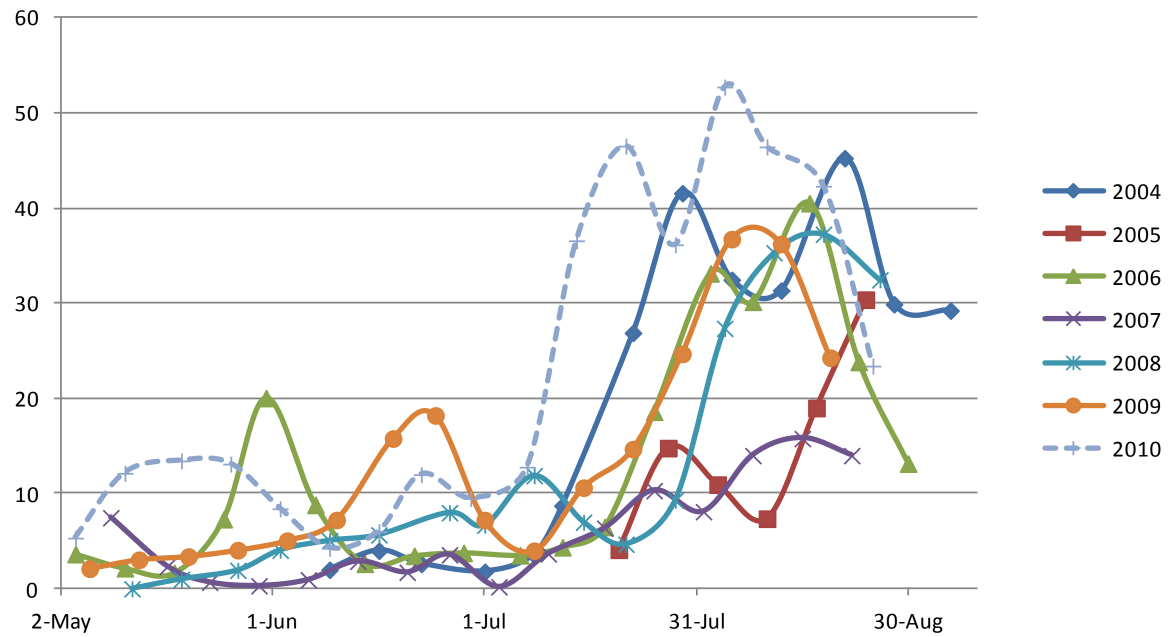

Figure 4. Average statewide catches of corn earworm (bollworm) moths during 2004-2010.

2) Relative Efficacy of Bt Cottons. An annual survey of boll damage in production fields was not done in 2011. This survey had been conducted in late season annually beginning in 2002. This information provides a historical database and also helps determine the relatively efficacy of various transgenic traits (e.g., Bollgard, Bollgard II and WideStrike). These data indicated the relative performance of Bt cottons in reducing boll damage caused by caterpillar pests (Table 1, Bollgard II > WideStrike > Bollgard>Non-Bt).

Table 1. Summary of boll damage surveys from 2002 - 2010 showing percent damage caused by caterpillar pests (primarily bollworm) in West Tennessee.

Trait	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg. (Years)
Non Bt	9.39	8.29	2.04	1.50	5.13	0.72	1.48	2.85	---	3.93 (2002-2009)
Bollgard	2.41	3.21	0.31	0.08	1.25	0.18	0.33	---	---	1.11 (2002-2008)
Bollgard II	---	1.05	0.13	0.08	0.15	0.08	0.05	0.33	0.19	0.15 (2005-2010)
WideStrike	---	---	---	0.12	0.35	0.13	0.10	0.41	0.78	0.32 (2005-2010)

Note: total bolls sampled ≈ 141,000

In 2011, in lieu of boll damage ratings, we compared the efficacy of WideStrike, Bollgard II, and TwinLink technologies in controlling high bollworm infestations at the West TN Research and Education Center in Jackson. A summary of similar data from other high pressure locations was also done. TwinLink, a dual-gene Bt cotton from Bayer CropScience, is expect to be introduced in 2013. Unfortunately, company agreements currently prevent showing direct comparisons between WideStrike and other Bt technologies.

<u>Outcomes:</u> A summary of the data across multiple locations was reflective of those collected in Tennessee and indicated that TwinLink and Bollgard II will provide similar protection from infestations of bollworm and tobacco budworm (Figs. 5, 6). These data also indicate that factors

other than Bt technology may influence injury from bollworm. For example, there was more square and boll damage observed in ST4554 B2F than in FM1740 B2F, despite both varieties being Bollgard II.

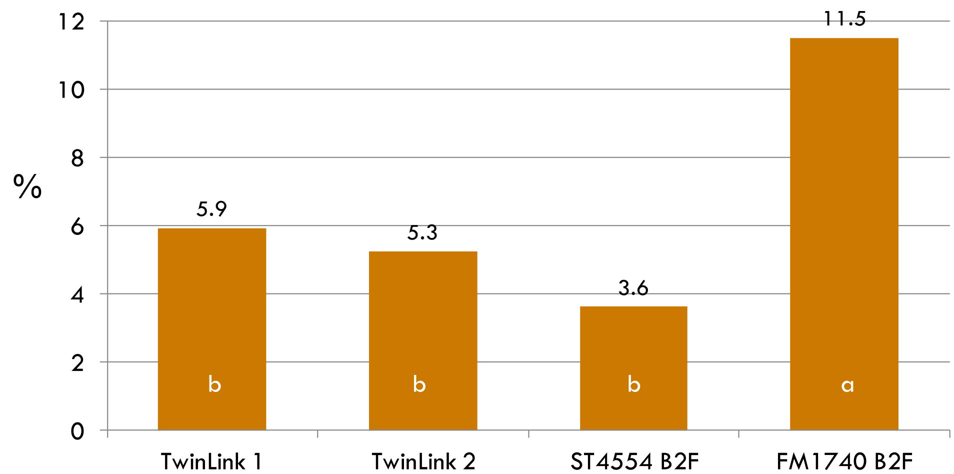

Figure 5. Average, cumulative square damage for Bt cotton varieties as a percent of that observed in non-Bt cotton across six locations. Bars not labeled with a common letter are significantly different (Fisher's Protected LSD, $P < 0.05$).

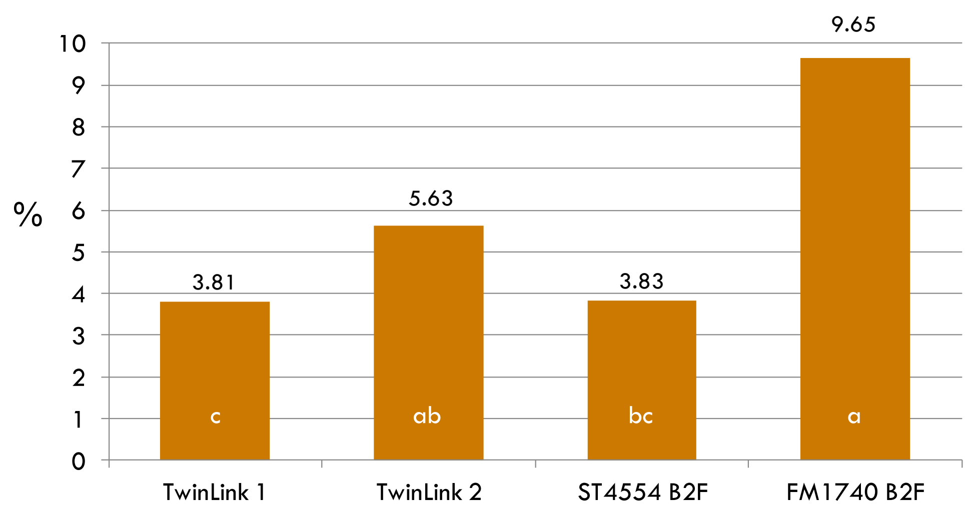

Figure 6. Average, cumulative boll damage for Bt cotton varieties as a percent of that observed in non-Bt cotton across seven locations. Bars not labeled with a common letter are significantly different (Fisher's Protected LSD, $P < 0.05$).

3) Herbicide/Insecticide Interactions. A study was conducted in 2010 and 2011 at the West Tennessee Research and Education Center in Jackson. The objective of this research was to evaluate the tolerance of Phytogen 375 WRF (WideStrike) cotton to the herbicides Ignite or Sequence when applied alone or tank mixed with various insecticides for thrips control. No at-planting treatment for thrips control was used. Applications were made to two-leaf cotton at 10 GPA using, FF 80015 nozzles and 40 psi. Plots were 4 rows wide x 35 ft long, and treatments were replicated four times.

Outcome: All insecticides significantly and similarly reduced thrips numbers. There were significant differences in visual injury between herbicides and also between insecticides in 2010, with Ignite and Sequence causing 29% and 6% leaf burn, respectively. Dimethoate caused a small increase (3%) in phytotoxicity compared with other insecticides. Both Ignite and Sequence caused about 10% leaf injury in 2011, but insecticides had no discernable effect. Ignite delayed crop maturity in 2010 but not in 2011 (data not shown). Total yield was reduced by application of Ignite but not by insecticide treatment in 2010 (Table 2). Herbicide treatment did not affect yield in 2011, but insecticide application increased yield. There was no interaction between herbicide and insecticide on injury or total yield in 2010 or 2011. These data show that maturity can be delayed and yield decreased by an early season Ignite or Ignite + insecticide application to WideStrike cotton that is already stressed by thrips. However, there was no interaction when tank mixing herbicides and insecticides, and herbicide injury was considerably more substantial than that caused by insecticides.

Table 2. Effects of tank mixing herbicide and insecticide treatments on seed cotton weights in 2010 and 2011.

Main Effect	Treatment (oz/a)	2010 (lbs/acre)	2011 (lbs/acre)
Herbicide	Sequence (32 oz)	4733 a	3085 a
	Ignite (29 oz)	4160 b	3174 b
		P = 0.0007, LSD = 299	*P = 0.3496, LSD = 193*
Insecticide	Untreated	4648 a	2885 a
	Dimethoate (6 oz)	4230 a	3068 ab
	Bidrin (3 oz)	4361 a	3286 b
	Acephate (4 oz)	4549 a	3280 b
		P = 0.1969, LSD - 423	*P = 0.0165, LSD = 273*

Herbicide by insecticide interactions were not significant (2010: *P* = 0.7009, LSD = 598; 2011: *P* = 0.1456, LSD = 387).

4) Resistance Monitoring. Insects are well known to develop resistance to insecticides. There is increasing documentation of bollworm resistance to pyrethroid insecticides in parts of the lower Midsouth. Although pyrethroid and acephate resistance in some tarnished plant bug populations has also been documented in at least part of the Midsouth, until recently there have been no monitoring efforts in Tennessee. Therefore, an insecticide resistance monitoring program was instigated in 2006 for both bollworm and tarnished plant bug populations collected in West Tennessee. Monitoring resistance of key insect pests helps to document resistance and implement insect resistance management plans. Vial assays of adults are used in both cases.

Vial assays using 5 ug/vial cypermethrin, a synthetic pyrethroid, were again performed on bollworm moths. This represents a discriminating dose where 90% or higher of susceptible moths are expected to die after 24 h exposure. Fresh bollworm (i.e., corn earworm) moths were collected from traps that were baited with pheromone lure on the previous night. All moths were collected in Madison County at the West Tennessee Research and Education Center (WTREC). For several years and as part of a cooperative effort, moths from the above tests have been submitted to scientists in Mississippi (F. Musser, R. Jackson) who are assaying moths using a technique that determines if the larval host was a C_3 or C_4 plant. These data are being collected to better understand the population dynamics of bollworm and determine the impact of host origin on resistance levels. C_3 plants are broadleaves such as cotton and soybean. C_4 plants are usually grasses, and presumably any bollworms testing positive for C_4 plants developed on corn or sorghum because these are primary hosts during the time frame of moth trapping.

Outcomes: A total of 858 moths were used in the vial tests between 8 June and 14 September, 2011. Percent survival after 24 h was recorded for moths in treated and untreated vials (Table 3). Survival in vials indicated that pyrethroid resistance levels of bollworms collected in Tennessee was about average compared with other states but higher than that observed in Missouri and Mississippi, and as usual, lower than Louisiana. Survival rates were highest during July. Carbon isotope testing has indicated that most moths during July came from C_4 plants such as corn, which corresponds to the time when bollworm moths would be emerging from corn fields. So some increase in survival may be due to increased fitness of moths originating from corn. Tennessee data indicate a level of resistance that should result in field control insecticide failures when spraying pyrethroid insecticides for the control of bollworm infestations. However, across a broad geography, there has been an overall reduction in moth susceptibility to cypermethrin in vial assay test in the last decade (Table 4).

Table 3. Percent survival of bollworm moths to cypermethrin in vial assays (24 h exposure). Table is courtesy of Fred Musser, Mississippi State University.

State	May	June	July	August	Average
AR	11.3	16.4	20.0	9.5	13.4
GA	19.4	16.0	22.7	19.0	18.8
LA	31.8	30.2	43.5	23.3	32.9
MO	6.1	1.9	1.9	2.0	1.8
MS	5.1	8.5	6.9	4.1	5.8
TN	-	6.9	20.2	12.8	15.0
TX	-	-	13.3	3.3	6.4
VA	16.4	36.9	50.6	29.9	31.4
Average	15.0	16.7	22.4	13.0	15.7

Table 4. Average bollworm survival during July in the adult vial test at 5 µg cypermethrin/vial during 2009-2011 compared to 1998-2000. Table is courtesy of Fred Musser, Mississippi State University.

	% Survival		
State	1998-2000	2009-2011	Change
Arkansas	3.8	19.5	+15.7
Georgia	9.6	19.7	+10.1
Louisiana	11.7	47.4	+35.7
Mississippi	0.0	12.0	+12.0
Missouri	12.4	5.7	-6.7
South Carolina	10.9	9.9	-1.0
Tennessee	0.0	12.7	+12.7

Texas	4.5	7.5	+3.0
Virginia	9.5	35.2	+25.7
Overall	8.2	19.3	+11.1

Resistance monitoring for tarnished plant bugs was largely unsuccessful because of poor survival during the shipping process. A population was collected from Palmer amaranth and horseweed during early August from the WTREC (Madison Co.) and shipped to Gordon Snodgrass (USDA ARS, Stoneville). His summary follows …"In regard to pyrethroids, the discriminating dose test with permethrin killed 20 out of 50 for a 40% mortality. The bugs were resistant to pyrethroids. I tested 30 adults with thiamethoxam by feeding them a dose of 7.5 ug for 24 h. This dose killed 25 or 83.3%. This indicates that the bugs were susceptible to thiamethoxam since I have only tested one population over the last 5 years in which this dose would not kill 80-90%. I also tested 30 bugs by exposing them to 10 ug of Orthene for 24 h. This dose killed 17/30 or 56.7% which indicates that the LC50 would have been near 10 ug. An LC50 of 10 would produce a RR50 of over 3 fold which would indicate resistance."

5) Regional Projects. In 2011, $6,600 in core Cotton Incorporated funding was received to support several regional projects. Full reports on these efforts have been submitted separately by project leaders. However, shortened summaries are included here because state-support funding is substantially used to complete these efforts.

a) Impact on spray adjuvants on insecticide performance (PI: Don Cook et al., unfunded). Across LA, AR, MS, and TN, trials were conducted during 2011 to evaluate the impact of spray adjuvants on insecticide performance against thrips (two trials) and tarnished plant bug (six trials). Trials were conducted on research stations and grower farms where sufficient infestation levels were encountered. The insecticides included in these trials included Acephate 90S (0.15 lb AI/acre) and Bidrin 8E (0.15 lb AI/acre) for thrips trials and Bidrin 8E (0.3 lb AI/acre) and Transform 50WG (1 oz prod./acre) for the plant bug trials. The adjuvants included in these trials represent several classes according to the Compendium of Herbicide Adjuvants (Young 2010) and are detailed in Table 1.

Table 5. List of adjuvants used as treatments, adjuvant category, and application rates.

Adjuvant	Adjuvant Category	Rate (%v/v)
Agri-Dex	Crop Oil Concentrate	1%
Penetrator Plus	Crop Oil Concentrate + Deposition Agent + Buffering Agent	1%
Induce	Nonionic Surfactant	0.25%
Dyne-Amic	Methylated Seed Oil + Organo-Silicone Surfactant + Nonionic Surfactant	0.5%
Kinetic	Organo-Silicone Surfactant	0.25%
Dyna-Pak	Nonionic Surfactant + Nitrogen Source	1%
Hyper-Active	Deposition, Retention, and Wetting Agent	0.25%
Cohere	Nonionic Spreader-Sticker	0.125%
Cide-Winder	High Surfactant Oil Concentrate	0.5%

In each trial, one insecticide (acephate, Bidrin, or Transform) was applied at a standard rate with all or selected adjuvants listed in Table 1. The insecticide was also applied alone and a non-treated control was included. Treatments were applied with high clearance ground applicators calibrated to deliver 10 GPA. Thrips densities were determined at 2 to 6 days after treatment (DAT) by sampling five plants from the center two rows of each plot using a whole plant washing procedure. Densities of tarnished plant bugs were determined by sampling 10 row feet from the center two rows with a black drop cloth at 2 to 7 DAT. Data were subjected to ANOVA procedures, with means separated according to Fisher's Protected LSD.

Outcomes: The performance of Bidrin or Transform against tarnished plant bug was not significantly improved with the addition of any of the adjuvants tested. In some trials, including those in Tennessee (Fig. 7), the addition of some adjuvants negatively impacted plant bug control. We observed a similar lack of response to adjuvants with Bidrin applications targeting thrips in one test in Tennessee (Fig. 8). Our studies indicate that with the organophosphate insecticides, Acephate and Bidrin, the addition of an adjuvant did not provide a benefit. The performance of adjuvants in aerial applications or with other insecticides may respond differently.

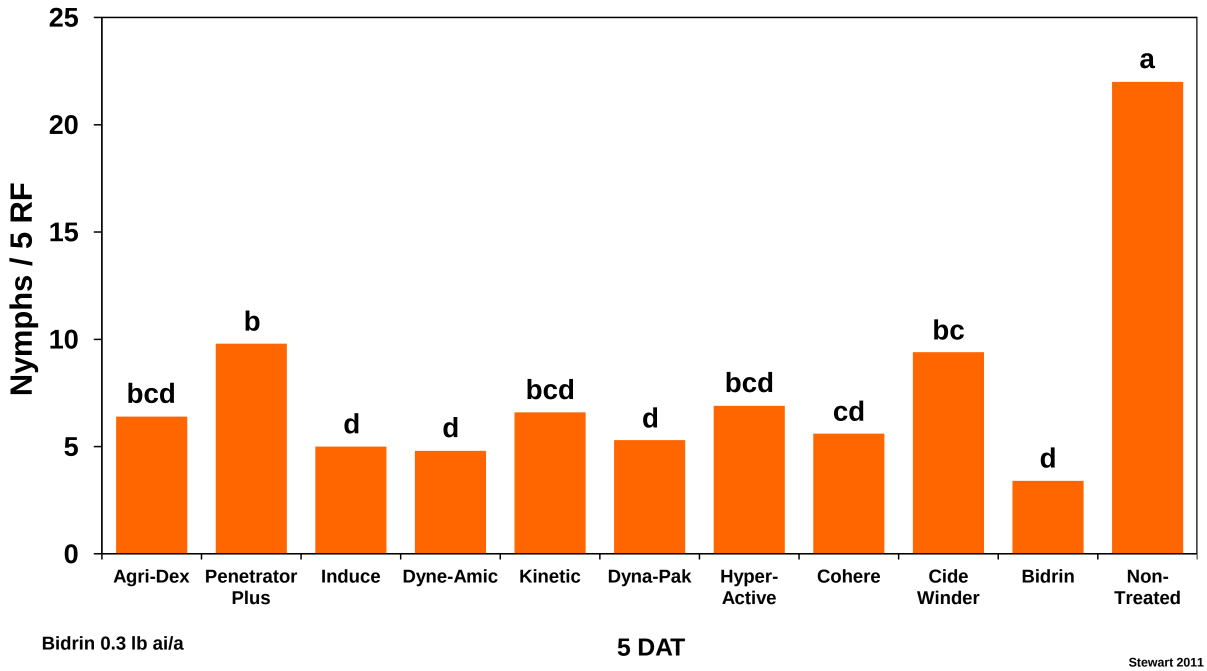

Figure 7. Impact of selected adjuvants on the performance of Bidrin against tarnished plant bug at 5 DAT, 2011, Tennessee.

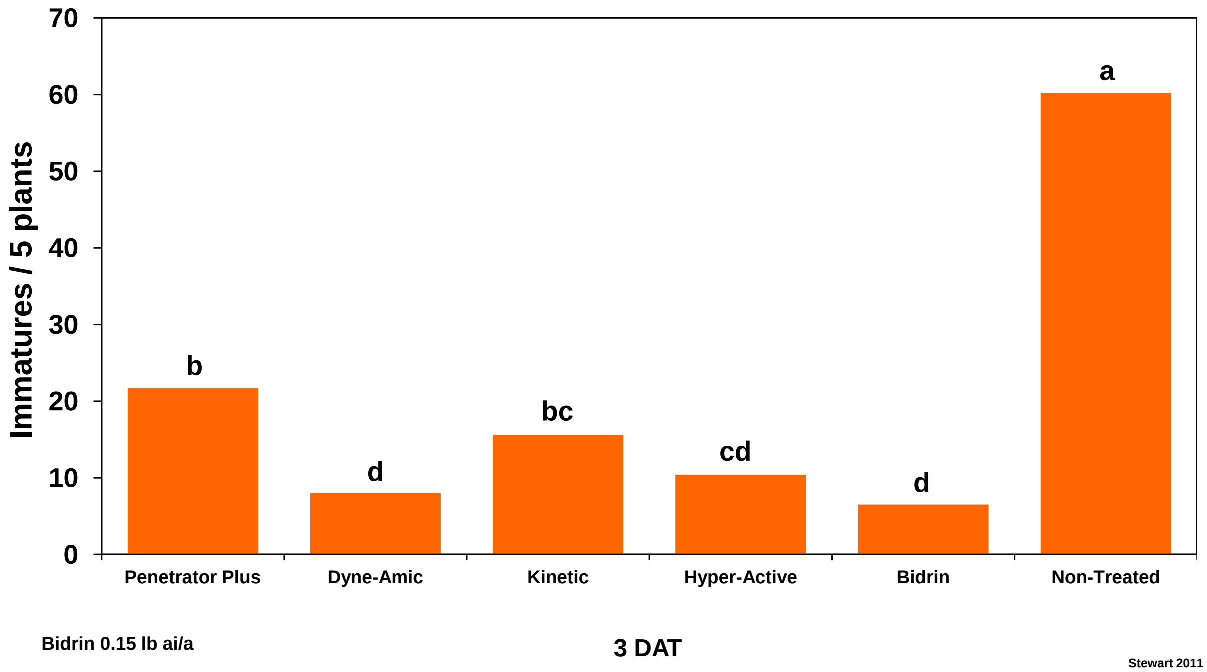

Figure 8. Impact of selected adjuvants on the performance of Bidrin against thrips at 3 DAT, 2011, Tennessee.

b) Evaluation of cotton yield loss caused by twospotted spider mite and efficacy of selected miticides (PI: Jeff Gore, CI Project 09-604).

Impact of twospotted spider mites on cotton yield. In this experiment cotton was infested with high densities of mites at 3 true leaves, first flower, and at 200 heat unit intervals from flowering to cutout, resulting in a total of 6-7 infestation-timing treatments plus a non-infested control. Plot size was be 4 rows (38-in centers) by 20ft long. The experiment was arranged as a randomized complete block with 4-5 replications. Plots were separated by 2 unplanted rows and 10 ft alleys consisting of unplanted bare ground to reduce migration of mites between plots. Heavily infested cotton or green bean leaves were used to infest cotton with mites. Once infested, every effort was made to maintain damaging densities of mites on the cotton until defoliation. If densities began to decline, plants were re-infested and/or treated with acephate to reduce predatory insects. A Bollgard II or WideStrike variety was planted at each location to minimize the impact of lepidopteran pests on yields. Additionally, prophylactic applications were made with pyrethroid and organophosphate tank mixtures to manage plant bugs and assist with establishment of mite populations. When the non-infested plots reached first flower, mites were removed from the third true leaf treatment by applying a high rate of etoxazole, spiromesifen, or abamectin.

Visual damage ratings were taken to capture and describe the physical damage caused by two-spotted spider mites within the growing season. Plots were rated at bloom, each subsequent infestation date, and after the final infestation but before defoliation. The first visual rating was a symptomology or leaf reddening index: on a 0-5 scale where 0 = no damage and 5 = nearly complete reddening and/or defoliation on nearly all leaves. Rankings were assigned as follows: 1) light stippling occurring on sporadic leaves, 2) stippling and reddening present on 15-20% of leaves, 3) 50% of leaves have very apparent reddening on basal portions of leaf, 4) > 50% of leaves contain extensive reddening of entire leaves and area where leaves begin to excise. The second rating was a stunting index on 0-100% scale that estimates stunting in infested plots compared to non-infested plots. The third rating was a defoliation rating (0-100%).

Injury response of cotton varieties to spider mite infestations. Experiments were conducted across the mid-South to measure the response of multiple cotton varieties to injury from spider mites. The treatments were arranged in a split-block design with 4 replications. The main-plot factor had two levels and included infested with spider mites or non-infested. The sub-plot factor was cotton variety. A total of eight commercially available cotton varieties were planted at each location. The varieties were chosen based on phenotypic differences in leaf characteristics ranging from smooth to hairy. The varieties included Phytogen 375 WRF (semi-smooth), Phytogen 499 WRF (semi-smooth), Stoneville 5288 B2F (very hairy), Stoneville 5458 B2F (Hairy), Deltapine 1133 B2F (smooth), Deltapine 0912 B2F (semi-smooth), Deltapine 0949 B2F (light-hairy), and Deltapine 1034 B2F (smooth). Plot size was 2 rows by 20 ft. In the infested blocks, mites were infested on all varieties between the third true leaf and six true leaf stages. The infestation procedures followed those described in the previous experiment. The non-infested blocks were sprayed with miticides as needed to minimize migration of mite into those plots. Ratings of spider mite densities and injury were measured weekly beginning one week after infestation and continued for 6 weeks after infestation. The ratings included the number of mites from 10 leaves (10 sq in.). Additionally, leaf reddening ratings were taken on a scale of 0-5 as described above. At the last rating (6 weeks after infestation) plant heights were recorded from 10 plants in each plot. Percent defoliation was estimated on the last sampling date. At the end of the season, plots were harvested and seedcotton weights were determined. A sample of seedcotton from each plot will be ginned to determine percent lint of each variety.

Outcomes: Excessive rainfall and adverse environmental conditions significantly impacted the results of these experiments in 2009. In 2010 and 2011, conditions were better and spider mites infestations were successfully established at multiple locations. In general, mites significantly impacted yields where data was able to be generated (Figs 9, 10). Responses in Tennessee were similar to overall trends. The 3-leaf stage through first flower plus 400 heat unit infestations resulted in significantly lower yields compared to the non-infested when averaged across all locations and years. These data suggest that cotton should be protected at least until 600 heat units beyond the first week of flowering. In the variety trial, significant differences were observed in mite injury ratings among the 8 varieties at low to moderate mite densities at individual locations. However, no consistent differences were observed between all of the locations. When averaged across all locations, there were no differences in mite injury among the varieties tested. Additionally, at individual locations where mite densities were high (ratings greater than 4 on a scale of 0-5), no differences were observed in mite injury. Based on yields in the infested and non-infested plots, no differences were observed for percent yield loss among the 8 varieties (Fig. 11). Based on these results, it appears that mite injury and impacts on yield are similar among varieties.

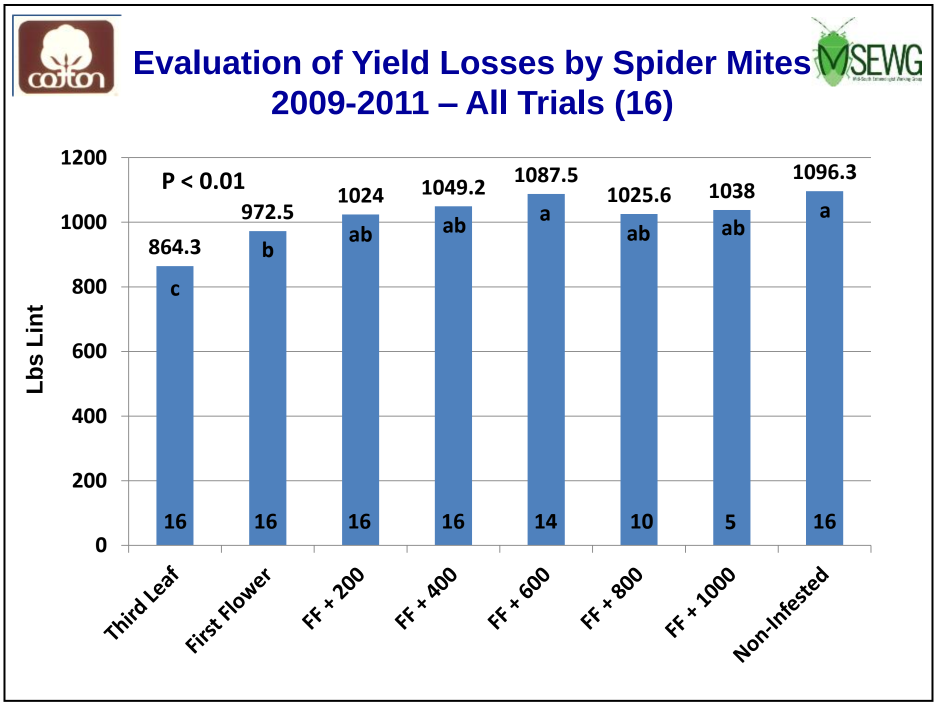

Figure 9. Mean impact of spider mite infestation timing on cotton yields across all experiments.

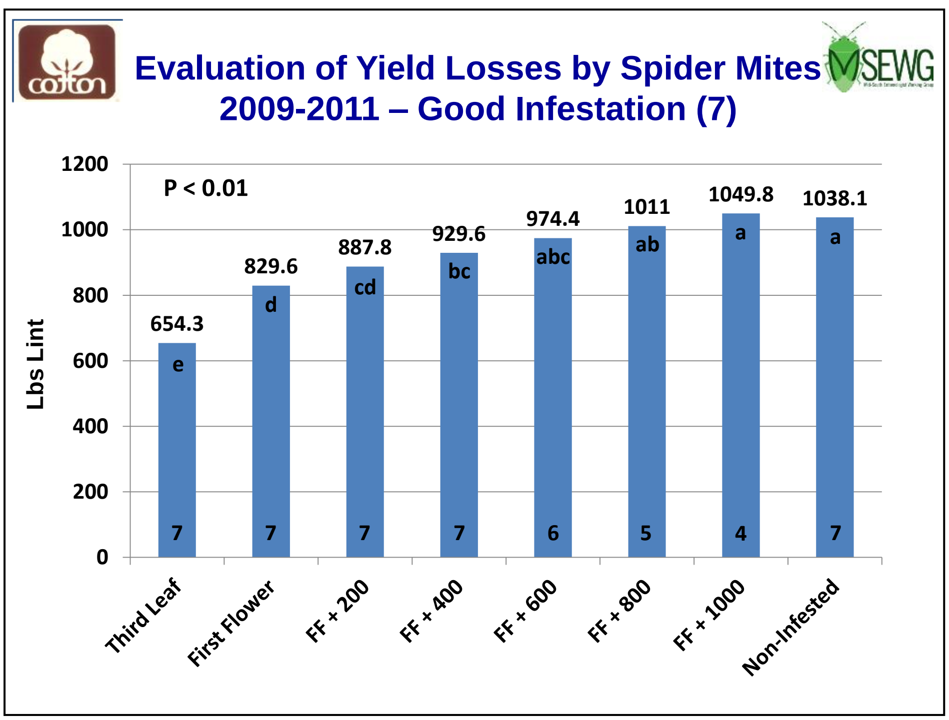

Figure 10. Mean impact of spider mite infestation timing on cotton yields across seven experiments where infestation levels were high and sustained.

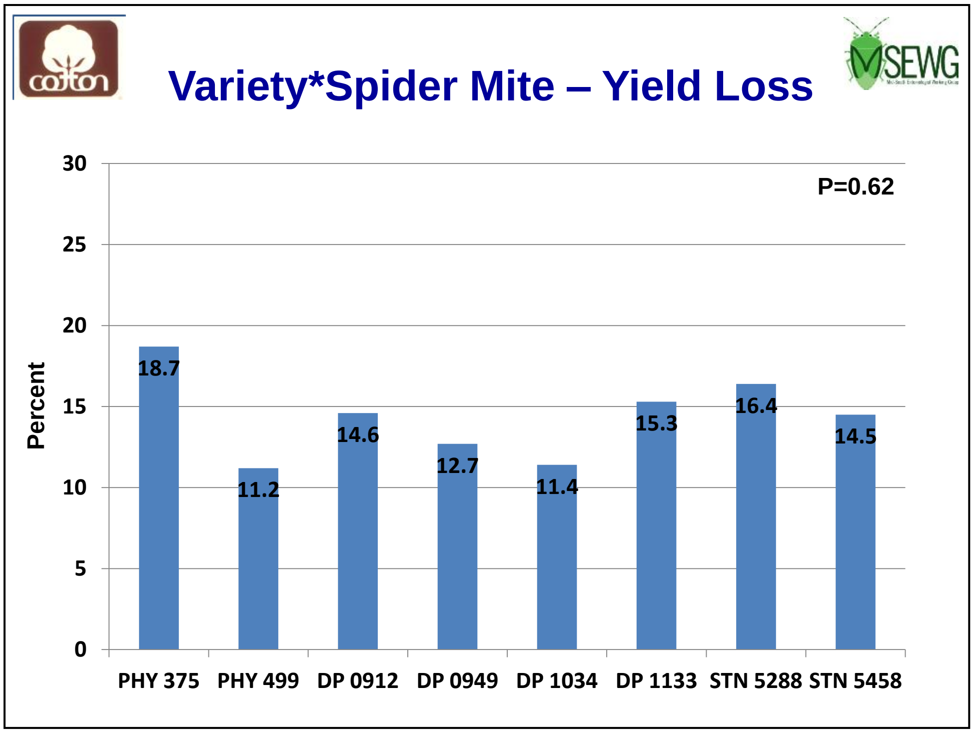

Figure 11. Percent yield loss from spider mites on eight commercial cotton varieties.

c) Evaluation of automatic insecticide applications following preventative insecticides for thrips (PI: Scott Akin). For a third year, a standardized experiment was implemented at many locations across the Cotton Belt including a location in Madison Co., Tennessee. The main intent of this study is to determine in which conditions do scheduled, foliar applications of insecticide for the control of thrips on seedling cotton result in improved yield. Plot size was 4 rows x 50 feet and arranged in a randomized complete block design with factorial arrangement of treatments (3 x 4, 4 replications). Treatments consisted of two factors including 'Factor A' (at-plant insecticide) and 'Factor B' (automatic application timing of foliar insecticide). 'Factor A' consisted of no seed preventative insecticide, Aeris® seed treatment, or Temik® 15G (5.0 lbs/A) applied in-furrow. 'Factor B' consisted of no foliar application, an automatic application at 1-2 true leaves, an automatic application at 3-4 true leaves, or automatic applications at 1-2 and 3-4 true leaves. Varieties were chosen based on optimal agronomics/insect protection for each location (e.g., PHY375 WRF in TN). Seed-cotton yield was recorded from the middle two rows and analyzed with various secondary data such as thrips numbers, weather data, nematode samples, plant stage at each sampling, and a maturity rating of the approximate date when the plots reached NAWF5.

Outcomes: Data from this test are not fully analyzed across all location. Overall, the data form 2011 showed that at-planting insecticide treatments improved yields at some but not all locations. This was similar to results in 2009 and 2010. Substantial thrips infestations and injury were observed in Tennessee. At-planting treatments of Aeris or Temik significantly improved yield compared with cotton not receiving an at-planting treatment (Fig. 12). A foliar application of acephate at either the 1st, 3rd or 1st and 3rd true leaf improved yield if an at-planting insecticide was not used, but it did not statistically improve yields for treatments of Aeris or Temik.

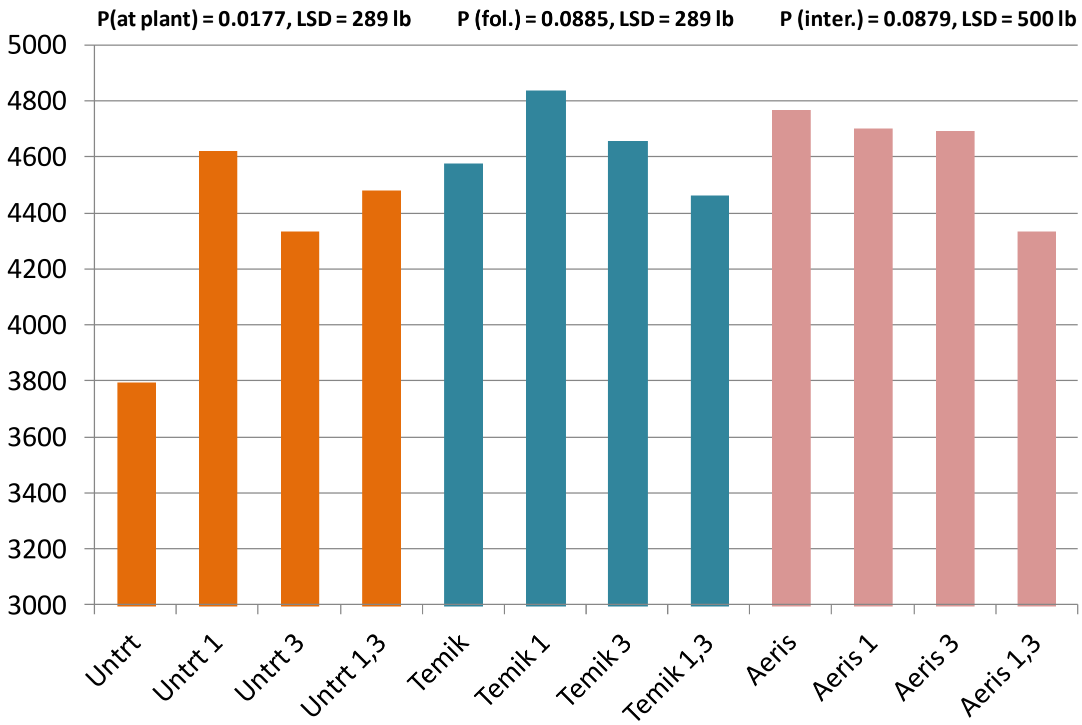

Figure 12. Seed cotton yields for at-planting treatments with or without a foliar insecticide applications made at the 1st, 3rd or 1st and 3rd true leaf. Statistics for the factorial analysis are shown above the graph.

5) Other Activities. Funding for this project is used to support general IPM Extension activities in Tennessee and an insecticide screening program. This includes the delivery of the annual Cotton Scout School held at the West Tennessee Research and Education Center. Scouts are delivered classroom-style and in-field training related to cotton plant development, insect management (identification, sampling, etc.) and disease and weed identification. A scouting notebook was prepared for each attendee. This project also supports the preparation and publication of *Insect Control Recommendations for Field Crops* (UT Publication, PB1768) which contains IPM information for cotton and other crops. This publication is also available on the web at www.utcrops.com. In addition, numerous insecticide trials and other experiments were established in 2011 to investigate various insect control practices and strategies for cotton pests. In all cases, replicated trials were established in an RCB design, usually with four replicates, and analyzed using appropriate statistical methods.

Outcomes: Approximately 70 scouts participated in the Cotton Scout School during 2011. A scouting notebook was prepared for each attendee. About 2,000 copies of the *Insect Control Recommendations for Field Crops* (PB1768) were distributed to clientele groups. Demand for this publication has nearly doubled since insect control recommendations for cotton, corn, soybean, wheat, sorghum and pasture were included in one publication.

Approximately 30 other experiments not reported above were successfully established in cotton to investigate various insect control practices and strategies. The data generated from these activities are used to validate and modify extension insect control recommendations for Tennessee. These evaluations included insecticide efficacy trials for thrips, spider mites, plant bugs, stink bugs and bollworm. For example, tests included several new insecticides and insecticide formulations such as sulfoxaflor (Transform, Dow AgroSciences) and clothianidin (Belay, Valent) for control of plant bugs and stink bugs. The results of these experiments have been individually summarized and are available on www.utcrops.com at the link below. The same website also serves as a data warehouse for some efficacy trial done by other universities in the Midsouth.

Insecticide Trials - http://www.utcrops.com/MultiState/MultiState.htm.