FARMER FRIENDLY SUMMARY

EXTENSION SUPPORT - COTTON INSECT MANAGEMENT
Agreements 07-961TN and 07-962TN
Scott Stewart, The University of Tennessee

Funding for this project used to partially support general extension activities such as moth trapping, resistance monitoring, insecticide testing and on-farm evaluations of various insect control technologies and treatment thresholds. Pheromone moth trapping for bollworm, tobacco budworm, and beet armyworm provides insight into the timing and intensity of moth flights. 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. In 2007, moth catches for each county were reported weekly in the Tennessee IPM newsletter. This information was posted on the internet at www.utcrops.com and was distributed to agents, producers, consultants and other agricultural professionals. Moth catches, particularly of bollworm, were very low in 2007. This was consistent with the generally low populations observed in fields. Corresponding data from an annual boll damage survey also confirmed the low incidence of caterpillar infestations in West Tennessee. Assays using bollworm (i.e., corn earworm) moths indicated low to moderate resistance to pyrethroid insecticides that would probably not result in noticeable field control failures unless larval populations were high. Assays with tarnished plant bugs collected from wild hosts in selected cotton growing areas also indicated low to moderate levels of resistance to pyrethroid insecticides and acephate. There was no indication that tarnished plant bugs were becoming resistant to imidacloprid (e.g., Trimax Pro, representing the neonicotinoid class of insecticides.

Over 20 separate experiments related to insect pest management in cotton were successfully completed in 2007. These evaluations included insecticide efficacy trials for thrips, spider mites, plant bugs, and bollworm. The data generated from these above experiments are used to validate and modify extension insect control recommendations in Tennessee. Only selected results are shown in this report. However, the results of all experiments have been individually summarized and published on the utcrops.com website at http://www.utextension.utk.edu/fieldCrops/MultiState/MultiState.htm. This website is also being maintained as a data warehouse for many insecticide trials conducted in the Midsouth. Several experiments indicated that Temik provide the best residual control of thrips and that various seed treatments fro thrips control performed similarly to each other. Two newly labeled, premixed insecticide (Bidrin XP and Endigo ZC) provided good control of plant bugs, at least comparable to traditional foliar treatments. Dicofol (e.g., Kelthane) continues to provide the most consistent and economical control of early season spider mites. Brigade and several other miticides performed similarly in controlling mites during mid season. Two foliar insecticide trials control indicated that two experimental insecticides provided promising control of bollworm infestations in non-Bt cotton. An evaluation of a new, unregistered Bt corn trait (YieldGard VT Pro, Monsanto) suggests this technology would reduce bollworm moths emerging from corn fields and subsequently infesting cotton. However, because this new technology is more effective on bollworm, the implications on Bt resistance management for this pest should be considered.

ANNUAL REPORT

EXTENSION SUPPORT - COTTON INSECT MANAGEMENT
Agreements 07-961TN and 07-962TN

Scott Stewart, The University of Tennessee

Justification and Approach

Funding for this project used to partially support general extension activities such as moth trapping, insect damage surveys, resistance monitoring, and insecticide testing and on-farm evaluations of various insect control technologies and treatment thresholds. In addition, these funds were also used to help support a multi-state evaluation of tarnished plant bug sampling methodologies and threshold levels. The complete activities for this project (Agreement No. 07-240TN) have been reported separately.

1) Moth Trapping. Despite the use of Bt-transgenic cotton on about 95% of the acreage in Tennessee, bollworm and tobacco budworm compose a very 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 infestation result 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 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.

2) Boll damage survey in non-Bt, WideStrike, Bollgard and Bollgard II cotton. A late season survey of boll damage in grower fields has been performed annually since 2003. In recent years, we have been doing this survey for selected varieties in the UT County Standardized Variety Trial. These data are used to identify major insect pest, changes in pest trends, and to estimate crop losses. This information provides a historical database and also helps determine the relatively efficacy of various transgenic traits (e.g., Bollgard, Bollgard II and WideStrike).

In 2007, as part of the County Standard Testing program, non-Bt, WideStrike, Bollgard and Bollgard II cotton varieties were planted in grower fields throughout West Tennessee. Four varieties within these tests were surveyed to compare insect injury in non-Bt (PHY310 R), WideStrike (PHY370WR), Bollgard (DP444 BR) and Bollgard II (STN4554 BGII/RF) cotton. Damage surveys were done in mid August. At each of 13 locations, three samples of 100 consecutive bolls each were taken in all the above varieties. Counties included in the survey included: Carroll, Crockett, Dyer, Fayette, Shelby, Tipton, Gibson, Hardeman, Haywood, Lake, Lauderdale, and Madison (2 locations). The data recorded included numbers of bolls with "worm" injury primarily caused by bollworm, tobacco budworm or fall armyworm, numbers of bolls with "bug" injury (stained lint, etc.) caused by hemipteran pests such as plant bugs or stink bugs, and the number of bolls with boll rot not apparently caused by insect injury. Only bolls which potentially could have contributed to yield were sampled. Application of foliar insecticides was similar across varieties within each location.

3) 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 parts the Midsouth, there have been no monitoring efforts in Tennessee. Therefore, insecticide resistance monitoring was undertaken in 2006 and 2007 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 were used in both cases.

a) Tarnished Plant Bug. Populations of tarnished plant bugs were collected from wild hosts in cotton growing areas of West Tennessee and sent to Dr. Gordon Snodgrass (USDA ARS, Stoneville, MS). As part of a regional effort, scientists from Mississippi, Louisiana and Arkansas also submitted samples. Only data for Tennessee (2006 and 2007) are shown in this report. The results of insecticide treated vial assays for each population are shown in the table below. Three classes of insecticides were evaluated including synthetic pyrethroids (permethrin), organophosphates (Monitor or acephate) and neonicotinoids (imidacloprid). This effort was also partially funded in 2006 by the Cotton Foundation. Imidacloprid was included in these analyses to generate baseline susceptibility data for tarnished plant bug. For the purpose of this report, populations were considered at least moderately resistant if:

- permethrin or Monitor --- discriminating dose mortality < 75%, or
- acephate --- LC50 Value > 7.50

b) Bollworm. Vial assays using 5 ug/vial cypermethrin, a synthetic pyrethroid, were performed on bollworms moths in 2007. Fresh bollworm (i.e., corn earworm) moths were collected from

traps that were baited with pheromone lure on the previous night. Most moths were collected in Madison County at the West Tennessee Research and Education Center. Moth survival in untreated and treated vials was recorded after 24-h period. Both surviving and dead moths from treated vials have been submitted to scientists in Mississippi (F. Musser, R. Jackson) who will assay moths to determine host origin (C3 vs. C4 plants). These data are being collected to better understand the population dynamics of bollworm and determine the impact of host origin on resistance levels.

4) Other Activities. Numerous insecticide trials and other experiments were established in 2007 to investigate various insect control practices and strategies for cotton pests. The data generated from these activities are used to validate and modify extension insect control recommendations in Tennessee. Selected results are presented in this report. In all cases, replicated trials were established in an RCB design with four replicates. Data were analyzed with GLM procedures using Fischer's Protected LSD ($\alpha = 0.05$) for mean separation.

Results, Progress, and Accomplishments

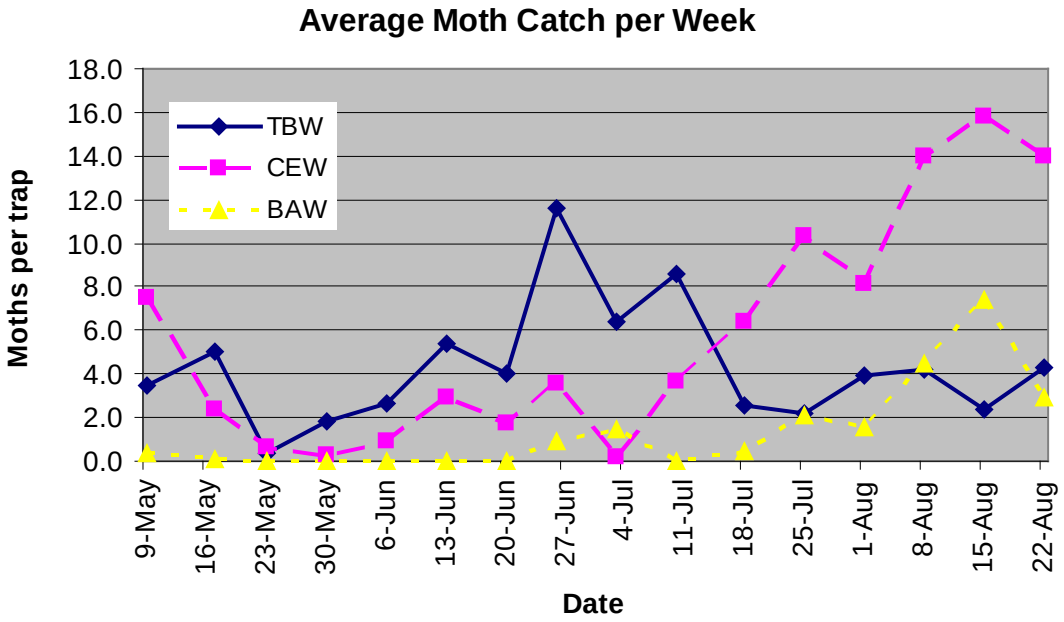
1) Moth Trapping. Weekly moth catches for each trap were reported weekly in the Tennessee IPM Newsletter. The newsletter is distributed to agents, cotton producers, consultants and other agricultural professionals and is also posted on the internet at www.utcrops.com.

Tobacco budworm moth catches were similar to 2006 with an early June peak reflecting emergence from alternate hosts. Like 2006, most tobacco budworm moths were caught in the southern counties of west Tennessee including Shelby and Tipton. During late June, some non-Bt cotton fields had tobacco budworm infestation above treatment threshold, particularly in Madison, Crockett, Shelby and Lauderdale counties. This corresponded well with trap catches in the previous weeks. Tobacco budworm moths were saved and shipped to Syngenta where they are being assayed to identify whether they developed on cotton or non-cotton hosts. This information is being used to understand the importance of alternate hosts as a non-Bt refuge resource for tobacco budworm. The highest single-trap capture was Shelby County where 81 tobacco budworm moths were caught the week preceding June 26.

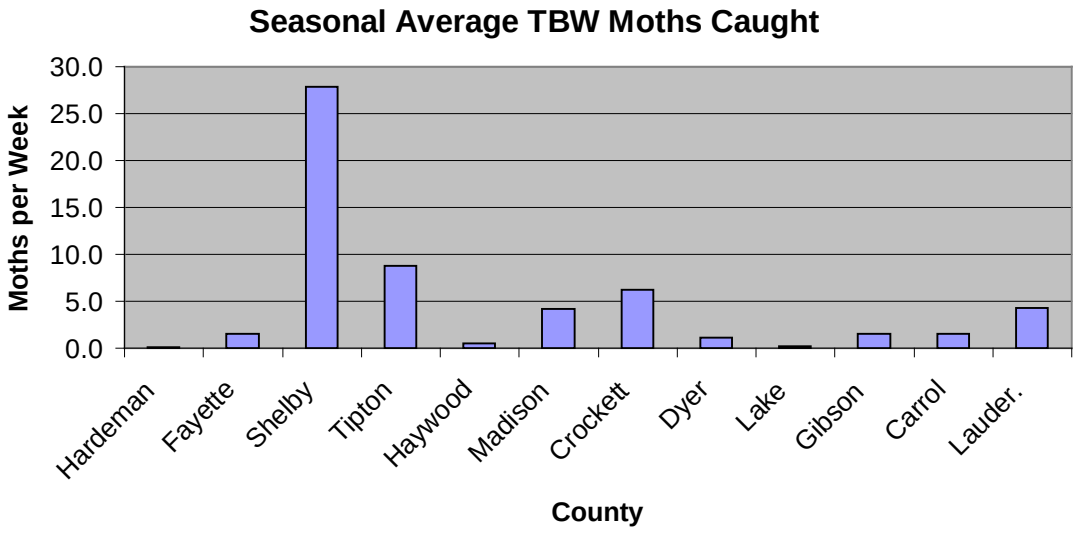
Catches of earworm (i.e., bollworm) and beet armyworm moths in pheromone traps were very low in 2007. The bollworm is Tennessee's most significant caterpillar pest in cotton because this species is able to cause economic injury to Bt cotton, which composes the vast majority of the acreage. However, bollworm trap catches were much lower than previous years. The highest single-trap capture observed was 85 moths in west Tipton County on July 25. The major peak of moth activity occurred in mid to late August, beginning about two weeks later than usual and when most fields were too mature to be at risk. Average peak moth catches were less than one-half of those recorded since 2003. It is likely that the "Easter freeze" which caused the replanting of most corn fields also resulted in a delayed emergence of corn earworm from corn. Shelby, Tipton, Madison and Lake Counties caught more corn earworm moths than other counties.

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

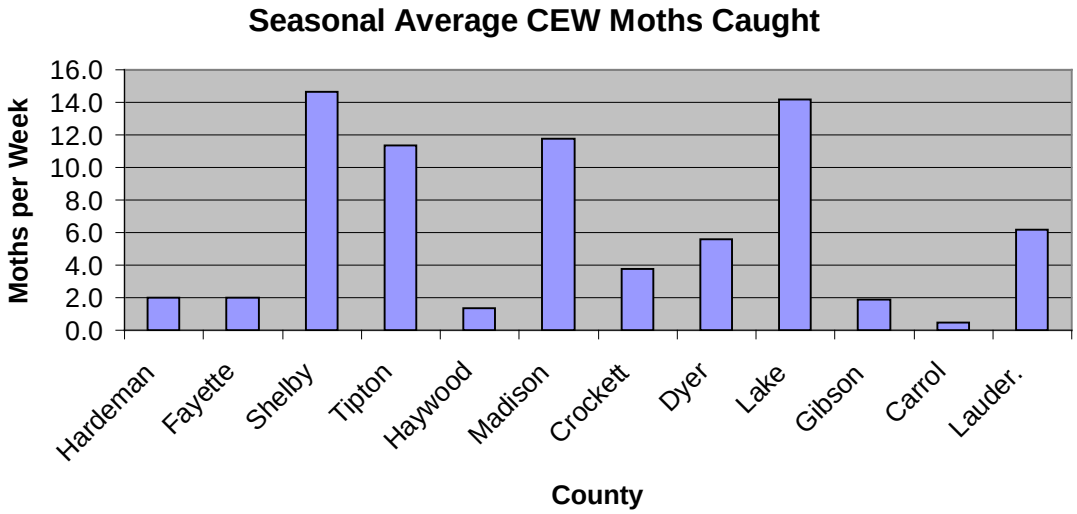
survival of these pests in cotton. However, the pheromone trapping program did an excellent job of predicting the low levels of corn earworm and beet armyworm populations observed this year. This low level of moth catches also correlated well with reduced late season boll damage (see below). Trapping also identified the observed, isolated field infestations of tobacco budworm found during June in non-Bt cotton in several southern counties of West Tennessee.



Average number of tobacco budworm (TBW), corn earworm (CEW), and beet armyworm (BAW) moths caught per trap in pheromone traps across West Tennessee (2007).



Seasonal, county average number of tobacco budworm moths caught per week in 2007.



Seasonal, county average number of corn earworm moths caught per week in 2007.

2) Boll damage survey in non-Bt, WideStrike, Bollgard and Bollgard II cotton. In a 2003 survey, caterpillar-caused boll damage was 9.2, 3.8 and 1.3% in non-Bt, Bollgard and Bollgard II cotton, respectively. About 5.8% of surveyed bolls were injured by bugs in 2003. In the 2004 survey, boll damage attributed to worms was 2.04, 0.31 and 0.13% in non-Bt, Bollgard and Bollgard II cotton, respectively. Approximately 3.5% of bolls were injured by bugs in 2004. Survey results from 2005 indicate that, like 2004, there was relatively little injury from caterpillar pests. Significantly more worm damage was observed in non-Bt cotton (≈ 1.5%) varieties than in Bollgard (0.08%), Bollgard II (0.08%) and WideStrike (0.12%) cotton. Across all varieties, about 4.3% of bolls had evidence of bug damage in 2005. The 2006 survey of boll damage indicated low bug injury to bolls across the state (average ≈ 1.5%). This was consistent with unusually low stink bug and plant bugs populations observed in most areas of West Tennessee. Boll injury caused by caterpillar pests, primarily bollworm, was about 5% in non-Bt cotton in 2006.

In 2007, boll damage caused by caterpillar pests was by far the lowest recorded since this survey began, averaging only 0.72% in non-Bt cotton across all locations (see tables below). Only samples in Lauderdale and Gibson County locations exceeded 3% boll damage due to caterpillar pests. The low level of injury was also consistent with moth trapping data and in-field observations of larval infestations. Overall, caterpillar induced boll damage in Bollgard, Bollgard II and WideStrike varieties were inconsequential. Despite modest infestation of plant bugs or stink bugs in many areas, bug induce boll damage was typical of previous years, averaging about 3% across all varieties. One trend observed over the years is a slightly increased level of bug damage in non-Bt cotton. This probably indicates that some caterpillar injury is being confused with stink bug or plant bug injury.

Average Percent Damage by Variety Across 13 Locations

Variety	Worm Damage	Bug Damage	Boll Rot	Total Damage
DP 444 BG/RR	0.18	2.59	0.00	2.77
PHY 370 WR	0.13	3.00	0.00	3.13
ST 4554 BGII RF	0.08	2.38	0.00	2.46
PHY 310 R	0.72	3.41	0.00	4.13

Damage = penetration of boll wall
Rot = any rot not apparently caused by insect
Each location = 3 samples of 100 consecutive, harvestable bolls per variety.

3) Resistance Monitoring. Resistance to selected insecticide was monitored for two important insect pests, the tarnished plant bug and bollworm.

a) Tarnished Plant Bug. Data from Tennessee (below) indicated relatively low levels of resistance compared with other lower mid-southern states, particularly Mississippi and Louisiana. However, survival in assays using acephate indicated some populations had at least moderate levels of resistance to this insecticide. Additionally, a few populations showed some level of resistance to permethrin, indicating that pyrethroids may not have provided adequate plant bug control of in cotton. No resistance issues were identified with imidacloprid, the active ingredient of Trimax Pro and representative of the neonicotinoid class of insecticide.

Tarnished plant bug insecticide assay data from Tennessee in 2006 and 2007. Bolded numbers indicate populations with potential resistance.

Year	Collection Site (County)	Discriminating Dose (% Mortality)		LC50 Value (ug)	
		Monitor	Permethrin	Acephate	Imidacloprid
2006	Haywood*	86	100		0.81
	Lauderdale*	90	100		0.86
	Madison*	98	100		0.71
	Gibson*	98	100		0.93
	Crockett	**60**	86	4.92	
	Dyer	86	**68**		2.21
2007	Haywood*	**72**	98	7.22	
	Lake*	88	**75**		
	Madison*	**68**	96	**9.62**	
	Dyer	96	96	**10.53**	1.04
	Crockett	90	100	4.89	
	Tipton	88	84	**10.64**	

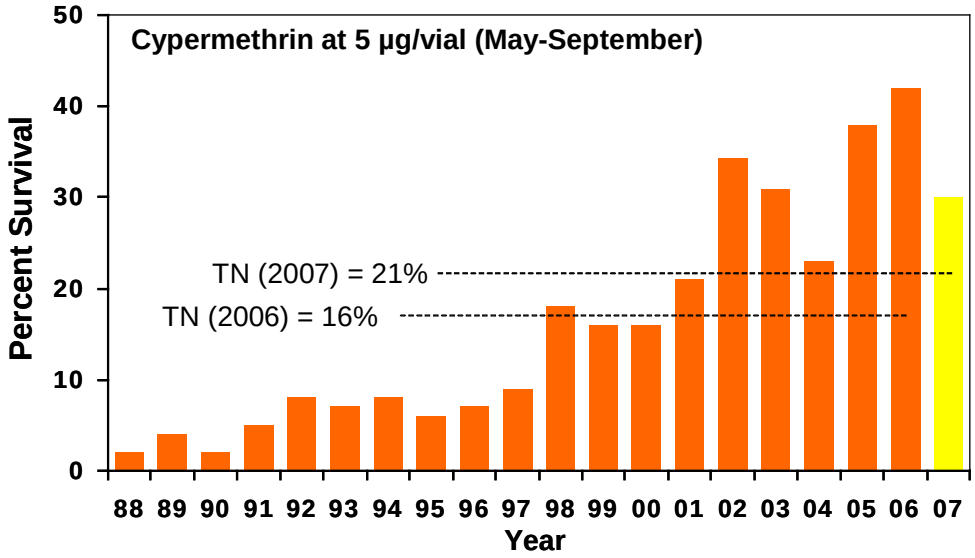
* Spring or early summer samples (other samples were made late summer or early fall).

b) Bollworm. Vial assays with cypermethrin, a synthetic pyrethroid, were done on bollworms moths collected from pheromone traps (see table below). Across all locations, corrected mean percent survival to the 5 ug/vial dose of cypermethrin was 21% (16% in 2006). This level of resistance would probably not result in field control insecticide failures when spraying pyrethroid

insecticides for bollworm control. In perspective, about 30% of bollworm moths collected in Louisiana survived using the same assay procedures (40% in 2006). However, bollworm survival was considerably lower than those observed in some other states (e.g., Virginia < 5%).

Percent survival of bollworm moths in vial assays (24 h exposure).

County	Collection Date	Cypermethrin Rate (ug/vial)	Number Moths Treated	% Moths Surviving
Madison Co.	17-Jul	5	30	26.7
		0	29	82.8
	18-Jul	5	4	50.0
		0	4	100.0
	24-Jul	5	11	27.3
		0	16	75.0
	25-Jul	5	11	45.5
		0	6	100.0
	31-Jul	5	4	25.0
		0	3	33.3
	4-Aug	5	28	28.6
		0	28	85.7
	7-Aug	5	27	11.1
		0	28	82.1
	8-Aug	5	21	33.3
		0	18	94.4
	9-Aug	5	20	25.0
		0	21	85.7
	10-Aug	5	8	12.5
		0	8	87.5
	14-Aug	5	53	34.0
		0	53	92.5
	16-Aug	5	19	42.1
		0	20	85.0
	17-Aug	5	22	36.4
		0	20	100.0
	21-Aug	5	2	0.0
		0	2	50.0
	5-Sep	5	2	100.0
		0	2	100.0
	18-Sep	5	13	7.7
		0	13	76.9
	21-Sep	5	17	94.1
		0	17	76.5
	25-Sep	5	4	0.0
		0	3	100.0
Lauderdale Co.	18-Jul	5	5	0.0
		0	5	100.0
Total	All	5	301	31.9
		0	296	86.5



Seasonal, average survival of bollworm moths exposed to cypermethrin in vial assay tests (24 h exposure to 5 ug/vial). Bars are historical data from Louisiana (Dr. B. R. Leonard, LSU AgCenter). Dashed lines indicate survival in Tennessee in 2006 and 2007. Numbers are corrected for check mortality.

4) Other Activities (selected summaries from insect management experiments in 2007). Approximately 20 insecticide trials were successfully established in 2007 to investigate various insect control practices and strategies for cotton pests. The data generated from these activities are used to validate and modify extension insect control recommendations in Tennessee. These evaluations included insecticide efficacy trials for thrips, spider mites, plant bugs, and bollworm. They also include the testing a several new insecticides and insecticide formulations. The complete results of all experiments have been individually summarized and published on the utcrops.com website at http://www.utextension.utk.edu/fieldCrops/MultiState/MultiState.htm. Selected results are presented below. The same website also serves as a data warehouse for other insecticide trials done by other universities in the Midsouth.

a) Selected Thrips Insecticidal Tests. Several new insecticidal/nematicidal seed treatments were introduced to the market in 2006 and 2007, including Aeris (Bayer CropScience) and Avicta (Syngenta). Thus, experiments were performed to determine if these new treatments provided comparable thrips control when compared to standard at-planting treatments. Various experimental formulations of Avicta were also evaluated (Test 2). Other treatments tested included Regent (fipronil, BASF, not labeled) as a seed treatment and sidedressed Temik applied in the presence and absence of various seed treatments. All treatments were also treated with a fungicidal seed treatment. Aeris, Avicta, Gaucho Grande and Cruiser provided similar levels of thrips control in most tests (tables below). Temik or Temik plus a seed treatment, particularly at a rate of 5 lb/acre, significantly improved the longevity of control. Temik outperformed the seed treatments more so than in previous years, probably because western flower thrips were more common than usual. At 18 days after planting, Regent did not appear to provide adequate thrips control when compared with Gaucho. In a foliar thrips test, two applications of Dimethoate 4F (2 rate), Orthene 90S (0.3.5 oz/a) and Carbine 50WG (1 oz/a) provided the best level of thrips

control on untreated cotton. However, these treatments were numerically less effective than Furadan 4F (carbofuran 32/a) or Gaucho Grande treatments in the same test. In general, there were very few effects of thrips treatments on yield in test done this year (table below).

Test 1. At-planting Thrips Trial in Cotton (Test of Fipronil/Regent).

Location: West Tennessee Research and Education Center (Jackson)
Variety: DP432RR (planted 4-27-07)
Plots: 4 rows X 30 ft (RCBD, 5 Reps)
Investigators: Stewart, Willis, S.Steckel, Hanks

Pest Name Pest Stage Rating Date Rating Data Type Sample Size Sample Size Unit Trt-Eval Interval, Days After Planting						Thrips Total 5/15/07 Counts 5 PLANT 18 DAP	Thrips Injury 5/16/07 Rating 0-5 SCALE 19 DAP	Thrips Total 5/21/07 Counts 5 PLANT 24 DAP	Yield 9/4/07 Seedcotton 1 ACRE, (lbs) 130 DAP
Treatment				Rate					
1	Maxim 4 Fs	480	FS	2.5	g a/100 kg seed	27 ab	2.1 a	32 a	2507 a
	Dynasty	100	FS	15	g a/100 kg seed				
	Apron Xl	360	LS	7.5	g a/100 kg seed				
2	Regent 500 Ts	500	FS	17	g a/100000 seed	35 a	1.7 b	44 a	2395 a
	Maxim 4 Fs	480	FS	2.5	g a/100 kg seed				
	Dynasty	100	FS	15	g a/100 kg seed				
	Apron Xl	360	LS	7.5	g a/100 kg seed				
3	Gaucho Grande	600	FS	38	g a/100000 seed	15 c	1.1 c	35 a	2364 a
	Maxim 4 Fs	480	FS	2.5	g a/100 kg seed				
	Dynasty	100	FS	15	g a/100 kg seed				
	Apron Xl	360	LS	7.5	g a/100 kg seed				
4	Regent 500 Ts	500	FS	17	g a/100000 seed	18 bc	1.2 c	39 a	2488 a
	Gaucho Grande	600	FS	25	g a/100000 seed				
	Maxim 4 Fs	480	FS	2.5	g a/100 kg seed				
	Dynasty	100	FS	15	g a/100 kg seed				
	Apron Xl	360	LS	7.5	g a/100 kg seed				

Test 2. At-planting Thrips Trial in Cotton (Avicta Formulations, etc.).

Location: West TN Research and Education Center (Jackson)
Variety: DP154 B2RF (planted 4/27/07)
Plots: 4 rows x 30 ft (RCBD, 4 Reps)
Investigators: Stewart, Willis, S.Steckel, Hanks

Pest Name Pest Stage Rating Date Rating Data Type Rating Unit Sample Size Trt-Eval Interval, Days After Planting				Thrips 5/16/07 Injury 0-5 Scale 19 DAP	Thrips Total 5/14/07 Counts 5 Plant 17 DAP	Thrips Total 5/21/07 Counts 5 Plant 24 DAP	Vigor 5/26/07 Vigor 0-5 Scale 29 DAP	Thrips Total 5/30/07 Counts 4 Plant 33 DAP	 9/4/07 Seedcotton Lbs Acre 130 DAP
Treatment		Rate							
1	Allegiance-Ls	15	g ai/100 kg	2.2 a	79.3 a	43.0 a	2.3 c	75 bc	3015 a

	Baytan 150 Sc	5	g ai/100 kg										
	Thiram 42-S	31	g ai/100 kg										
2	Allegiance-Ls	15	g ai/100 kg	0.3	bc	5.3	b	11.3	d	3.1	ab	29	c	2946	a
	Baytan 150 Sc	5	g ai/100 kg										
	Thiram 42-S	31	g ai/100 kg										
	Temik 15 G	840	g ai/ha										
3	Allegiance-Ls	15	g ai/100 kg	0.2	bc	8.3	b	30.5	abc	3.2	a	166	a	3009	a
	Baytan 150 Sc	5	g ai/100 kg										
	Thiram 42-S	31	g ai/100 kg										
	Dynasty Cst 125 Fs	0.034	mg ai/seed										
	Cruiser 5 Fs	0.342	mg ai/seed										
	Avicta 4.17 Fs	0.145	mg ai/seed										
4	Allegiance-Ls	15	g ai/100 kg	0.2	bc	6.5	b	30.3	abc	2.9	b	192	a	2997	a
	Baytan 150 Sc	5	g ai/100 kg										
	Thiram 42-S	31	g ai/100 kg										
	A14911	0.045	mg ai/seed										
	A16113	0.5	mg ai/seed										
5	Allegiance-Ls	15	g ai/100 kg	0.1	c	9.3	b	41.5	a	3.0	ab	132	ab	2980	a
	Baytan 150 Sc	5	g ai/100 kg										
	Thiram 42-S	31	g ai/100 kg										
	A14911	0.045	mg ai/seed										
	A16114	0.5	mg ai/seed										
6	Allegiance-Ls	15	g ai/100 kg	0.2	bc	7.8	b	26.8	bc	2.9	b	153	ab	2848	a
	Baytan 150 Sc	5	g ai/100 kg										
	Thiram 42-S	31	g ai/100 kg										
	A14911	0.045	mg ai/seed										
	A16115	0.5	mg ai/seed										
7	Allegiance-Ls	15	g ai/100 kg	0.2	bc	9.5	b	35.0	ab	3.0	ab	126	ab	2831	a
	Baytan 150 Sc	5	g ai/100 kg										
	Thiram 42-S	31	g ai/100 kg										
	Stp15273	0.375	mg ai/seed										
	Stp17217	0.375	mg ai/seed										
8	Allegiance-Ls	15	g ai/100 kg	0.2	bc	7.0	b	30.0	abc	2.9	b	208	a	2745	a
	Baytan 150 Sc	5	g ai/100 kg										
	Thiram 42-S	31	g ai/100 kg										
	Cruiser 5 Fs	0.342	mg ai/seed										
9	Allegiance-Ls	15	g ai/100 kg	0.3	b	7.8	b	19.8	cd	2.9	b	124	ab	2992	a
	Baytan 150 Sc	5	g ai/100 kg										
	Thiram 42-S	31	g ai/100 kg										
	Gaucho Grande 5	0.375	mg ai/seed										

Test 3. At-planting Thrips Trial in Cotton (Benefit of Temik Sidedressed Application).
Location: West Tennessee Research and Education Center (Jackson)
Application: A= at planting 4-27-07, B= side-dress 6-4-07
Variety: DP143 B2RF (planted 4-27-07)
Plots: 4 rows X 30 ft (RCBD, 4 Reps)
Investigators: Stewart, Willis, S.Steckel, Hanks

Pest Name Pest Stage Rating Date Rating Data Type Sample Size Sample Size Unit Trt-Eval Interval, Days After Planting				Thrips Injury 5/16/07 Rating 0-5 Scale 19 DAP	Thrips Total 5/15/07 Counts 5 Plant 18 DAP	Thrips Total 5/21/07 Counts 5 Plant 24 DAP	Thrips Total 5/30/2007 Counts 4 Plant 33 DAP	Yield 9/4/2007 Seedcotton 1 Acre, (lbs) 130 DAP
Treatment		Rate	Appl.					
1	Untreated Check		A	1.9 a	57.8 a	60.5 a	91.5 ab	2596 a
2	Aeris	Standard	A	0.4 d	11.0 bc	38.0 b	132.8 a	2814 a
3	Avicta 4.2FS	Standard	A	0.7 bcd	12.0 bc	24.5 bc	110.8 a	2837 a
4	Aeris Temik 15G in-furrow	Standard 5 lb/a	A A	0.5 cd	2.8 c	9.0 c	28.0 b	2740 a
5	Avicta 4.2FS Temik 15G in-furrow	Standard 5 lb/a	A A	0.5 cd	3.8 c	7.8 c	27.3 b	2631 a
6	Aeris Temik 15G side-dress	Standard 5 lb/a	A B	0.7 bcd	17.5 b	20.0 bc	106.8 a	2820 a
7	Avicta 4.2FS Temik 15G side-dress	Standard 5 lb/a	A B	0.5 cd	5.3 bc	30.0 b	132.0 a	2367 a
8	NUP 05071 600FS	12.8 lf oz/cwt	A	0.8 bc	9.3 bc	20.5 bc	86.8 ab	2676 a
9	NUP 0766 600FS	12.8 lf oz/cwt	A	1.0 b	13.0 bc	26.5 bc	79.5 ab	2831 a

Test 4. Thrips/Temik Trial in Cotton (Aeris, Avicta, Temik, Temik Sidedress).
Location: West TN Research and Education Center (Jackson)
Variety: DP 444 BG/RR (planted 4/27/07)
Applications: A = At planting; B = Sidedress applications on 6/4/07 (pinhead square)
Plots: 4 rows x 30 ft (RCBD, 4 reps)
Investigators: Stewart, Willis, S.Steckel, Hanks

Pest Name Pest Stage Rating Date Rating Data Type Sample Size Sample Size Unit Trt-Eval Interval, Days After Planting				Thrips Total 5/15/07 Counts 5 Plant 18 DAP	Thrips Injury 5/16/07 Rating 0-5 Scale 19 DAP	Thrips Total 5/21/07 Counts 5 Plant 24 DAP	Thrips Total 5/30/07 Counts 4 Plant 33 DAP	Yield 9/4/07 Seedcotton 1 Acre, (lbs) 130 DAP
Treatment		Rate	Appl.					
1	Untreated Check 1	------	A	34.5 a	1.8 a	26.8 a	30.3 a	2556 abc
2	Temik 15G in-furrow	3.5 lb ai/a	A	7.3 b	0.4 c	5.5 c	19.0 a	2459 a-d
3	Temik 15G in-furrow	5 lb ai/a	A	3.5 b	0.3 c	5.5 c	22.0 a	2688 ab
4	Temik 15G sidedress	5 lb ai/a	B	43.5 a	1.0 b	37.3 a	30.5 a	2132 cd
5	Temik 15G in-furrow Temik 15G sidedress	5 lb ai/a 5 lb ai/a	A B	4.0 b	0.3 c	4.3 c	22.5 a	2252 bcd
6	Untreated Check 2	------	A	31.8 a	0.8 b	25.0 ab	27.3 a	2442 a-d

7	Avicta 4.2FS	Standard	A	2.0	b	0.3	c	8.8	bc	51.0	a	2098	d
8	Aeris	Standard	A	4.0	b	0.4	c	6.5	c	26.5	a	2722	a

Test 5. Foliar vs. At-planting Thrips Trial in Cotton.
Location: West TN Research and Education Center (Jackson)
Variety: ST4554 B2RF (planted 4/27/07)
Application: A= at plant, B= 5/11/07 and C= 5/18/07, High-clearance sprayer (8 GPA, 43 PSI, TX 6)
Plots: 4 rows x 30 ft (RCBD, 4 reps)
Investigators: Stewart, Willis, S.Steckel, Hanks

Pest Name Pest Stage Rating Date Rating Data Type Sample Size Sample Size Unit Trt-Eval Interval					Thrips Total 5/15/07 Counts 5 Plant 4 DA-B		Thrips Injury 5/16/07 Rating 0-5 Scale 5 DA-B		Thrips Total 5/21/07 Counts 5 Plant 3 DA-C		Vigor 5/26/07 Rating 0-5 Scale 8 DA-C		Yield 9/4/07 Seedcotton 1 Acre, (lbs) 109 DAP	
Treatment		Rate		Appl.										
1	Untreated Check				23.5	bc	1.5	a	20.8	a	2.4	d	2619	a
2	QRD 400 FS	32	fl oz/a	BC	32.0	ab	1.3	abc	16.5	abc	2.4	d	2539	a
3	QRD 400 FS	16	fl oz/a	BC	35.0	a	1.0	bcd	17.8	ab	2.4	d	2780	a
4	Dimethoate 4EC	8	fl oz/a	BC	23.5	bc	0.8	cde	10.8	cde	2.7	c	2843	a
5	Dimethoate 4EC	4	fl oz/a	BC	17.0	cd	1.3	abc	13.5	b-e	2.7	c	2883	a
6	Bidrin 8EC	2.5	fl oz/a	BC	19.0	cd	1.4	ab	14.0	bcd	2.7	c	2774	a
7	Acephate 90SP	3.5	oz wt/a	BC	10.8	def	1.1	a-d	9.0	de	2.8	bc	3020	a
8	Carbine 50WG	1	oz wt/a	BC	15.0	cde	1.3	abc	7.0	e	2.7	c	2837	a
9	Carbofuran 4F (in furrow)	32	fl oz/a	A	6.0	ef	0.4	e	11.0	cde	2.9	b	2464	a
10	Carbofuran 4F (in furrow) Gaucho Grande 600FS	32 0.375	fl oz/a mg ai/seed	A A	4.3	f	0.4	e	8.3	de	3.2	a	2711	a
11	Gaucho Grande 600FS	0.375	mg ai/seed	A	5.0	ef	0.6	de	9.5	de	3.1	a	2562	a

b) Selected Plant Bug Insecticide Tests. Plant bugs have become the primary pest of cotton during mid to late season. Multiple trials were established during late July and August of 2007 to evaluate insecticide control. Across all tests, traditional insecticides such as Bidrin and acephate provided the most consistent control. Centric (2 oz/acre) was comparable to these treatments. Pyrethroid insecticides, imidacloprid (Trimax Pro, Couraze), Intruder and Carbine were somewhat less effective. However, pyrethroid insecticides in combination with other classes of chemistry (e.g., acephate, Bidrin) also provide excellent plant bug control. Premixed insecticide such as Bidrin XP (= dicrotophos + bifenthrin) and Endigo ZC (lambda-cyhalothrin + thiamethoxam) also performed well. Malathion (16 oz/a) provided modest control of plant bug, and the addition of Couraze Max (imidacloprid) did not appear to improve its performance. As seen in previous years, imidacloprid (e.g., Trimax Pro, Couraze) did not provide adequate control of plant bugs in blooming cotton.

Test 1. Mid Season Plant Bug Trial in Cotton.
Location: Dyer County, TN
Application: 7/27/07, High-clearance sprayer (8 GPA, 43 PSI, TX 6)
Rating: 2 drop cloths per plot (10 row ft)
Plots: 4 rows x 50 ft (RCBD, 4 Reps)
Investigators: Stewart, Willis, S. Steckel, Hanks

Pest Name Pest Stage Rating Date Days After Last Applic.				TPB Adult 7/31/07 4		TPB Immature 7/31/07 4		CPB Total 7/31/07 4		BSB Total 7/31/07 4		Total Bugs All 7/31/07 4	
Treatment		Rate											
1	Trimax Pro 4.44SC	1.8	fl oz/a	2.0	a	6.0	ab	0.3	a	0.0	a	8.3	ab
2	Trimax Pro 4.44SC Baythroid XL 1EC	1.8 1.5	fl oz/a fl oz/a	0.8	a	5.0	abc	0.0	a	0.0	a	5.8	bc
3	Trimax Pro 4.44SC Bidrin 8EC	1.8 4	fl oz/a fl oz/a	0.3	a	2.8	cd	0.0	a	0.0	a	3.0	c
4	Trimax Pro 4.44SC Dimethoate 4EC	1.8 8	fl oz/a fl oz/a	1.8	a	2.3	cd	0.0	a	0.0	a	4.0	c
5	Endigo 2.06 SC	4	fl oz/a	0.8	a	3.3	bcd	0.0	a	0.3	a	4.3	c
6	Endigo 2.06 SC	5	fl oz/a	1.0	a	3.3	bcd	0.0	a	0.0	a	4.3	c
7	Bidrin 8EC	6	fl oz/a	1.0	a	1.8	d	0.0	a	0.0	a	2.8	c
8	Untreated Check			2.5	a	7.0	a	0.3	a	0.0	a	9.8	a

TPB= Tarnished Plant Bug; CPB= Clouded Plant Bug; GSB= Green Stink Bug; BSB= Brown Stink Bug

Test 2. Mid Season Plant Bug Trial in Cotton.
Location: Lauderdale County (Fullen Farms)
Variety: ST4554 B2RF (planted 4-26-07)
Application: A = 7/19/07, High-clearance sprayer (8 GPA, 43 PSI, TX 6)
Rating: 2 drop cloths per plot (10 row ft)
Plots: 4 rows X 50 ft (RCBD, 4 Reps)
Investigators: Stewart, Willis, S.Steckel, Hanks

Pest Name Pest Stage Rating Date Days After First/Last Applic.				TPB Adult 7/23/07 4		TPB Immat. 7/23/07 4		Total Bugs 7/23/07 4		TPB Adult 7/26/07 7		TPB Immat. 7/26/07 7		Total Bugs 7/26/07 7	
Treatment		Rate													
1	Malathion 5ec	1	pt/a	1.0	abc	6.5	a	8.3	a	0.3	a	2.5	a	3.5	a
2	Malathion 5ec Couraze Max 4f	0.75 1	pt/a fl oz/a	0.8	abc	4.8	a	5.5	abc	0.8	a	1.8	a	2.5	a
3	Malathion 5ec Couraze Max 4f	0.75 1.5	pt/a fl oz/a	0.5	bc	2.5	a	3.3	bc	1.0	a	1.0	a	2.0	a
4	Malathion 5ec Couraze Max 4f	1 1	pt/a fl oz/a	1.3	ab	2.0	a	3.3	bc	0.0	a	2.0	a	2.3	a
5	Malathion 5ec Couraze Max 4f	1 1.5	pt/a fl oz/a	0.3	bc	4.8	a	5.5	abc	0.8	a	2.0	a	4.0	a
6	Couraze Max 4f	1	fl oz/a	1.3	ab	3.5	a	4.8	abc	0.3	a	2.5	a	3.8	a
7	Couraze Max 4f	1.5	fl oz/a	1.0	abc	4.3	a	6.0	ab	0.5	a	6.0	a	7.0	a
8	Dimethoate 4ec	1	pt/a	0.0	c	1.8	a	2.0	bc	0.5	a	3.0	a	3.8	a

	Prolex 1.25cs	1.25	fl oz/a										
9	Centric 40wg	2	oz/a	0.0	c	1.5	a	1.8	c	1.8	a	1.3	a	3.3	a
10	Bidrin 8ec	6	fl oz/a	0.0	c	1.8	a	2.3	bc	0.3	a	0.5	a	0.8	a
11	Untreated			1.8	a	5.3	a	7.5	a	1.0	a	3.3	a	6.3	a

TPB= Tarnished Plant Bug; Total bugs also includes stink bugs and clouded plant bugs

Test 3. Mid Season Plant Bug Trial in Cotton.
Location: Lauderdale County, TN
Variety: STN4554 B2RF (planted 4/26/07)
Application: 7/26/07, High-clearance sprayer (8 GPA, 43 PSI, TX 6)
Rating: 2 drop cloths per plot (10 row ft)
Plots: 4 rows x 50 ft (RCBD, 4 Reps)
Investigators: Stewart, Willis, S.Steckel, Hanks

Pest Name Pest Stage Rating Date Days After Last Applic.				TPB Adult 7/30/07 4		TPB Immature 7/30/07 4		Total bugs Total 7/30/07 4	
Treatment		Rate							
1	Endigo 2.06SC	4	fl oz/a	0.3	a	0.7	d	1.7	cde
2	Leverage 2.7SE	3	fl oz/a	1.3	a	4.3	ab	5.7	b
3	Mustang Max 0.8EC Carbine 50WG	2.7 2	fl oz/a oz wt/a	0.3	a	1.3	cd	2.0	cde
4	Brigade 2EC Carbine 50WG	3.5 2	fl oz/a oz wt/a	0.3	a	0.7	d	1.0	de
5	Asana XL 0.67EC Intruder 70WG	7.5 0.8	fl oz/a oz wt/a	0.0	a	1.7	cd	1.7	cde
6	Ammo 2.5EC Orthene 90S	3.5 0.33	fl oz/a lb/a	1.0	a	0.3	d	1.7	cde
7	Bidrin 8EC	6	fl oz/a	0.3	a	0.0	d	0.3	e
8	Diamond 0.83EC	6	fl oz/a	0.7	a	2.0	bcd	3.0	cd
9	Diamond 0.83EC Bidrin 8EC	4 4	fl oz/a fl oz/a	0.3	a	0.0	d	0.7	de
10	Asana XL 0.67EC Vydate 3.77EC	7.5 8	fl oz/a fl oz/a	0.7	a	3.3	abc	4.0	bc
11	Untreated Check			2.0	a	4.7	a	8.3	a

TPB= Tarnished Plant Bug; Total bugs also includes stink bugs and clouded plant bugs

Test 4. Plant Bug Trial in Cotton
Location: Dyer County, TN
Application: 7/27/07, High-clearance sprayer (8 GPA, 43 PSI, TX 6)
Rating: 2 drop cloths per plot (10 row ft)
Plots: 4 rows x 50 ft (RCBD, 4 Reps)
Investigators: Stewart, Willis, S.Steckel, Hanks

Pest Name Pest Stage Rating Date Days After First/Last Applic.				TPB Adult 7/31/07 4		TPB Immature 7/31/07 4		Total Bugs All 7/31/07 4	
Treatment		Rate							
1	BAS350 500EC	1.54	fl oz/a	0.8	a	3.0	b	3.8	b
2	Bidrin 8EC Discipline 2EC	4 4	fl oz/a fl oz/a	0.5	a	0.8	bc	1.3	bc
3	Bidrin 8EC Discipline 2EC	5.33 5.33	fl oz/a fl oz/a	0.0	a	0.8	bc	0.8	bc
4	Bidrin 8EC	8	fl oz/a	0.5	a	1.3	bc	1.8	bc
5	Discipline 2EC	6.4	fl oz/a	0.5	a	0.8	bc	1.5	bc
6	Endigo 2.06SC	4.5	fl oz/a	0.8	a	1.8	bc	2.5	bc
7	Acephate 90SP	0.75	lb ai/a	0.3	a	0.3	c	0.5	c
8	Diamond 0.83EC Bidrin 8EC	4 5.33	fl oz/a fl oz/a	0.3	a	1.0	bc	1.3	bc
9	Vydate 3.77EC	12	fl oz/a	1.0	a	1.5	bc	2.5	bc
10	Untreated Check			1.5	a	7.5	a	9.0	a

TPB= Tarnished Plant Bug; Total bugs also includes stink bugs and clouded plant bugs

Test 5. Mid Season Plant Bug Trial in Cotton.
Location: Lauderdale County (Fullen Farms)
Variety: STN4554 B2RF (planted 4-26-07)
Application: A= 7/19/07, High Clearance Sprayer (8 GPA, 43 PSI, TX 6)
Rating: 2 drop cloths per plot (10 row ft)
Plots: 4 rows X 50 ft (RCBD, 4 Reps)
Investigators: Stewart, Willis, S.Steckel, Hanks

Pest Name Pest Stage Rating Date Days After First/Last Applic.					TPB Adult 7/23/07 4		TPB Immature 7/23/07 4		Total bugs All 7/23/07 4	
Treatment		Rate		Appl						
1	Hero 1.24 EC	5.2	oz/a	A	0.3	a	3.0	bc	3.3	bc
2	Hero 1.24 EC Bidrin 8EC	5.2 8	oz/a oz/a	A A	0.3	a	1.5	cd	2.0	bc
3	Diamond .83EC	6	oz/a	A	0.5	a	3.8	abc	4.8	abc
4	Carbine 50WG	2.3	oz wt/a	A	1.0	a	2.0	bcd	4.0	bc
5	Mustang Max 0.8EC Bidrin 8EC	3.6 8	oz/a oz/a	A A	0.5	a	0.3	d	1.0	c
6	Bidrin 8EC	8	oz/a	A	0.5	a	2.0	bcd	2.5	bc
7	Mustang Max 0.8EC	3.6	oz/a	A	1.3	a	4.5	ab	5.8	ab
8	Acephate 90SP	0.5	lb a/a	A	1.5	a	1.3	cd	3.5	bc

9	Bidrin 8EC	5	oz/a	A	1.5	a	2.3	bcd	3.8	bc
	Diamond .83EC	4	oz/a	A						
10	Untreated Check				0.8	a	6.3	a	8.5	a

TPB= Tarnished Plant Bug; Total bugs also includes stink bugs and clouded plant bugs

c) Spider Mite Tests. Both early and late season spider mites have been problematic in West Tennessee in recent years. Several miticide experiments were implemented to evaluate control in 2007. As seen in previous years, Kelthane 4F (dicofol, 32 oz/a) provided the most consistent control of mites in prebloom cotton. However, several other miticides gave statistically similar levels of control. Also as seen in previous years, the worst treatments for early season mites were bifenthrin (e.g., Brigade of Discipline) and Dimethoate. However, in a later season test, Brigade was numerically the best treatment with the exception of Oberon 4SC (4 oz/a) and Acramite 4SC (16 oz/a) which performed similarly (test 3 below). But all treatments with the exception of Dimethoate (8 oz/a) significantly reduced spider mite populations.

Test 1. Early Season Spider Mite Trial in Cotton.
Location: Carroll County, TN
Application: 6/7/07, Backpack sprayer (11.4 GPA, 30 PSI, FF 80015)
Plots: 3 rows x 35 ft (RCBD, 4 Reps)
Investigators: Stewart, Willis, S.Steckel, Hanks

Pest Name				Spider mites		Spider mites		Spider mites	
Pest Stage				Total		Total		Total	
Rating Date				6/11/207		6/15/07		6/19/07	
Sample Size				30		10		5	
Sample Size Unit				IN2		IN2		IN2	
Days After Last Applic.				4		8		12	
Treatment		Rate							
1	Comite II 6EC	24	fl oz/a	61.5	e	58.3	cd	81.0	bc
2	Zephyr 0.15EC	4	fl oz/a	92.3	cde	11.5	e	80.5	bc
3	Zeal 72WP	0.8	oz wt/a	117.8	cde	38.8	cde	74.3	bc
4	Oberon 4SC	4	fl oz/a	156.0	bc	75.0	bc	106.8	b
5	Oberon 4SC	6	fl oz/a	57.5	de	18.8	de	39.5	bc
6	Dimethoate 4EC	8	fl oz/a	239.8	ab	114.3	b	199.3	a
7	Discipline 2EC	5	fl oz/a	69.0	cde	80.3	bc	97.5	b
8	Brigade 2EC	5	fl oz/a	82.0	cde	105.0	b	104.8	b
9	Denim 0.16EC	10	fl oz/a	140.5	bcd	27.5	de	51.8	bc
10	Kelthane 4EC	32	fl oz/a	2.8	f	17.3	de	10.0	c
11	Untreated			310.0	a	198.0	a	209.0	a

Test 2. Early Season Spider Mite Trial in Cotton.
Location: Carroll County, TN
Application: 7/13/07, Backpack sprayer (11.4 GPA, 30 PSI, FF 80015)
Rating: 5 leaves, 1 sq inch/leaf
Plots: 3 rows x 35 feet (RCBD, 4 Reps)
Investigators: Stewart, Willis, S. Steckel, Hanks

Pest Name Pest Stage Rating Date Days After Last Applic.				Spider mites Total 6/15/2007 4		Spider mites Total 6/19/2007 8	
Treatment		Rate					
1	Zephyr 0.15EC	4	fl oz/a	97.7	cd	38.0	bc
2	Zeal 72WP	0.67	oz wt/a	142.3	bc	76.7	bc
3	Oberon 4SC	3	fl oz/a	113.0	cd	34.0	bc
4	Oberon 4SC	5	fl oz/a	85.3	cd	65.7	bc
5	Dimethoate 4EC	8	fl oz/a	191.3	ab	81.7	b
6	Discipline 2EC	5	fl oz/a	101.7	cd	70.0	bc
7	Denim 0.16EC	10	fl oz/a	98.7	cd	60.0	bc
8	Kelthane 4EC	32	fl oz/a	62.3	d	25.7	c
9	Untreated			224.3	a	169.7	a

Test 3. Mid Season Spider Mite Trial in Cotton.
Location: Fayette County, TN
Application: 7/17/07, Backpack sprayer (11.4 GPA, 30 PSI, FF 80015)
Rating: 10 leaves, 1 sq inch/leaf
Plots: 3 rows x 50 ft (RCBD, 4 Reps)
Investigators: Stewart, Willis, S.Steckel, Hanks

Description Pest Stage Rating Date Days After Last Applic.				Spider mites Total 7/17/2007 4		Spider mites Total 7/20/2007 7	
Treatment		Rate					
1	Untreated			107.8	a	75.8	a
2	Kelthane 4EC	32	fl oz/a	55.5	bc	31.3	b
3	Zephyr 0.15EC	4	fl oz/a	56.3	bc	25.3	b
4	Brigade 2EC	5	fl oz/a	24.3	c	8.3	b
5	Acramite 4SC	16	fl oz/a	34.8	c	11.8	b
6	Oberon 4SC	4	fl oz/a	40.5	c	7.5	b
7	Dimethoate 4EC	8	fl oz/a	76.5	ab	44.5	ab

d) Evaluation of Bt Cotton Traits and Foliar Insecticides for Lepidoptera. Two experimental insecticides were evaluated for control of bollworms in non-Bt cotton: foliar applications of DPX-E2Y45-310 (rynoxypyr, DuPont) and NNI-0001 (flubendiamide, Bayer CropScience) were compared with other foliar insecticides and the control provided by a Bollgard II cotton variety (see tests 1 and 2 below). Low populations of bollworm, tobacco budworm or other caterpillar pests were encountered in 2007. Thus, it was difficult to separate treatment effects. Both rynoxypyr and flubendiamide appeared to provide good control of bollworm populations, at least comparable to that of other foliar standards, but no better than a standard pyrethroid treatment (Asana XL). The Bollgard II variety generally provided the best numerical reduction in

bollworm numbers and damage. In a head to head comparison, Bollgard II and WideStrike varieties provided a similar level of protection against low populations of lepidopteran pests (see test 3 below).

Test 1. Bollworm Trial in Non-Bt Cotton Compared with Bollgard II.
Location: West TN Research and Education Center (Jackson)
Variety: ST4664 RF (non-Bt) or ST4554 (Bollgard II), planted 5/8/07
Application: One spray on 7/31/07, High-clearance sprayer (8 GPA, 43 PSI, TX 6)
Plots: 4 rows x 30 ft (RCBD, 4 Reps)
Investigators: Stewart, Willis, S.Steckel, Hanks

Description Rating Data Type Sample Size Sample Size Unit Pest Stage			Square Damage Season Tot. 60 PLANT	Terminals Damage Season Tot. 60 PLANT	Boll damage Damage Season Tot. 60 PLANT	Total Plant Damage* Season Tot. 60 PLANT	Bollworm Counts Season Tot. 60 PLANT Total
Treatment	Rate						
1 DPX-E2Y45-310	0.088	lb ai/a	1.5 a	1.3 a	1.5 bc	4.3 ab	0.3 b
2 DPX-E2Y45-310	0.1	lb ai/a	1.0 a	1.0 a	0.8 bc	2.8 ab	0.0 b
3 Tracer 4F	0.067	lb ai/a	1.5 a	1.3 a	3.0 ab	5.8 ab	0.3 b
4 Bollgard II	n/a	n/a	0.3 a	0.0 a	0.0 c	0.3 c	0.0 b
5 NNI-0001 480SC (Belt)	0.094	lb ai/a	0.8 a	1.0 a	1.8 bc	3.5 ab	0.5 b
6 Steward 1.25SC	0.107	lb ai/a	1.0 a	1.0 a	2.0 abc	4.0 ab	0.0 b
7 Denim 0.16EC	0.0125	lb ai/a	0.8 a	1.0 a	4.3 a	6.0 a	1.5 a
8 Asana XL 0.67EC	0.04	lb ai/a	0.8 a	0.5 a	1.3 bc	2.5 bc	0.3 b
9 Untreated Check			1.3 a	1.0 a	4.3 a	6.5 a	1.5 a

Test 2. Bollworm Trial in Non-Bt Cotton Compared with Bollgard II (late cotton)
Location: West TN Research and Education Center (Jackson)
Variety: ST4664 RF (non-Bt) or ST4554 (Bollgard II), planted 5/8/07
Application: One spray on 8/6/07, High-clearance sprayer (8 GPA, 43 PSI, TX 6)
Plots: 4 rows x 30 ft (RCBD, 4 Reps)
Investigators: Stewart, Willis, S.Steckel, Hanks
Comment: Maturity was intentionally delayed by spraying with one-half rate of Ignite

Description Rating Date Rating Data Type Sample Size Sample Size Unit Pest Stage			Square Damage Season Tot. 60 PLANT	Terminal Damage Season Tot. 60 PLANT	Boll Damage Season Tot. 60 PLANT	Total Fruit Damage Season Tot. 60 PLANT	Bollworms Counts Season Tot. 60 PLANT Total
Treatment	Rate						
1 DPX-E2Y45-310	0.088	lb ai/a	0.3 c	0.3 a	1.3 bc	1.8 cd	0.0 c
2 DPX-E2Y45-310	0.1	lb ai/a	0.5 c	1.0 a	0.3 c	1.8 cd	0.5 bc
3 Tracer 4F	0.067	lb ai/a	4.5 b	3.0 a	3.0 abc	10.5 ab	2.8 ab
4 Bollgard II	n/a	n/a	0.3 c	0.3 a	0.3 c	0.8 d	0.3 bc
5 NNI-0001 480SC(Belt)	0.094	lb ai/a	2.5 bc	1.3 a	2.3 abc	6.0 bcd	1.3 bc
6 Steward 1.25SC	0.107	lb ai/a	2.5 bc	1.3 a	3.8 ab	7.5 bc	2.0 bc

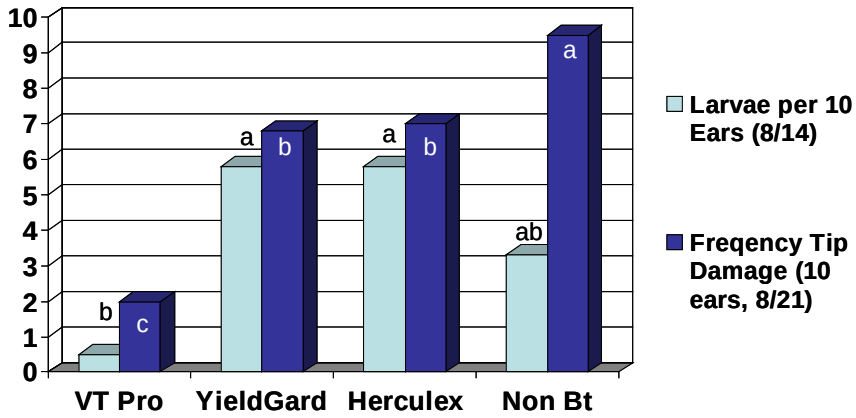
7	Denim 0.16EC	0.0125	lb ai/a	3.3	b	2.3	a	0.5	c	6.0	bcd	1.3	bc
8	Asana XL 0.67EC	0.04	lb ai/a	3.5	b	2.5	a	1.8	abc	7.8	bc	0.8	bc
9	Untreated Check			7.8	a	3.8	a	4.5	a	16.0	a	4.8	a

Test 3. Comparison of Bt Traits on Bollworm Control.
Location: West Tennessee Research and Education Center (Jackson, TN)
Rating: 7/27/07 (25 plants per plot), 8/2/07 & 8/9/07 (20 plants per plot)
Plots: 4 rows X 30 ft, (RCBD, 4 Reps)
Harvest: 9/17/2007
Investigators: Stewart, Willis, S.Steckel, Hanks

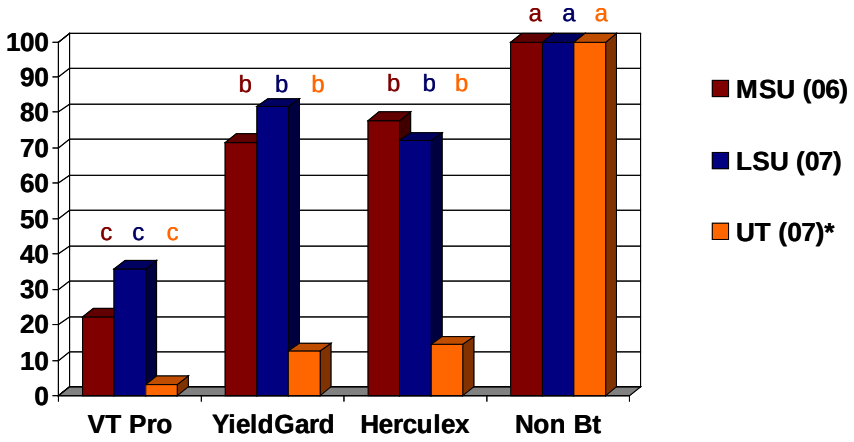
Description	Bt Trait	Bollworm Season Total		Total Fruit Damage		Season Terminal Damage		Seedcotton Per Acre (lbs)	
Treatment									
1 PHY375WRF	WideStrike	0.0	b	0.0	c	0.3	c	1639.1	a
2 PHY485WRF	WideStrike	0.3	b	0.5	c	0.3	c	997.2	c
3 PHY315RF	Non-Bt	2.3	a	8.3	a	3.5	a	1232.2	bc
4 PHY425RF	Non-Bt	0.3	b	0.3	c	1.0	bc	1111.9	bc
5 ST4554B2RF	Bollgard II	0.3	b	0.3	c	0.0	c	1392.7	ab
6 ST4664RF	Non-Bt	1.8	a	5.5	b	2.8	ab	1375.5	ab

e) Potential Implications of Stacked Bt Corn Traits on Bollworm Management in Cotton. This research addresses the efficacy of new Bt corn traits on bollworm populations and the potential implications of this technology on bollworm management in cotton, including Bt resistance management. Corn varieties that have multiple Bt traits are under development. YieldGard VT Pro® produces two Bt toxins, Cry1Ab and Cry1A.105, that have activity on lepidopteran pests. In contrast, currently available Bt corns with activity on lepidopteran pests produce only one toxin (i.e., Cry1Ac in YieldGard® and Cry1F in Herculex®). YieldGard, Herculex and YieldGard VT Pro provides excellent and similar levels of control on southwestern corn bore (data not shown). However, YieldGard VT Pro had considerably better activity on corn earworm, i.e. bollworm, than either YieldGard or Herculex corn (see figures below). Annually, corn may produce 50 - 80% of bollworms within the landscape of some cropping environment. The percentage of bollworm moths originating from corn, as opposed to other hosts, may be even higher at certain times of the season. Cotton growers may benefit from reduced numbers of bollworms emigrating from corn into cotton if new Bt corn technologies are widely adopted.

For YieldGard VT Pro, Monsanto is petitioning the Environmental Protection Agency to decrease non-Bt refuge requirements in corn, proposing a minimum 20% refuge in the Cotton Belt and a 5% refuge in the Corn Belt. Current non-Bt corn refuge requirements in the Cotton and Corn Belt are 50% and 20%, respectively. In areas where corn borers typically cause yield loss, corn growers could benefit from these relaxed refuge requirements. However, corn is an important host of bollworm. Because new, stacked-Bt technologies have greater efficacy on bollworm, and because similar Bt traits are present in cotton, the impact on Bt resistance management for bollworm should also be considered.



Number of corn earworm larvae and frequency of ears with damage corn earworm in YieldGard VT Pro, YieldGard, Herculex and non-Bt corn (S.D. Stewart, 2007, UT Extension). Bars without a common letter are significantly different (LSD, $P < 0.05$).



Percent relative kernel damage caused by corn earworm larvae in YieldGard VT Pro, YieldGard, Herculex and non-Bt corn (F. Musser, 2006, Mississippi State University; B.R. Leonard, 2007, LSU AgCenter; S.D. Stewart, 2007, UT Extension). Average kernel damage to non-Bt corn was set to 100% and averages observed in other varieties were adjusted accordingly. Bars, within location, without a common letter are significantly different (LSD, $P < 0.05$). *Natural infestations of southwestern corn borers inflated kernel damage in non-Bt corn at the UT location.