65th ANNUAL CONFERENCE REPORT ON COTTON INSECT RESEARCH AND CONTROL

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Abstract

There were 15,008,040 acres of cotton planted in 2011 but only 10,131,040 acres of U.S. Cotton (Upland and Pima) harvested with an average of 770 pounds of lint per acre (USDA –January 2012 report) in 2011.

Arthropod pests of cotton reduced yield by 3.03% in 2011. *Lygus* reduced yields by 1.03% attaining losses greater than all other pests. Thrips were second at 0.695% infesting 84% of the US crop. Stink bugs were the 3rd most damaging pest at 0,51%. Heliothines were 4th at 0.383%. The bollworm was the predominant heliothine species to attack cotton in 2011. Bollworms were estimated to make up 76% of the population Spider mites were the 5th most damaging pest at 0.167% loss. Beltwide, direct insect management costs amounted to $62.34 per acre. Cost plus loss is estimated at $1.022 billion. **(see M.R. Williams, this proceedings)**.

Crop and Arthropod Pest Conditions:

Alabama

Cotton was planted on approximately 450,000 acres in 2011, an increase of about 30% over the previous year. More than 98% of the acreage contained the Round-Up gene and approximately 99% contained genes for lepidoptera control.

Early season thrips pressure was extremely high. Extreme drought was a contributing factor in high thrips numbers. Many fields planted with seed treatments for thrips control required, or needed, a foliar insecticide for thrips. Cutworms and aphids were low during the early season window. Grasshoppers were abundant in many fields, especially in reduced tillage situations. One sharp peek of migrating adult tarnished plant bugs moved into cotton between June 20 and July 10. However, offspring of these adults did not reach treatable levels in most fields. One foliar spray was applied for the adult TPB's in most instances.

Approximately 85% of the acres were planted with insecticide treated seed with most of the remainder receiving Temik in-furrow. Midseason pests were very limited in 2011. Bollworms were at historical low levels. Sub economic levels of bollworms occurred about the third to fifth week of bloom but most fields were not treated with a foliar insecticide. 2011 was the lowest pressure year in history for all lep species on cotton. No tobacco budworms or fall armyworms were experienced.

Stink bugs, the most dominant economic insect of cotton, were also at the lowest levels since the introduction of genetically altered varieties. Only a limited number of fields received a single foliar insecticide application for stink bugs. Most of the few stink bugs observed were the brown stink bug, *Euschistus servus*. It is suspected that winter temperatures reduced overwintering populations of the southern green stink bug. Extreme heat, 98-100^{0}F, and drought likely took its toll on brown stink bugs in the spring and early summer window. Overall insect losses were estimated to be between 2 and 3%, an all time low.

The lack of soil moisture was a limiting factor in obtaining stands between April 15 and mid to late May. Skippy stands on late planted cotton were the norm in the southeastern region of the state in 2011. Adequate to good moisture occurred from about mid-June to early August. Thereafter, no more rainfall occurred until harvest season. Temperatures were at an all-time average high throughout much of the 2011 season. The only benefit from these unusually high temperatures was the lack of boll rot.

Yields are projected to be about 750 pounds of lint per acre. However, many of the irrigated fields within the state yielded 2.5-4 bales per acre. **(Ron Smith)**.

Arkansas

Cotton was planted on about 680,000 acres in 2011 which was up from 545,000 planted acres in 2010. Approximately 660,000 acres were harvested with an average yield of 997 lbs lint/acre in 2011. Over 95% of the cotton in the state was planted to WideStrike and Bollgard II varieties. A small percentage of conventional cotton was planted (approximately 1%) this year. Growers continue to show an increasing interest in conventional varieties in response to increasing problems with herbicide resistance. Two significant storm events caused problems for growers in the northeastern portion of the state. High winds and a tornado hit seedling cotton causing a significant number of acres to be replanted. Some growers had to replant 2 additional times. In addition, over 100 pivots were also damaged by both storms which hit in a 2 week period. As a result, some growers had difficulty irrigating their crop due to the delay in getting pivots replaced during the growing season. Bacterial blight also occurred at significant levels in some areas, particularly northeast Arkansas. High winds and driving rain that occurred earlier were thought to contribute to the spread of this disease in some areas. Temperatures were slightly higher than normal and hit over 100 degrees F several times during the month of August. Weed resistance to glyphosate continues to be an increasing problem across the state. Yields were down from the previous season.

Thrips- pressure was heavy across some areas of the state. A foliar application for thrips was made on approximately 80% of the acres. Some seed treatments did sustain significant thrips damage where pressure was extremely high. Spider mites were high in those areas of the state that have traditionally had mite problems. Mite populations were higher in the northern part of the state. Approximately 20% of the cotton in the state was treated for spider mites and requiring 1 to 2 applications of a miticide. Tarnished plant bugs were at moderate to high levels and was the number one pest again this year causing a 3.42% yield loss across the state. High populations were in the typical areas near corn fields. Pockets of clouded plant bugs were seen in northeast Arkansas. Growers made 4 to 5 applications for plant bugs in 2011. Bollworms were heavy again in 2011, particularly in the southern part of the state. Bollworm was the number 2 pest in cotton in 2011 causing a 2.35% reduction in yield. Approximately 32% of the cotton acreage was treated 2 times with a pyrethroid for bollworms. One hundred percent of the conventional cotton grown was treated 2 to 3 times for bollworms. Pyrethroids were the chemistry of choice in the northern part of the state while growers in the south tended to use other materials that also gave good tobacco budworm control such as Prevathon or Belt. **(Glenn Studebaker)**.

California

There were 454,595 acres of cotton planted in CA in 2011, an increase of 147,600 acres from 2010. There were 273,020 acres planted to Pima cotton and 181,575 acres planted to upland cottons. Almost all the upland Bt cotton was planted primarily in the Southern Desert Valleys.

Yield is estimated to be 1,432 lbs/acre for upland and 1,269 lbs/acre for Pima. Due to cold, wet conditions during March and April, planting in the San Joaquin Valley (SJV) was delayed until mid April through May. Planting conditions during March and April (based on $DD_{>60}$, five days post planting) were unfavorable or marginal for planting cotton 53% of the days and 47% of the days were adequate to ideal for cotton emergence at the Westside REC. The warm temperatures in September and October allowed for an extended growing season and provided the opportunity to develop additional yield.

The cool and very late start to the season created scattered areas that required thrips treatments. Spider mites were generally a greater problem, especially in the southern area of SJV. Due to extended spring rain, Lygus was the key issue in the San Joaquin Valley. Multiple insecticide applications were made in many areas, especially in those located near uncultivated natural areas. Because of the delayed season, treatment decisions were very conservative. However, the pressure and treatment response varied widely through the SJV from none to 4-5 applications. Aphid and whitefly populations were not severe. Pink bollworm eradication efforts continued in the southern deserts with good progress being reported. **(Peter Goodell)**.

Georgia

Approximately 1.6 million acres of cotton was planted in Georgia of which 1.52 million acres were harvested during 2011. Production was variable depending primarily on available moisture; irrigated yields were generally good to excellent and dryland ranged from very poor to good. Harvest conditions were generally good and average yield is estimated at 807 lbs. lint per acre.

Thrips populations were variable depending on location and planting date. Early planted cotton experienced heavy thrips infestations whereas low to moderate infestations were observed on later plantings. The availability of aldicarb was limited and neonic seed treatments were used on the majority of acres. A significant portion of early planted cotton received a supplemental foliar insecticide application for thrips control. Other seedling pests such as grasshoppers and cutworms were rarely observed. Aphid populations were light to moderate and crashed due to the naturally occurring fungus during early summer; only a small percentage of the acreage was treated with insecticide for aphids. Tarnished plant bug infestations were uncommon and few acres were treated with insecticide. Spider mites continue to be a potential pest; populations were detected at low levels in many fields during mid and late season. Fortunately, spider mite infestations rarely built to economic levels. We continue to encourage economic infestations of spider mites in research trials by disrupting natural controls. Spider mites are a pest which requires careful management.

Corn earworm and tobacco budworm populations were very low. Most cotton planted in Georgia is transgenic Bt cotton and only a small percentage of acres needed a supplemental insecticide application for corn earworm. We continued to monitor pyrethroid susceptibility of corn earworm using cypermethrin treated vials; 2011 results were similar to previous years in terms of susceptibility. Fall armyworm, beet armyworm, and soybean looper populations were also low statewide.

Stink bugs were the most common insect treated with insecticide during mid and late season but populations were also much lower than normal during 2011. The most common stink bug observed was the brown stink bug. Southern green stink bug populations were very low, which has been a trend now for a couple of years.

Silverleaf whiteflies were present in localized areas but generally did not build to high populations. No boll weevils were captured by boll weevil eradication personnel during 2011. In summary, insect pest populations and associated damage were unusually low during 2011. **(Phillip Roberts)**.

Louisiana

Cotton was planted on approximately 285,000 acres in Louisiana during 2011, which was approximately a 10% increase above that planted in 2010. Much of the cotton region in the state suffered from excessive heat and droughty conditions for much of the summer. In spite of these adverse weather conditions, cotton yields were considerably higher than expected. Boll rot was rare in many fields and the ability to harvest additional bolls low in the plant canopy may have contributed to higher yields. Yields were actually 10-15% higher than field estimates during the season. Lint yields were extremely variable across farms, but the statewide average was estimated at 980 lb/acre in 2011. Much of the crop was harvested with little to no rainfall on open seedcotton and lint quality (except for micronaire) was above average. However, weather-induced yield losses remain the primary limiting factor for cotton production potential Louisiana.

Greater than 95% of the cotton acreage was planted with varieties containing Bollgard 2 or WideStrike technologies. In addition, nearly all (>80%) of the cotton seed was treated with an insecticide and fewer than 10% of the acres received an application of Temik 15G as an in-furrow granule at-planting. Excessive thrips populations infested cotton fields for an extended period during the early season. Seedling injury appeared to be severe in some instances due to poor growth and low nightly temperatures. The species composition in many areas was comprised of a higher than normal percentage of western flower thrips which were more difficult to control with insecticides. The insecticide seed treatments (primarily imidacloprid and thiamethoxam) used by many producers provided initial control of infestations, many fields were over-sprayed with a single insecticide application for thrips. In the presence of western flower thrips, spinosad and spinetoram were the most effective insecticides. Cotton aphid was a minor problem during 2011 and very few fields were treated. One Louisiana population of cotton aphid was tested by Mississippi State University and exhibited reduced susceptibility to thiamethoxam. Thiamethoxam (Centric) will be removed from the recommended list of insecticides for cotton aphid in Louisiana. Tarnished plant bugs were a significant and widespread cotton pest, but infestations were generally not as high or persistent as that experienced in 2009-10. Unsatisfactory control was observed with single applications of some products during late July and August. Insecticide susceptibility surveys continue to show that acephate and pyrethroid resistance is widespread in Louisiana populations of tarnished plant bug. Many populations remained susceptible to the neonicotinoids. Co-applications of pyrethroids and neonicotinoids were the most effective treatments. Bollworm was a major pest in Bollgard, Bollgard 2, and WideStrike fields, but the same co-applications of insecticides used for tarnished plant bugs reduced the overall significance of the problem. Oversprays specifically targeted bollworm as a single target in

Bollgard 2 and WideStrike fields. Significant yield losses from bollworm were not common but supplemental pyrethroid sprays were used to mitigate fruiting form injury. Sufficient numbers of bollworm as late instars were collected from these fields and used to establish laboratory colonies. Other caterpillar pests such as fall armyworm and soybean/cabbage looper were isolated problems on limited acreage, but generally did not cause significant yield losses. Brown stink bugs were common in some fields during the boll maturation periods of plant development and likely migrated from senescing fields of soybean. Levels of stink bug-damaged bolls were recorded above the action threshold in few fields, but in general, overall stink bug infestations were very low compared to previous infestations. Spider mites were a full season pest in many fields. Extended periods of drought and high temperatures caused spider mites to infest significant acreage. Many of these initial infestations were detected on the borders of cotton fields that were adjacent to field corn or found in isolated spots associated with poor winter / spring weed control. This is the second year for surveys of corn fields that showed high infestations of two-spotted spider mite after plants entered the tassel stage. Those populations dispersed by wind into adjacent cotton fields which resulted in multiple sprays to cotton field borders or even the entire field. In spite of effective acaricides, spider mites are causing local isolated yield losses due to poor application timing. **(B. Rogers Leonard)**

Mississippi

Cotton producers in Mississippi planted approximately 600,000 acres of cotton in 2010. Approximately 97% of cotton in MS was planted to dual gene Bt varieties. The most popular varieties planted in 2011 were Stoneville 5288 BGII/F, 5458BGII/F, and DeltaPine 0912BG/RR.

Total insect losses in MS were higher in 2011 than in 2010. Overall losses from insect pests in 2011 were 7.06%. Mississippi averaged 10.3 foliar applications to control pests in 2011 for an average foliar insect control cost of $121.47 per acre. Final cotton yield estimates for 2011 was 954. Cotton yields in the delta averaged approximately 1010 pounds per acre while the hill region of the state averaged approximately 925 pounds per acre.

Thrips pressure across the state was heavy across the state. Seed treatments continue to gain popularity in MS for control of thrips due to convenience and ease of use. Approximately 75% of the cotton acreage received a foliar application for thrips up 50% from previous years.

Tarnished plant bug ranked as the number one damaging pest in 2011. The delta region of the state averaged 7 spray applications for plant bugs while the hill region of the state averaged only 2.5 spray applications. The chloro-nicotinyl class of chemistry, such as, Trimax and Centric was widely used in pre-bloom cotton to control tarnished plant bugs in 2011 with "standards" such as Orthene, Bidrin, and Vydate getting more use in post-bloom cotton tank mixed with pyrethroid insecticides. The IGR insecticide Diamond was also widely used in 2011 in the Delta region of the state.

Bollworm/Budworm pressure was moderate to high in 2011 with average number of foliar sprays at 2.5 for cotton in the delta region of the state. The hill region of the state received on averaged 1.0 foliar application. Although 2011 had significantly higher pressure from cotton bollworm, the increase in dual toxin Bt cotton to 97% prevented high numbers of foliar sprays targeted at cotton bollworm. Fall armyworm pressure was very light in 2011.

Spider mites once again ranked as Mississippi's third most damaging pest. Lack of rainfall allowed populations to persist for most of the growing season; requiring producer's to treat a record percentage of acres for this pest. Approximately 228,000 acres were treated for spider mites in the state in 2011.

In summary, total insect control cost for the state in 2011 was $281.36 per acre up approximately $55.24 per acre compared to 2010. This was largely due to increased costs of insecticides, application fees, and frequency of application. **(Angus Catchot)**.

New Mexico

Glandless cotton plots were established in a number of locations in New Mexico on both University and commercial farms. Insect damage was evaluated in Artesia and in Las Cruces. Thrip numbers were surprisingly three times higher on glanded cotton. Beet armyworm damage was significantly higher on glandless cotton despite similar egg lay in glanded cotton. Beet armyworm also preferred glandless cotton by 2:1. Beet armyworm larvae were also 86% larger after 14 days feeding on glandless cotton. There was no difference in bollworm damaged squares in Artesia but there was significantly higher square damage in Las Cruces. There was no difference in predation of sentinel eggs between glanded and glandless plots. However there was significantly higher predation by chewing predators June 27 in glanded cotton> There were also significantly more spiders, ladybug adult and larvae and nabids in glanded cotton which was also unexpected. Pink bollworm traps were placed late season in 20 fields and in a trap line south from the New Mexico Pecos valley to just beyond the Texas border in cooperation with Texas A & M University and the USDA/Aphis Methods Development Lab in Phoenix. Traps were also placed in Lea County, NM as part of the Gaines County, Texas trapline by Texas A & M entomologists. No pink bollworms were collected in any of the pink bollworm traps placed in New Mexico. **(Jane Pierce).**

North Carolina

Thrips levels were generally moderate in most areas of the state, though individual cases of very high and very low levels were seen in some areas. With Temik availability limited in 2011, the use of seed treatments, followed most often by a foliar spray, were common. An average of just over 75% of our cotton acreage was treated with a foliar insecticide for thrips. In our replicated thrips trials in northeast North Carolina near Rocky Mount, most adult thrips were western flower thrips. Typically tobacco thrips are far and away the most common species. In some far-eastern NC locations, western flower thrips represented approximately 3% of the adult population in several replicated tests – more representative of long term averages. Based on consultant and grower surveys, Temik use was down to approximately 40% in 2011.

Aphids were again only a minor problem on most farms, with only 1.1% of our cotton acreage treated in 2011. Growers and consultants have become more confident of the effectiveness of beneficial insects, primarily "mummies", and in the fungus *Neozygites fresenii* in reducing cotton aphids to sub-economic levels in most cases. We apparently had our first unconfirmed outbreak of neonicotinoid-resistant cotton aphids in a few fields that were exposed to this class of insecticides 5 times (perhaps a record for NC!) during the growing season, including two applications of Belay for stink bugs.

Plant bugs occurred at high levels (at least for North Carolina) in 2011, with approximately 12% and 20% of the pre-bloom and post-bloom acreage being sprayed, primarily in the eastern part of the state, by the clients of independent crop consultants.

Green stink bugs appeared to be more prevalent than "browns" this year in cotton, particularly in the more northern counties. Where needed, sprays for stink bugs went out somewhat later in the season that is typical in North Carolina, perhaps in part due to droughty weather throughout most of the growing season, followed by a more generous late summer and fall season weather pattern. Stink bug damage to bolls was low to moderate across most of the state in 2011, causing a mean of approximately 3.15 and 2.85% internal damage to bolls on WideStrike and Bollgard II cotton, respectively, based on a survey of 112 randomly-selected cotton fields. This underscores the correlation between generally drier years and lower stink bug damage to cotton. Consultants indicated that stink bugs accounted for approximately 80% of the need for stink bug/bollworm insecticide sprays in 2011.

The major late-season **bollworm** moth levels were generally low for the mid-July to mid-August flights but on the high side for the typically-lower September generation by which time cotton was less susceptible to boll damage. Bollworms caused an average of 0.25 and 0.085% damage to bolls on Wide-Strike and Bollgard II cotton, respectively, based on the above survey. WideStrike and particularly Bollgard II cotton varieties have shown very low damage from a wide variety of caterpillar species since their introduction in North Carolina.

Other caterpillars

Migratory beet and fall armyworms did not reach North Carolina's cotton acreage in significant numbers this past growing season. Additionally, both WideStrike and Bollgard II varieties show a high degree of resistance to both armyworm species, as well as to cabbage loopers and European corn borers. However, as we and others have noted, WideStrike and Bollgard II varieties are not resistant to early season damage to seedlings from cutworms.

Bt Cotton Varieties

Bt varieties were planted on over 99 percent of the state's cotton acreage in 2011, with Bollgard II accounting for approximately 60% of the planted cotton acreage and WideStrike accounted for all buy approximately 0.2% of the remainder.

Cotton Outlook
As of this mid-December writing, North Carolina cotton producers are expected to harvest approximately 750 pounds of lint per acre on approximately 800,000 acres. Hurricane Irene resulted in a significant yield reduction, particularly in our northeastern counties where many cotton producer yields were down more than 40% from the previous growing season.
(Jack Bacheler and Dominic Reisig).

South Carolina
Cotton was planted on about 303,000 acres in South Carolina during 2011, approximately equivalent to acreage planted in 2006. Almost 99% of cotton acres were planted with varieties containing Bt technology, with almost all of the varieties containing dual-gene Bt technology. Early-season issues with insects were characterized as having moderate levels of thrips. Mid-to-late-season problems with insects consisted of bollworm, stink bugs, and fall armyworms primarily. Localized moderate-to-heavy populations of bollworm were observed, but Bt cotton performed well in suppressing numbers. Supplemental insecticides were used for a combination of bollworm and stink bugs. Populations of secondary pests such as aphids and spider mites were sporadic but persistent in many cases. Losses were due mostly to less-than-perfect environmental conditions, poor establishment of stands, herbicide-resistant weeds, and generally low-to-moderate levels of pestiferous insects. An estimated 850-lb average yield is reported. **(Jeremy Greene)**.

Tennessee
Tennessee harvested approximately 480,000 acres of cotton in 2011, about a 90,000 acre increase over the previous year. Over 99% of the crop was *Bt* cotton, either Bollgard II® or WideStrike® varieties. The most commonly planted varieties were PHY375 WRF (≈ 59%) and DP0912 B2F (≈ 19%) and ST4288 B2F (≈ 5%). In part, WideStrike varieties are being planted in response to glyphosate resistant palmer amaranth as they allow the foliar application of Ignite® (glufosinate). Early rainfall delayed planting, and most cotton was planted from May 5 to May 25. Flooding prevented cotton from being planted in low lying fields and flood plains of the Mississippi River. Subsequent rainfall patterns varied but many areas suffered from drought and excessive heat during June, July and August. The average lint yield for Tennessee in 2011 was estimated at about 820 lb/acre, down approximately 140 lb from 2010.

The 2011 season was characterized by variable populations of arthropod pests. The estimated statewide yield loss caused by insect pests was higher than usual at 9.4%. Most of this loss was attributed to thrips and tarnished plant bug injury. Early season thrips populations were very high in most areas, often caused delays in maturity, and resulted in complete stand loss in isolated instances. High infestations of tarnished plant bugs also occurred in some areas prior to flowering, resulting in substantial fruit loss and an associated delay in maturity. The presence of glyphosate tolerant palmer amaranth caused the increased use of pre-emergence herbicides and over-the-top applications of Ignite (glufosinate) and other herbicides. Maturity delays caused by insects were compounded by the injury resulting from herbicide use, causing more exposure to late season heat and drought conditions.

Most acres received at least one foliar application for the control of thrips despite the almost universal use of insecticide seed treatments. An average of about three applications per acre were made targeting tarnished plant bug for isolated but serious pre-flowering infestations and more widespread infestations during peak and late bloom. Bollworm populations were high in counties bordering the Mississippi River. Bt cotton technologies and lower than normal cotton acreage in this area helped minimize losses. Nevertheless, insecticide applications targeting bollworm were made on over 50% of cotton acres in Tennessee. Mid and late season infestations of spider mites also caused some yield loss, but unlike recent years, pre-flowering infestations were uncommon. Populations of stink bugs were much lower than in recent years, with fewer than one-half the acres requiring treatment for this pest complex. Cotton aphids were present in many fields during mid to late season, but few insecticide applications were made to control this pest. Beet armyworm, fall armyworm, loopers, whiteflies, clouded plant bug, other insect pests and slugs were of little importance in 2011. For the third straight year, no boll weevils were found in Tennessee. The entire state is in a maintenance phase of eradication. No yield losses caused by boll weevils have been reported for ten consecutive years. The total average cost of insect control was estimated at $66.68 per acre. About 50% of this cost was for foliar insecticide applications. Most of the remaining costs were for *Bt* technologies, insecticide seed treatments and scouting fees. Because of the relatively high value of lint in 2011, estimated at $0.92/lb, the cost of insect-induced yield losses were about double those of recent years.

Tennessee cooperated in several multi-state efforts to evaluate IPM strategies in cotton. These included experiments related to the management on thrips, tarnished plant and spider mites. Summarized results of these experiments are reports elsewhere in these proceedings. Many additional insecticide and insect management trials were performed in 2011. The results of many tests and other information are available on-line at www.utcrops.com. The UT crops News Blog, http://news.utcrops.com, was launched in 2011 to keep clients current on crop management issues in cotton and other crops. **(Scott Stewart).**

Texas

Texas. The Texas cotton crop was fraught with devastating drought in 2011. Approximately 41% of the Texas cotton crop failed leaving about 3.1 million standing acres. Most of the failed acres occurred in the South Plains, Panhandle, Permian Basin and Rolling Plains. The average yield across the state was estimated at 542 lbs/acre, resulting in approximately 3.5 million bales.

Bt technology, Bollgard II and Widestrike, represented approximately 80% of the harvested acres. This figure is higher than normal, and although the drought caused the loss of most West Texas dryland acres, we are seeing more dryland planted to Bt traits than normal. In West Texas, this is a reflection of variety choice rather than a desire for the Bt trait.

Overall, insect pressure was low in 2011. Much of this is thought to be due to the drought. Throughout the state, insects resulted in only 1.95% of cotton yield losses, whereas weather is thought to have caused a 43% yield reduction on standing acres.

Thrips were not as severe as most years with 2.6 million acres infested and only 0.57% loss in yield. Cotton fleahopper were almost non-existent in most of West Texas and only a moderate problem in the eastern half of the state where 1.44 million acres were infested and 977,000 acres required treatment. Cotton aphids were common through much of the state but required treatment on less than 200,000 acres. Lygus were almost non-existent and stinkbug problematic primarily along the Gulf Coast. Spider mites are becoming more of a problem in Texas and 2011 saw spider mite issues statewide. Approximately 160,000 acres were treated for mites in 2011.

Cotton bollworm/tobacco budworm pressure was relatively low throughout the state with about 250,000 acres requiring treatment. By far bollworm was the most predominant species encountered, and because of the drought and a high percentage of Bt cotton, few insecticide applications were made targeting this pest complex. Very little Bt cotton was treated for bollworms, approximately 21,000 acres, which represents about 8% of the Texas cotton acreage treated for bollworms. Most of the Bt cotton treated was in the Coastal Bend region.

Boll weevil eradication in Texas has progressed well. At the end of 2011, approximately 96.4% of the acres were weevil-free. Additionally, populations in areas still catching boll weevils were low. Thirty weevils were caught during 2011 in the Coastal Bend region, and 108 were caught in the Winter Garden area. Traps in the Lower Rio Grande Valley (LRGV) caught 209,860 weevils. The higher captures in the LRGV were influenced by tropical storms in previous years, and by higher weevil populations in nearby cotton fields in Mexico. An International Boll Weevil Technical Advisory Committee, sanctioned by the National Cotton Council, has been established to examine ways to improve eradication programs on both sides of the border so that boll weevil eradication in the region can be completed expediently.

The pink bollworm eradication program made significant progress in the Trans Pecos region in 2011. Sterile moths are marked with a dye as the larvae feed on dyed diet in the rearing laboratory. Although no unmarked moths were caught until late in the season, after August 14, 60 unmarked moths were caught. The trapping and situational information strongly indicates these unmarked moths were sterile insects in which the dye became depleted late in the year. This phenomenon has been observed each fall for the last five years.

A trapping program was conducted in the fall of 2011 in the southern plains region of Texas and New Mexico. The study – outside the El Paso Trans Pecos eradication zones - monitored pink bollworm activity in ~1.3 million acres of cotton located north and east of the Trans Pecos region. It was a part of a 2-year trapping program. A localized area of about 60 acres (two fields) of organic, non-Bt cotton was identified as the only source of pink boll worms in the region. A total of 729 native pink bollworm moths were caught on and in the vicinity of the organic, non-Bt fields. Plans are being made to eradicate this localized population in 2012.

Panhandle (PH). Like much of West Texas, the Panhandle suffered severely from drought in 2011. The Panhandle planted 1,240,000 acres and harvested 700,000 acres. Thus, 56% of the acres planted were failed. In addition to lost dryland acres, the competition for irrigation water between corn and cotton resulted in a high number of irrigated cotton acres to be abandoned. The northern Panhandle did receive a few timely showers in late July, but not enough to overcome the effects of the drought. Some cotton in the Panhandle recorded record yield for their area in 2011. Access to ample irrigation and higher than normal heat units helped drive these yields. However, as a region, yields were down averaging about 570 lbs/acre. Insect pressure was very light for the entire region with the only pest of much concern being early-season thrips which were sporadic.

South Plains (SP). West Texas suffered through its worst drought in recorded history during 2011, and subsequently the cotton crop reflected it. In the South Plains approximately 3.37 million acres of cotton was planted, of which 1.04 million acres were harvested. Thus, only 31% of the planted cotton made to harvest; not a single acre of dryland cotton is thought to have been harvested in 2011. Conditions during early to mid-May were dry and cool, and cold soil temperatures deterred much planting, and the incessant winds quickly dried the soil. Drip irrigated fields were especially hurt by the dry conditions where they could not sub moisture up and over to the seed, and did not have the capabilities to row water. In late May and June, conditions turned extremely hot and windy, further exacerbating the droughty conditions. As cotton began to bloom, growers had difficulty meeting water demand. Evapotranspiration often exceeded 0.6-inch per day and very few pivots were able to meet this demand. The dry, hot weather continued into August and although some isolated precipitation did occur, it was too little too late. Because of the abnormally hot weather, the cotton crop received a good amount of heat units which resulted in an earlier than normal harvest. Quite a few acres were harvested in September. Although the crop was harvested earlier than normal, it returned lint with high micronaire. Yields were negatively impacted by the drought averaging 485 lbs/ac in the South Plains. Early-season thrips pressure was light to moderate across the region; isolated to small areas. Some areas saw almost no thrips whereas others, sometime close by, had severe problems. The most prevalent thrips species on the South Plains were onion thrips. The only cotton that suffered much damage and yield loss from thrips was that which was planted in early May. Because of the excessive heat the remaining cotton had fewer thrips and was able to outgrow what little damage it suffered. Spider mites were evident upon plant emergence from Seminole to Muleshoe, and in the Lubbock area and south, they progressed into bloom. Over 15,000 acres were infested with mites, about 7,000 of which were treated. Cotton fleahopper, Lygus and stinkbugs were almost non-existent. Aphids were common in mid-July through mid-August, but never developed treatable populations. Most non-Bt cotton failed along with the dryland, but some Lepidopterous pest were problematic in irrigated non-Bt cotton in the southwestern portion of the South Plains. These included bollworms and fall armyworms. Worms were not a problem in any Bt cotton fields. The most severe pest problem experienced in 2011 was *Kurtomathrips morrilli*. This is a little known thrips that has never been reported damaging cotton in Texas. It was first detected in late-July in Gaines County and it quickly spread as far north as southern Bailey County and east to southwestern Crosby County. It infested an estimated 330,000 acres, 83,000 acres of which were treated with insecticides. Losses and control costs due to this pest were estimated at about $20 million. This thrips was capable of destroying a cotton crop within a week of its detection. Drought stressed cotton was extremely sensitive to this pest.

Permian Basin (PB). An extremely dry winter, spring, and summer resulted in a total loss of 460,000 acres of dryland cotton and irrigated yields that ranged from 350 lbs to 2000 lbs, depending on available water. Insect pests had virtually no effect on cotton yields this season. Thrips were low to moderate early season but damage was minimal. Fleahopper were virtually nonexistent this year because alternate early season hosts never developed. Bollworm activity was very light with most irrigated cotton protected by an insect protection gene. Stink bugs were nonexistent also. Spider mites developed early with hot, dry, dusty conditions in many area fields. They persisted through much of the season but only flared to treatable levels in some area fields. Yield loss was very minimal. Pink bollworms were rare but emerging populations could be detected around some organic cotton fields.

Trans Pecos (TP). Approximately 39,000 acres were planted in Trans Pecos area, 65% of which was Pima. Thrips, cotton fleahopper and bollworms were the most common pests with most losses associated with thrips and bollworms. Bollworms tend to be more troublesome in the Trans Pecos area because of the lack of Bt technology in Pima varieties. The drought of 2011 had little impact on cotton in this region simply because this area normally sees much precipitation, thus yields remained good, averaging about 1,000 lbs/ac.

Rolling Plains (RP). Like most of West Texas, the Rolling Plains insect situation was dictated by the drought. Rainfall in the winter of 2010 and early spring was 50% less than normal so planting conditions were poor. Most of the dryland crop did not emerge. A rainfall event of less than an inch in May resulted in some minimum tillage fields coming to a partial stand but for the most part, the stands were inadequate. In irrigated fields producers used a lot of water pre-planting to ensure adequate moisture. For the first time, drip irrigated stands were marginal and had multiple emergence because producers were not able to provide enough water to get moisture throughout the seed bed. For the most part, early insect populations were very low. Hot, dry winds in the spring seemed to minimize thrips populations and seed treatments seemed to be adequate. Cotton fleahopper populations were also low although a few irrigated fields were treated once. Bollworm and tobacco budworm moth traps captured the lowest totals in the past ten years. Stink bugs were non-existent. Spider mites were the major pest of concern and approximately 10% of the remaining acreage was treated once. Yield losses due to mites were less than one percent. The cotton crop received 2.19 inches of rainfall during the growing season with no rain during July and no rainfall events greater than one inch. Overall, less than one percent of the dryland fields had any cotton harvested and irrigated fields yielded approximately 50% of a normal crop (an average crop where water was adequate).

Blacklands (BL). The majority of the Texas Blacklands started out in the spring with an adequate to full profile of soil moisture. Plant stands range from poor to excellent depending on surface soil moisture at planting. Rainfall events starting the first of May achieved adequate to excellent stands for most fields. Thrips were at moderate numbers and were treated with one insecticide application. Fleahopper numbers range from moderate to high and were treated with two insecticide applications. Fleahopper treatments were effective and most fields had an excellent boll load. Very limited amount of rainfall in June, July and August caused cotton to have a short plant stature and the ability to mature a limited amount of bolls. Approximately 5% of area fields were treated with one insecticide application for spider mites. Bollworm egg lay was moderate and several conventional fields of cotton had moderate to high levels of bollworms damage. Very few Bollgard II and Widestrike required treatment for bollworms. No boll weevils were trapped in 2011 in the Northern Blacklands Boll Weevil Eradication Zone. To summarize, insects were light to moderate. Hot, dry, windy conditions had a severe impact on cotton yields, with average yields being 280 lbs/A. The Blacklands averages one bale per/A.

South Texas [Coastal Bend (CB), Winter Garden (WG), Lower Rio Grande Valley (LR)]. Most of the region had a full profile of water to start the season, and fields that were planted early came up to good plant stands. Thrips and aphid populations in early season were generally light and insecticide seed treatment was all that was needed for the period. Fleahopper numbers were low and only the latest planted cotton had to be treated twice for the insect. With treatment, no yield was lost to fleahopper. Verde plant bug numbers were low in most fields but there were cases where high numbers did cause problems in the Lower Rio Grande Valley. Likewise, stink bugs were generally low with only a small percentage of the acreage requiring treatment. Spider mites caused significant damage in the Valley and at other scattered locations throughout the region. Very few tobacco budworms were observed in non-Bt cotton, but bollworm numbers were high enough to require treatment on some acreage. Generally, little yield loss was attributed to bollworm. Other insects that were observed in low numbers included beet armyworm and salt marsh caterpillar. The boll weevil eradication program made excellent progress especially in the South Texas/Winter Garden Region. In summary, pest insect numbers were generally low on most acreage and insect control cost was low to moderate. Although very dry conditions existed for the season, key rains in a fairly large region resulted in good yields and in the irrigated regions yields ranged from 2 to 5 plus bales/acre. The highest yields on irrigated cotton were made where high quality water was available. **(Submitted by David Kerns and Colleagues).**

Virginia

An estimated 85,000 acres of cotton were planted in Virginia in 2011, up from 83,000 in 2010. Cotton planting was generally timely across the state but soils were very dry which resulted in uneven stands both in research trials and throughout many commercial fields. Rains picked up during June, but turned dry for several consecutive weeks. Hurricane Irene in August caused a lot of twisting of plants in fields, but the long rainy period post-Irene caused the bigger problem of extensive hardlock and bollrot. The average yield is estimated at 750 lb lint/acre which is well below normal for Virginia, with losses due mainly to the wet late summer/early fall. These weather conditions did have a positive side in that stink bug populations were very low and early maturity made plants less attractive to bollworms (discussed below).

Transgenic Cotton Varieties

An estimated 2% of the acreage was planted to RR, RF or conventional varieties. Thirty-three percent of the remaining acreage was planted to BG2/RF varieties and 65% to WS Phytogen varieties. Close to hundred percent of the acreage was treated with an insecticide seed treatment, and about 15% with an additional in-furrow applied insecticide (aldicarb or phorate).

Insect Pest Overview
Thrips—Thrips pressure was extreme and feeding damage was exacerbated by slow seedling growth due to dry soils. One-hundred percent of the growers used either insecticide seed or in-furrow treatments, and a small percent used both. All growers made at least one foliar insecticide application for thrips control, and a small percent made two. The timing of foliar applications was difficult due to uneven seedling emergence and the different sizes and stages of maturity of plants in the same field. Tobacco thrips was the primary species and western flower thrips were present in low numbers in research trials and growers' fields.

Plant bug/Stink bug— Plant bug populations were very low. We reckoned this to also be a result of the early and mid-season dry, hot conditions and the impact on early season alternate weed hosts. To our knowledge, no fields reached threshold for plant bugs. Stink populations were also low although some fields were treated pre-bloom with neonicotinoid insecticides, but not based on random field sampling of damaged bolls and justified need.

Bollworm—Based on the July field corn survey (see more details below) corn earworm levels were low (48%) compared with 2010 at 54% infested in the cotton counties. Moth flights were light and sporadic (based on moth capture with a series of black light traps operated throughout eastern Virginia). Because of the rapid maturity and early cutout of many fields, cotton was not attractive to bollworm and damage was light with only about 5 to 13% boll damage in unprotected cotton (no BG/BG2/WS, and no bollworm insecticide).

Other mid- to late-season insect/mite pests—No economic infestations of other pest species occurred and there were no reported acres treated for aphids, spider mites, or other species. **(Ames Herbert).**

Student Paper Competition Report:

The Gary A. Herzog Awards (PhD) and the Stacy Hall Awards (MS) are given annually to those students delivering outstanding oral research papers within each respective category at the annual Cotton Insect Research and Control Conference (CIRCC). The awards are based on the performance of the student in presenting a paper on his/her original research only in oral form. The recipients in both categories are recognized with a cash award and a plaque at the annual business meeting of CIRCC.

There were five Ph.D. and five Masters students in the competition, which was down from last year, where one undergraduate, four Ph.D. and eight Masters students were in the competition. Feedback in the form of copies of completed judging sheets, with other students and judge information blacked out, were mailed to students if they responded to an e-mail inquiry.

2012 Chair: Dominic Reisig (North Carolina State University)

2012 Judges: Scott Stewart, Jonathan Holloway, Charles Suh, Konasale Anilkumar, Michael Towes and Glynn Tillman

2012 Sponsor: Dow AgroSciences (Bobby Haygood presenting)

2012 Recipients:

Ph.D.

1st - Timing of cotton fleahopper herbivory and cotton compensatory response.
Loriann Garcia (Advisor: Micky Eubanks)
Honorable Mention – Susceptibility of cotton bollworm, *Helicoverpa zea*, collected from Genuity VT3 PRO field corn on dual-gene transgenic cotton.
Ben Von Kanel (Advisors: Angus Catchot/Jeff Gore/Fred Musser)

Masters

1st - Evaluation of cultural IPM practices for controlling tarnished plant bugs in cotton.
Brian Adams (Advisors: Angus Catchot/Jeff Gore/Fred Musser)

Honorable Mention - Effects of precision-applied in-furrow nematicide/insecticide (Temik™) and seed treatments (AERIS®, AVICTA®) in management zones defined by electrical conductivity on populations of thrips and nematodes in cotton.
Ginger Divinney (Advisor: Jeremy Greene)

Recipients of 1st place were awarded $500 and a plaque for each competition (M.S. and Ph.D.). Recipients of 2nd place were awarded $250 and a plaque for each competition (M.S. and Ph.D.). (**Dominic Reisig, Chair 2012 CIRCC Student Competition)**

Research Progress and Accomplishments:

Alabama

This study was conducted in 2011 to determine the impact of the red imported fire ant, *Solenopsis invicta* Buren, on tobacco budworm/bollworm populations infesting cotton. The primary objective of this effort was to quantify the actual value of red imported fire ants (RIFA's) to producers of Bt and non-Bt cotton varieties. The study was conducted in central Alabama at the Prattville Agricultural Research Unit. The study utilized a split-split plot experimental design. The main plot variables were a normal RIFA population and an insecticide-reduced RIFA population. The fire ant population was reduced by applying insecticides to the soil prior to planting. The study examined the effect of these two population levels on the yields of 3 varieties (subplots); DPL 1050 B2RF (Bollgard II), PHY 565 WRF (Widestrike) and DP 174 RF (non-Bt). The effect of a mid-season pyrethroid overspray (sub-subplot) was also assessed. RIFA population levels were determined in each plot by counting RIFA's on small sections of frankfurters placed in the plots and RIFA density indexes were measured using a scale of 0 (= no RIFA's present) to 3 (= 11 or more RIFA's present).

The RIFA density indexes showed that fire ant numbers increased as the season progressed in the non-treated plots but remained extremely low in the plots treated pre-plant with insecticides. RIFA density index values indicated that over the growing season (3 sampling dates) there were 12.7 times more RIFA's in the plots with normal RIFA populations than in plots with a reduced population. The % (worms in blooms + worm damaged blooms) on 8/9/2011 was greater (P>F = 0.06) in the plots where fire ants were reduced (1.3%) than in plots where fire ants were maintained (0.4%) (LSD 0.1 = 0.7). This variable was also greater (P>F = 0.03) in the non-Bt variety (1.8%) than in the PHY WRF variety (0.3%) and the DPL B2RF variety (0.5%) (LSD 0.01 = 1.0) . Although budworm and bollworm numbers were low in the test plots, after defoliation the number of worm-damaged bolls in the DP 174 RF (non-Bt) plots with reduced RIFA numbers was 4.3 times greater than in similar plots with normal RIFA numbers. The number of worm-damaged bolls in both Bt varieties was very low regardless of RIFA numbers. Despite having more damaged bolls in half the DP 174 RF plots (those with reduced RIFA numbers) the overall yield of DPL 174 RF (3224lbs/acre) was significantly greater (P>F= 0.065) than that of PHY 565 WRF (3005 lbs/acre)and numerically greater than DP 1050 B2RF (3149 lbs/acre) . A mid-season pyrethroid application significantly increased (P>F = 0.025) overall seed cotton yields by 140 pounds (LSD 0.1 = 101). (**Ron Smith, Tim Reed and Don Moore).**

A study was conducted in north and central Alabama to determine the effects of Diamond insecticide on (1) tarnished plant bug and lepidopteran pests' damage to cotton and (2) beneficial arthropod populations, including fire ants. Test locations were at the Tennessee Valley Research and Extension Center at Belle Mina and the Prattville Agricultural Research Unit. CT 210 conventional cotton was planted at Belle Mina on 5/20 and DPL 174 RR cotton was planted at Prattville on May 9. Test plots were arranged in a randomized complete block design with 4 replications per treatment and 8 rows per plot (40 to 45 ft. long) at both locations. Specific treatments applied at both locations are presented in Table 1. Sweepnet samples taken 8 to 10 days after chemical applications indicated that in comparison with untreated plots the following chemical treatments reduced predator numbers as indicated in parentheses: Centric 2 oz. (14%), Diamond 6 to 9 oz. (25%) and Belt 3 oz. + bifenthrin 5 oz. (63%). There were no significant differences with respect to fire ant density among treatments at either location. Very low numbers of plant bugs and bollworms resulted in no significant treatment effect on yield in central Alabama. Plant bug numbers were also very low in north Alabama but bollworm numbers were sufficient to allow significant differences among treatments with respect to both damaged blooms and yield. (**Tim Reed, Ron Smith, Barry Freeman and Eric Schavey)**

Louisiana

In 2011, pheromone-baited wire cone traps and the adult vial test (AVT) were used to survey pyrethroid susceptibility in bollworm, *Helicoverpa zea* (Boddie). Susceptibility levels of >1200 bollworm moths to a pyrethroid, cypermethrin, were determined using the adult vial test (AVT) from May to Sep in Louisiana. Adult survivorship exceeded 50% during numerous individual tests at a discriminating dose of 5µg/vial. Adult survivorship at a discriminating dose of 10 µg/vial exceeded 25% in some tests. Annual mean survivorship at 5 µg/vial exceeded 40%. These results continue to show that bollworm populations are becoming less susceptible to pyrethroids in adult vial tests. Bollworm tolerance to pyrethroids and high pressure within fields is creating control problems in fields treated with only a pyrethroid. When bollworms are the target pest, pyrethroids should be co-applied with acephate or other OP's to reduce the probability of field control failures.

Pyrethroid, OP, and NEO susceptibility was evaluated in Louisiana tarnished plant bug populations in cooperation with G. Snodgrass, USDA-ARS Stoneville, Mississippi. Considerable variability was observed in responses of these populations to the insecticides. Several populations exhibited LC_{50} values that were significantly higher than that for a susceptible population. Field trials also evaluated dose-responses of these insecticides against native infestations of tarnished plant bug. Selected rates and a non-treated control for each insecticide were placed in trials on LSU AgCenter Research Stations. . Although recommended rates of many individual products significantly reduced tarnished plant bugs compared to that in the non-treated plots, those rates did consistently reduce numbers below the action threshold. The highest labeled rates for many recommended products were required to consistently control infestations. Laboratory and field results during 2011 results show insecticide susceptibility in Louisiana tarnished plant bug populations continues to shift.

A new insecticide, sulfoxaflor (Transform 50WP) was tested against native infestations of tarnished plant bug. Transform 50WP at one or more rates demonstrated satisfactory control of insecticide-resistant populations and field performance equal to or better than the currently recommended standard products. The minimum effective Transform 50WP rate is ≥0.045 lb AI/acre, but the 0.067 lb AI/acre rate has provided more consistent performance against high (>three-fold) infestation levels. Transform 50WP is effective against populations expressing resistance to OP's, and PY's. Field observations have suggested Transform 50WP does not flare cotton aphids, spider mites, or caterpillar pests. Co-applications of Transform 50WP with other insecticides provided variable results, but were dependent on initial and resurging population levels, as well as, insecticide resistance in the local population. In field trials with sequential applications of Transform 50WP, the order of product use was not as important as rate, application timing, or treatment frequency. Transform 50WP will be recommended in rotations with other classes of chemistry during the production season as an IRM strategy.

The impact of spider mite infestations on cotton yields was determined by infesting plants during discrete periods of development. Plants were infested at several growth stages ranging from the 3-leaf stage to 1000 heat units after flowering. The most severe injury appeared to be for the infestation applied to vegetative stage cotton plants. Seedcotton yields were significantly affected ($P<0.001$) by spider mites during 2011. Spider mites were most yield-limiting in those plots infested pre-flowering and during the initial week of flowering. The latest infestations (≥flowering + 800 heat units) did not impact yields in this test.

Cotton varietal (eight commercial lines) susceptibility to spider mites was evaluated using artificial infestations. Varieties were chosen based on phenotypic differences in leaf characteristics ranging from semi-smooth to hairy. Significant effects were detected comparing non-infested vs. infested plots. Seedcotton yields were consistently higher in absence of spider mites. The yield differences among varieties and plant pubescence in the infested plots were inconsistent, but significant effects were detected with similar trends to that for the non-infested plots.

Two acaricide screening trials were initiated against infestations that were almost entirely comprised of two-spotted spider mites. Significant treatment effects were detected and differences among miticides were observed in both tests. At 4 DAT, plots treated with Agri-mek (1.25 fl. oz/acre), Athena, and Portal had significantly fewer spider mites than that in the non-treated plots. Populations were considerably lower at 10 DAT, but Zeal- and Portal-treated plots had significantly fewer spider mites than that in the non-treated plots.

Field studies evaluated the performance of Monsanto's Bollgard III and Bayer Crop Sciences TwinLink technology against the Mid-South Lepidopteran pest complex including bollworm, tobacco budworm, fall armyworm, and soybean looper in two independent trials. In the Bollgard III trial, plants were nearly immune from caterpillar injury of native infestations. Damaged fruiting forms in the conventional non-Bt line ranged from 0 to >40% during the test period. In the TwinLink trial, one experimental line provided exceptional control of caterpillar pests and was equal to or better than a commercial standard, but other TwinLink lines did not perform as well. Damaged fruiting forms in the conventional non-Bt line ranged from 0 to >30% during the test period. In addition to native infestations, fall armyworm, beet armyworm, and soybean looper adults were caged on TwinLink or conventional cotton plants for 18-21 days. All TwinLink lines received very little feeding injury from these pests. However, the non-Bt plots had significant injury throughout the plant profile for all species. **(Louisiana State University Agricultural Center's Northeast Region, St. Joseph and Winnsboro, LA; Louisiana Cooperative Extension Service, Winnsboro, LA; and Department of Entomology, Baton Rouge, LA).**

Table 1. Promising pesticides and transgenic technologies screened in Louisiana during 2010 for control of cotton arthropod pests.

Pesticide (formulation)	Target Pest (s)
Gaucho + Poncho-Votivo	Thrips, Cotton Aphid
Bollgard 3 (transgenic)	Bollworm, Tobacco budworm, Fall armyworm,
TwinLink (transgenic)	Bollworm, Tobacco budworm
Coragen	Bollworm, Soybean looper
Prevathon	Bollworm, Soybean looper
Cyazypyr	Tarnished plant bug, Cotton aphid
Belt	Bollworm, Soybean looper
Radiant	Thrips, Cotton aphid,
Brigadier	Tarnished plant bug, Southern green stink bug, Bollworm
Athena	Two-spotted spider mite, Tarnished plant bug
Transform (Sulfoxaflor)	Thrips, Cotton aphid, Tarnished plant bug
Malathion + ULV	Tarnished plant bug, Southern green stink bug, Brown stink bug

North Carolina

Our projects' applied research effort was directed largely toward thrips and stink bug management in 2011. Much of our two projects' 2011 applied cotton research results and other information may be found at:

Cotton Insect Corner- http://ipm.ncsu.edu/cotton/insectcorner/Research/2010/index.html
Eastern Field Crops Entomology- http://www.ces.ncsu.edu/plymouth/pubs/ent/results.html
Field Crops Blog- http://www.nccrops.com/

Nine at-planting insecticide tests evaluated the impact of granular insecticides, seed treatments, foliar applications, and combinations on plant development, maturity, and yield. Four of these tests were part of a Cotton Incorporatedsupported Southeast thrips initiative looking into 1) the impact of a starter fertilizer in narrowing the window of cotton seedling vulnerability to thrips damage, 2) the timing and impact of foliar spray(s) at different early stages of plant growth, and 3) the efficacy of conventional and new chemicals as foliar sprays. Other tests investigated conventional and new seed treatments and rates for thrips control.

Two stink bug insecticide efficacy trials in Wayne County showed the high efficacy of pyrethroids, pyrethroid/nicotinoids premixes, and all tank mixes with Bidrin against populations of primarily green stink bugs (*Acrosternum hilare*). Historically, Bidrin and Bidrin XP have shown an edge in efficacy against brown stink bug over other products tested.

Bollworm insecticide efficacy tests continued to show good control of this species with pyrethroids in 2-gene cotton. Additional tests were carried out to evaluate the efficacy of new and traditional insecticides on conventional cotton and in 2-gene cotton varieties the Coastal Plain and Tidewater areas.

The pocket-sized stink bug decision aid card, distributed in the Southeast in 2010, was remanufactured with various respective state extension logos; it was distributed to extension entomologists in the Southeast, Midsouth and in Texas and Oklahoma so that it's potential utility could be evaluated in areas of those states where stink bug may be a significant pest. Of the 22 independent crop consultants surveyed, their overall usage of this card was 82% and their rating of the cared usefulness was 8.0 out of 10 (0 = "this card sucks"; 10 "this card is terrific and I rely on it heavily").

A regional project, in collaboration with University of Georgia and Clemson University, was funded by the Southern Region IPM Center. Studies were conducted in the eastern portion of the state to compare a strip-spray approach with blanket field applications for stink bugs. Stink bugs were also sampled from various crops, including cotton, throughout the season to determine their reproductive status.

Our project's annual damaged boll survey, http://ipm.ncsu.edu/cotton/insectcorner/Research/2011/index.html (*item 14*) continued in 2011 and included 112 total of Bollgard II, and WideStrike producer-managed cotton fields. Stink bug damage to bolls was 2.85 and 3.15% for the above technologies, respectively. Bollworm damage to bolls was 0.08 and 0.25%, respectively, for these technologies. European corn borer and fall armyworm damage to bolls was virtually nonexistent in 2011.

An annual survey of North Carolina's licensed independent crop consultants working on cotton was continued in 2011: http://ipm.ncsu.edu/cotton/insectcorner/Research/2011/2011.Crop.Consultants.Insect.Survey.pdf
to gather data on how thrips, cotton aphids, and plant bugs, bollworms and stink bugs were managed by these individuals in conventional and in *Bt* cotton lines. Additional growers and selected county agents were contacted to make the survey more representative of North Carolina's producer population. Most of the results from this survey are provided in the North Carolina Cotton Insect section above. Of interest in 2011 was that Bollgard II and WideStrike cotton suffered less than 0.25% boll damage under grower conditions. With this high level of bollworm and other caterpillar control on 2-gene cotton in North Carolina, this information shows the importance of producers selecting varieties on the basis of agronomic and technology fee considerations, at least while this technology remains efficacious. **(Jack Bacheler and Dominic Reisig).**

Texas

Sampling Strategies for Square and Boll-feeding Plant Bugs Occurring on Cotton along the Coastal Bend of South Texas. Six sampling methods targeting square and boll-feeding plant bugs on cotton were compared during three cotton growth periods (early-season squaring, early bloom, and peak through late bloom) by samplers differing in experience (with prior years of sampling experience or no experience) along the coastal growing region of south Texas. Cotton fleaphopper was the predominant sucking bug collected from early-season squaring through early bloom at 25 coastal and inland cotton fields. Verde plant bug represented 55-65 % of collections beginning peak bloom in coastal fields. For cotton fleahopper, significantly more cotton fleahoppers were captured by experienced samplers with the beat bucket and sweep net than with the other methods. For verde plant bug, there were more than twice as many verde plant bugs captured by experienced and inexperienced samplers with the beat bucket and sweep net than captured with the KISS and visual methods. Using a beat bucket reduced sampling time for the experienced samplers**.** It was the preferred method overall**. (Brewer and Anderson, Texas AgriLife Research, Corpus Christi, Armstrong, USDA ARS Weslaco, Villanueva, Texas AgrLife Extension, Weslaco)**

Cotton Fleahopper and its Damage to Cotton as affected by Plant Water Stress and Insect Seasonality. A set of paired experiments were implemented at Corpus Christi and Lubbock, Texas to evaluate the interaction of damage expressed in cotton from cotton fleahopper under the following variables: cultivar, planting date, and water (irrigation vs. dryland). At Corpus Christi the experiment involved 2 planting dates, 3 cultivars, and 3 water regimes. The paired experiment in Lubbock involved 1 cultivar and 1 planting date across 4 water regimes. At both locations the least negative plant response to cotton fleahopper was detected when the amount of water was increased as compared to cultivar and planting date. At Corpus Christi this positive response was measured in increased yield. At Lubbock the positive response measured was fruit set, fruit retention, boll size, and boll weight. **(Brewer and Anderson, Texas AgriLife Research, Corpus Christi, Parajulee and Shrestha, Texas AgriLife Research, Lubbock)**

Verde Plant Bug Association with Boll Damage Including Cotton Boll Rot and Potential In-season Indicators of Damage. Cotton along the Gulf Coast of south Texas has experienced loss from cotton boll rot especially during the last 10 to 15 years, and stink bugs and plant bugs (Hemiptera: Pentatomidae and Miridae) that feed on cotton bolls have been suspected in introducing the disease. A replicated grower field survey was done to capture a representation of these sucking bug species and subsequent boll injury, including cotton boll rot, in 2010 and 2011. This survey was paired with a controlled field cage experiment that isolated feeding by verde plant bug, *Creontiades signatus* Distant (Hemiptera: Miridae). Verde plant bug was the dominant boll-feeding sucking bug species (~99% of insects collected) during peak to late bloom in cotton fields within 8 km of coastal waters (average of 0.42 bugs per plant), while it was not detected in inland fields. Cotton boll rot was found on up to 25% of the open bolls inspected, the disease was concentrated in coastal fields where verde plant bug was found. Isolating verde plant bug feeding further implicated it in introducing cotton boll rot. Verde plant bug-infested plants had significantly higher incidence of insect-punctured bolls and locules (15-35% in infested plants) and disease symptom incidence (5-27% in infested plants) than uninfested plants. All bolls with symptoms of disease tested positive for bacteria. Based on field data from 14 fields, stepwise regression using 4 independent variables (verde plant bug per plant [using a beat bucket or sweep net], proportion of green bolls with signs of external feeding, proportion of green bolls with signs of internal feeding, and proportion of green bolls with signs of boll rot) identified a one independent variable model as the best indicator of at-harvest boll damage. Verde plant bug per plant using a beat bucket was the selected model. Because verde plant bug presence is an early step in the sequence of events leading to boll damage, opening bolls to verify internal feeding may be useful to supplement the beat bucket sampling method. From a pest and disease monitoring viewpoint, an in-season insect monitoring program is justified and needed most critically for fields close to coastal waters. **(Brewer, Texas AgriLife Research, Corpus Christi, Armstrong, USDA ARS Weslaco, Medrano, USDA ARS, College Station)**

Insecticide use rules for green plant bug (now called verde plant bug) based on feeding preferences and economic thresholds. Two caged experiments were conducted at the Texas AgriLife Experiment Station at Corpus Christi, Texas to evaluate feeding preferences and damage to cotton by an emerging pest, the verde plant bug, *Creontiades signatus* (formally called green plant bug). The first experiment involved the caging of individual branches of cotton and infesting with verde plant bugs on three dates post 1st position bloom: 3-4 days, 9-10 days, and 14-15 days. The second experiment involved a whole plant caging of 4 plants per cage and infesting with verde plant bugs at two different bloom dates and five densities: 0, 0.5, 1, 2, and 4 insects per plant. The experiments complimented each other and the results emphasized the need to consider abscission damage to squares and young bolls as well as lint and seed loses in making management decisions for the control of verde plant bug. The results from the first experiment suggest that verde plant bugs prefer younger fruit when given a choice. Based on results from the second experiment, damage occurs at infestations of 0.5 bugs per plant and possibly lower, especially if field moisture is high and cotton boll rot is a threat. Additional analysis of the data from these two studies and comparison to last year's results will be used to estimate an economic threshold for this insect. **(Brewer, Texas AgriLife Research, Corpus Christi, Armstrong, USDA ARS, Weslaco, Parker, Texas AgriLife Extension, Corpus Christi)**

Cotton fleahopper control studies. Four field studies were conducted to evaluate the effectiveness of insecticides on cotton fleahopper (*Pseudatomoscelis seriatus*) and to measure impact on lint production. Chemicals evaluated included acetamiprid (Intruder), alpha-cypermethrin (Fastac), clothianidin (Belay), CMT4586 (Bayer experimental), dimethoate, flonicamid (Carbine), imidacloprid (Couraze), sulfoxaflor (Transform), and thiamethoxam (Centric). All insecticides with the exception of Fastac reduced fleahopper numbers compared to the nontreated, but Carbine was not as effective as the remaining tested insecticides. Two of the field studies compared Transform with Centric; Transform at all rates tested and Centric provided effective control of the fleahopper. Yield response was not expected nor did it occur in three of the studies due to the late occurrence of the fleahopper with respect to cotton growth stage. In one study, although there was not a statistical yield response, all insecticide treatments produced more lint than did the nontreated cotton. Another study was conducted to evaluate the effects of fleahopper control carried out at various weeks of squaring and to measure the impact of that timing on insect numbers, fruiting characteristics of plants, and lint production. Fleahopper numbers in the test were moderate and no differences were found in fruiting characteristics or lint production. However, there was a trend for increased lint production, and a dollar return was calculated for all treatment timings except where insecticide was only applied in squaring week 3. **(Parker and Biles, Texas AgriLife Extension Service, Corpus Christi and Port Lavaca)**

Bollworm and tobacco budworm pheromone trap survey. Pheromone trap data was collected to monitor relative abundance of bollworm (*Heliocoverpa zea*) and tobacco budworm (*Heliothis virescens*) during the 2011 growing season. Bollworm trap captures were much lower in the month of April and most of the month of May in 2011 compared with the same period in 2010. Trap numbers continued to decline in June and later months. The lower trap catch during these months was probably associated with the extended drought experienced in the region somewhat similar to 2009. Tobacco budworm moth catch never exceeded 0.5 per trap on any date in 2011. Tobacco budworm trap catches have been relatively low since about 2004 at the Corpus Christi location. **(Parker, Texas AgriLife Extension Service, Corpus Christi)**

Lygus damage potential of cotton fruit. Experiments were conducted to quantify the age of the boll (degree-days from boll formation) that is safe from *Lygus hesperus* damage. Boll damage assessment based on heat unit-delineated maturity provided a boll-safe cutoff value of 350 HU for *L. hesperus*. A penetrometer was used in determining the amount of pressure required to penetrate the carpel wall of a cotton boll of different ages. *Lygus* adults and nymphs both caused external lesions on bolls throughout boll development. However, *Lygus* generally could not cause internal damage to bolls that were older than 350 HU under a no-choice field-cage study. Late-instar nymphs caused 23, 29, and 15% more loss in lint yield, seed weight, and seed counts, respectively, per boll compared with that of adults. For *Lygus* management in west Texas, insecticide intervention is not necessary beyond 350 HU past cut-out. Preliminary whole-plant cage study, wherein variable age fruits were available for insects to choose from, also indicated that western tarnished plant bug boll susceptibility threshold may be around 350 HU. **(Shrestha and Parajulee, AgriLife Research, Lubbock)**

Quantification of cotton plant growth response to cotton fleahopper infestations. Cotton fleahopper is an important early season pest in Texas cotton. Cotton fleahoppers (both adults and nymphs) feed on cotton squares and cause heavy early season square loss. Different cotton cultivars may respond differently to various levels of cotton fleahopper injury. The growth response of cotton cultivars to cotton fleahopper injury has not been well characterized. In this study, plant growth response of two common cotton cultivars (DP 161B2RF and FM 9063B2F) to cotton fleahopper injury was evaluated. Cotton fleahoppers were reared on green beans in the laboratory and 3rd-4th instar nymphs were released on cotton plants at 1 (low) and 4 (high) nymphs per plant in insect-augmented treatment plots. Cotton plant growth parameters were monitored both in fleahopper released and control plots throughout the crop growing season. Cotton plant height, root length, number of nodes, leaves, fruits, and plant part-specific biomass were recorded from all plots. Most variables evaluated differed between the years due to record-breaking high temperatures and drought conditions during 2011. In 2011, plant height was significantly higher in cotton fleahopper infested plots than in control plots as a result of plant's response to insect-induced fruit loss. In general, early season fleahopper-induced fruit loss did not result in significantly different changes in plant biomass. In 2010, plant biomass measurements were higher in FM 9063B2F as compared to that in DP 161B2RF, but these differences were masked by harsher environmental conditions in 2011. Yield data suggested that cotton plants were able to compensate 15-20% of early season fruit loss induced by cotton fleahoppers in both cultivars. This study was conducted as a collaborative project between Texas AgriLife Research Center in Beaumont (Y. Yang and L. T. Wilson) and Lubbock. **(Shrestha and Parajulee, AgriLife Research, Lubbock)**

Varietal difference in compensation of Lygus-induced fruit loss in cotton. Two cultivars: DP 104 B2RF (early season) and DP 161 B2RF (full season) were evaluated. Different levels of pre-flower square loss were achieved by augmenting natural populations of western tarnished plant bugs (WTPB) with laboratory reared nymphs released three times at weekly intervals or via manual removal of fruits during the first three weeks of squaring. Treatments included: 1) augmentation of 2 bugs per plant (Low), 2) augmentation of 4 bugs per plant (High), 3) 0 bugs augmented (untreated control, UC), 4) 0 bugs achieved through spray application (spray control, SC), 5) manual removal of first position squares (ASC_{1st}), and 6) manual removal of all fruits (ASC_{all}). The test was deployed in a 2 (cultivar) x 6 (insect release treatment) factorial arrangement with randomized complete block design. In all years, crop compensated for lint loss due to WTPB treatments in both cultivars. Both insect-induced (Low and High) and manual removal of fruits (ASC_{1st} and ASC_{all}**)** significantly reduced lint yield contributed by first fruiting positions. Averaged over 3 years, SC, UC, Low, High, ASC_{1st}, and ASC_{all} had 916, 928, 745, 779, 480, and 476 lbs/A first position lint yields, respectively. Conversely, both insect augmented and manual removal plots resulted in significantly higher lint yield contributed by lateral fruiting positions. Averaged over three years, SC, UC, Low, High, ASC_{1st}, and ASC_{all} had 298, 275, 385, 423, 768, and 631 lbs/A lateral position lint yields, respectively. Regardless of the manner of fruit removal, plants were able to fully compensate, in terms of final lint yield, for early season fruit loss, largely via significant overcompensation by lateral fruiting positions. **(Shrestha and Parajulee, AgriLife Research, Lubbock)**

Population level genetic variability of cotton fleahopper in the United States. Cotton fleahopper is one of the major sucking insect pests of cotton. However, severe infestations and corresponding crop loss are mainly observed in southern Texas. This is the first study to determine the geographic genetic structure of cotton fleahopper populations in the United States. Cotton fleahoppers were collected from cultivated cotton in Arizona, Texas, Oklahoma, Arkansas, Mississippi, Louisiana, Alabama, Florida, Georgia, South Carolina, and North Carolina. The number of individuals (282) and AFLP bands (559) used in this study were adequate to reveal the presence of population structure. Molecular diversity as indicated by percent polymorphism was highest for the Texas (TX) population and lowest for the Florida (FL) population. The expected heterozygosity was similar for all the populations. Principal component analysis (PCA) based on Nei's genetic distance among the 12 geographic populations sampled revealed that populations were grouped into at least four clusters. Out of these four clusters, the cotton fleahopper population obtained from Florida (FL) and Arizona (AZ) formed two separate clusters. While Georgia (GA), South Carolina (SC) and North Carolina (NC) populations formed one cluster and the individuals from the remaining States (i.e., TX, OK, MX, AR, MS, LA, and AL) grouped together to form another cluster. An understanding of fleahopper population structures provides insight on their movement patterns between regions and/or local adaptation, in addition to providing information aimed at improving fleahopper management strategies. **(Barman, Parajulee, Sansone, and Medina, College Station, Lubbock, and San Angelo) Funded by TSSC, Cotton Inc.**

Rolling Plains Insecticide Efficacy Tests. Trials included looking at sulfoxaflor and a combination of spirotetramat and imidacloprid was evaluated for cotton fleahopper control. **(Sansone and Minzenmeyer, Texas AgriLife Extension, San Angelo)**.

Early season fruit loss compensation. Research has demonstrated the extraordinary capability of cotton to compensate for pre-bloom square loss. However, full compensation is questionable when the cotton growing season is shortened. The objectives of this test were to assess the ability of cotton to compensate for early season square loss under a "normal" length growing season and an "early" terminated growing season and the impact compensated fruit may have on lint quality. There were six levels of square removal on pre-bloom cotton in both a "normal" length (terminated at 80% open boll) and "early" terminated (at 25% open boll) growing season. Analysis shows the importance of protecting the early fruit in a shortened growing season. Loan values averaged \$0.55 (ranging from \$0.57 to \$0.49). With the above normal heat unit accumulation in Texas in 2011, micronaire was not an issue for late-season fruit. There were no discounts assigned to any treatment for length, strength or length uniformity. (**Kerns, Texas AgriLife Extension Service, Lubbock; Doederlein, Texas AgriLife Extension Service, Lamesa; Baugh, Texas AgriLife Extension Service, Lubbock; Patman Texas AgriLife Extension Service, Crosbyton).**

Managing mixed populations of bollworms and fall armyworms. Non-Bt cotton comprises approximately 50% of the cotton acreage planted in the Texas High Plains. Damage caused by bollworms, *Heliocoverpa zea*, and fall armyworms, *Spodoptera fugiperda*, often result in significant yield loss. Prior to August, populations are predominantly bollworms, but by mid-August populations are often mixed with both species. Pyrethroids used to control bollworms work well but are weak on controlling fall armyworms. Armyworm materials also tend to be weak on bollworms. The objective of this study was to evaluate the efficacy of new insecticidal chemistries on mixed populations of bollworms and fall armyworms in non-Bt cotton. Three tests were conducted in 2010-2011 in the Texas High Plains. Pyrethroids were found to be effective towards bollworms but ineffective towards fall armyworms. Benevia (cyazapyr), was found to be effective towards bollworms but was not evaluated against fall armyworms. Blackhawk (spinosad) was ineffective towards bollworms but was not tested against fall armyworm. Prevathon (rynaxypyr) was effective towards both bollworms and fall armyworms. When used alone, Belt (flubendiamide) was considered weak against bollworms and fall armyworms, but was highly effective when tank-mixed with a pyrethroid. **(Kerns & Dustin Patman, AgriLife Extension Service, Crosbyton, Baugh Texas AgriLife Extension Service, Lubbock; Anderson, Texas AgriLife Extension Service, Seminole).**

Influence of thiamethoxam seed treatments (Cruiser) on the ability of foliar applications of thiamethoxam (Centric) to control cotton aphids. Cruiser did not appear to influence aphid late –season populations in 2011 or the efficacy of Centric foliar sprays on these aphids. Essentially Centric completely failed to mediate the aphids regardless of seed treatment. Even 2 applications the top of the label rates of Centric failed. Bioassay indicated that these aphids were resistance to thiamethoxam. (**Kerns & Baugh, Texas AgriLife Extension Service, Lubbock)**.

Miticde efficacy. Two tests were conducted evaluating the efficacy of various miticides towards twospotted or carmine spider mites in pre-bloom and early bloom cotton. GWN-1708 at 16 and 24 oz/ac, Athena at 8 oz/ac, Oberon at 4 oz/ac, Epi-Mek at 6 or 8 oz/ac, Onager at 12 oz/ac, Brigade at 5 or 6.4 oz/ac and Zeal at 0.75 oz/ac were all highly active toward mites. We evaluated some low rates of selected miticide which proved to be ineffective. These included: Epi-Mek at 4 oz/ac, Onager at 8 oz/ac, and Oberon at 3 oz/ac. (**Kerns & Baugh, Texas AgriLife Extension Service, Lubbock, Anderson, Texas AgriLife Extension Service, Seminole, Doederlein, Texas AgriLife Extension Service, Lamesa, Scotton Russell, Texas AgriLife Extension Service, Brownfield)**.

Transgenic aphid resistance. Cotton genetically modified for overexpression of the protein osmotin was evaluated for resistance to cotton aphids. Demographic life table data suggest a slight reduction in the intrinsic rate of increase in aphids reared on cotton engineered for the overexpression of osmotin. (**Salimath, Tripathy & Chapman, University of North Texas, Denton; Kerns, Texas AgriLife Extension Service, Lubbock**).

Aphicide efficacy. Cotton aphids, Aphis gossypii Glover, are a common economically damaging pest in the Texas High Plains. The objectives of this study include: 1) To determine the efficacy of new insecticides at mitigating aphid populations in cotton and 2) To evaluate the impact of aphid populations on lint yield and quality. All three rates of Benevia (Cyantraniliprole) exhibited excellent control along with Intruder (Acetamiprid) during the duration of this test. CMT 4586 (spirotetramat + imidacloprid) showed excellent initial knockdown of aphid populations, but residual activity declined. F9210 (zeta cypermethrin + bifenthrin + imidacloprid) and Centric (thiamethoxam) exhibited initial knockdown of aphid populations but aphid populations quickly rebounded. Centric and F9210 provided no significant yield increase while all three rates of Benevia, CMT 4586, and Intruder provided a significant boost in yield. Centric, F9210, and Benevia (16.9 fl-oz) did not significantly differ from the untreated check with respect to open bolls and Centric and F9210 did not significantly differ in micronaire when compared to the untreated check. (**Kerns & Baugh, Texas AgriLife Extension Service, Lubbock)**.

Outbreak of Kurtomathrips morilli. Kurtomathrips morrilli is an unusual thrips that occasionally attacks and severely damages cotton in the southwestern United States, but there is very little information available regarding this pest. In 2011, the south plains region of Texas was severely impacted by a drought which may have been a key factor resulting in an outbreak of *K. morrilli*. This outbreak encompassed an estimated 330,000 acres of cotton, approximately 83,000 acres of which received insecticide applications. The outbreak resulted in the loss of about 24 million pounds of cotton lint, resulting in over $20 million in yield loss and control costs. Water-deficit stressed cotton appeared to be most severely affected by *K. morrilli*, while cool temperatures and precipitation appeared to naturally mediate the outbreak. Insecticide efficacy tests determined that the neonicotinoid insecticides, Intruder (acetamiprid), Trimax Pro (imidacloprid) and Centric (thiamethoxam), and the organophosphate Orthene (acephate) were highly effective in mediating *K. morrilli* infestations. The mostly commonly used insecticides in the 2011 outbreak were imidacloprid, primarily generic brands, and acephate. These were the insecticides of choice primarily because they were inexpensive, yet effective. **(Kerns & Anderson, Texas AgriLife Extension Service, Seminole, Patman, AgriLife Extension Service, Crosbyton, Baugh Texas AgriLife Extension Service, Lubbock).**

Managing thrips with organic pesticides. Thrips are a recurring problem to seedling cotton in the Texas High Plains. It has been estimated that thrips impact to the High Plains cotton industry in 2010 was in excess of $6 million. Two replicated trials were conducted in commercial organic cotton fields; one in Bailey County near Muleshoe, TX and the other in Lubbock County near Idalou, TX to evaluate the efficacy of numerous OMRI approved insecticides for thrips suppression in cotton and to determine yield benefits of those insecticide applications. Thirteen OMRI approved foliar insecticides and untreated check were compared. Thrips pressure was less than normally experienced and variability was high within the trial. Never-the-less Aza-Direct (8oz), Entrust, Bugitol, and Saf-T-Side + Ecotec did provide some suppression of thrips in this trial but residual activity may be limited. Entrust appeared to curb colonization to a greater degree. No treatment provided any benefit in lint yield. **(Kerns, Texas AgriLife Extension Service, Vandiver, Texas AgriLife Extension Service, Muleshoe Dever, Arnold, Parajulee, Texas AgriLife Research, Lubbock).**

Developing a binomial sampling plan for thrips. Thrips are problematic throughout much of the U.S. cotton belt and can negatively impact early-season cotton if curative action is not taken. In this study we compare two different methods (visual and cup) for sampling thrips on seedling cotton, and using these sampling methods we began the process of developing a binomial sampling plan. This study was conducted in a variety of locations across the Texas high plains and far west Texas in commercial cotton fields. The sample data collected from both methods of sampling were used to determine how many cotton leaves were infested to mean thrips density relationship needed to develop the binomial sample plan using the following formula ($P(I)=1-e^{-m[LN(amb-1)/(amb-1-1)]}$). Taylor's power law effectively modeled the thrips sample data from both sample methods. Taylor's coefficients suggested that thrips nymphs tended to be more closely grouped than adult thrips. Development of the sample plans indicated that the binomial sample plan, regardless of sample method, required significantly fewer samples to make a management decision. Sample size requirements between the sample methods for the binomial sample plan, although similar, favored the cup sample method, as it required only 90% of the effort of the visual sample plan. **(Kerns, Texas AgriLife Extension Service, Lubbock; Muegge, Texas AgriLife Extension Service, Ft. Stockton; Parajulee, Texas AgriLife Research, Lubbock; Vandiver, Texas AgriLife Extension Service, Muleshoe: Multer, Texas AgriLife Extension Service, Garden City; Doederlein, Texas AgriLife Extension Service, Lamesa; Patman, Texas AgriLife Extension Service; Crosbyton). Funded by Cotton Inc.**

Virginia

Bollworm Trials

Double-insect-toxin varieties have replaced single-insect-toxin varieties available to U.S. cotton producers. Previous research in Virginia has shown that these insect-resistant varieties still require at least one bollworm pesticide application to achieve their potential yields. Since 2006, research has been conducted annually at the Tidewater Agricultural Research and Extension Center (TAREC) in Suffolk, Virginia, to evaluate the effectiveness and costs associated with conventional (RR, RF, LL, or conventional), single (BG), and double-insect-toxin (BG2 or WS) cotton varieties.

In all years, varieties were selected based on OVT performances in Virginia and North Carolina using the highest yielding varieties from each grouping. Varieties were planted in early May at TAREC using a four-replicate split-plot experimental design with insecticide treatment (treated vs. untreated) as the main plot and variety as the sub-plot. Treated plots received bollworm protection with one (BG2, WS) or two (RR, RF, LL) Baythroid XL applications in August, while untreated plots received no insecticides for bollworm. Plots were four rows by 35 ft long with 36-in row centers. Bollworm was monitored by assessing external bollworm-induced boll damage on 25 randomly selected bolls per plot in late August and early September. Yield and the net value per acre for bollworm protection were determined for each variety using the formula: lint value (55¢/lb [2006-2008], 68¢ [2009], 72¢ [2010]), 95¢ [2011]) x protected yield – treatment cost ($9.37/acre for one application, $17.06/acre for two) – technology fee ($17.40/acre for BR, $22.80/acre for BG2, $11/acre for WR).

In the 2011 trial, percent boll damage ranged from 0 to 1% in insecticide protected BG2/WS cotton and 0 to 4% in conventional cotton; and in non-insecticide protected cotton, 0 to 2% in BG2/WS cotton and 5 to 13% in conventional cotton. Over all varieties, there was no significant difference in yields due to insecticide treatment (903 and 872 lb lint/acre with and without insecticide, P=0.3890). Over treatments, there was a significant difference in lint yields among varieties (P=0.0001).

Thrips Trials

Virginia participated in the Southeast Region Cotton Thrips Management Project which coordinated three field trials among five states (VA, NC, SC, GA and AL). Regional summaries were presented at the 2012 Beltwide Cotton Conferences in Orlando, FL and will be included in 2012 published Proceedings. The addition of starter fertilizer did not have the overall expected benefit of helping plants grow more rapidly out of the thrips-susceptible seedling stage. Of the foliar insecticides applied, Benevia (a 10OD formulation of cyazypyr) provided the best level of thrips control, as evidenced by less plant damage, lower numbers of adult and immature thrips, and higher (not in all locations) lint yields. Radiant, Dimethoate and Orthene were also effective. The pyrethriod, Karate Z, was essentially equal to the non-treated control in all locations. In trials assessing insecticide seed treatments, although not always statistically significant, treatments resulted in lint yields ranging from 831 to 939 lb lint/acre compared with 678 lb in the non-treated controls.

Annual CEW Field Corn Survey

To conduct the field corn survey, the number of corn earworms found in 50 ears of corn was recorded in 5 randomly selected corn fields in each of 27 counties, totaling 6,550 ears and 133 fields sampled. When fields were known to contain Bt or non-Bt corn, this was noted. Otherwise, samples were considered to be random and assumed to be representative of the actual Bt/non-Bt composition in each county. Age of earworms, or if they had already exited the ears, was also recorded. Statewide, 33% of ears were infested with earworms in 2011. This is down from 40% in 2010. The regional average for the Southeast where cotton is grown was 47% compared with 57% in 2010. Survey results were provided via the Virginia Ag Pest Advisory and at grower meetings and field days.

CEW AVT Cypermethrin Monitoring

Adult corn earworms were captured live from ten pheromone-baited traps at the Tidewater AREC in Suffolk, VA, from late May through mid-September 2011. Moths were returned to the laboratory on the day of collection to be assessed for resistance using the adult vial test with scintillation vials pre-treated with cypermethrin including untreated vials as a control (provided by Dr. Ryan Jackson, USDA-ARS, Stoneville, MS). Moths were assessed for survival 24 hours after being placed into vials by categorizing them as dead, down (unable to fly), or live. A total of 3,001 months were tested in 2011, with a mean survival of 32%, slightly higher than the 29.8% survivorship recorded in 2010. Survivorship exceeded 40% in several individual samples and in one, exceeded 55%. Data summaries with a brief discussion of the results were compiled and updated weekly, and forwarded to agents, growers and the ag sector via the Virginia Ag Pest Advisory.

Regional Products/Publication

Two educational publications were produced and distributed to growers, the 2nd edition of the Mid-Atlantic Guide to the Insect Pests and Beneficials of Corn, Soybean and Small Grains, Virginia Cooperative Extension (VCE) Publ. 444-360 was updated to include new insect pest species introduced since its initial release in 2005; and Field Guide to Stink Bugs of Agricultural Importance in the Upper Southern Region and Mid-Atlantic States, VCE Publ. 444-356 was reprinted for wider distribution among states in other regions. **(Ames Hebert).**