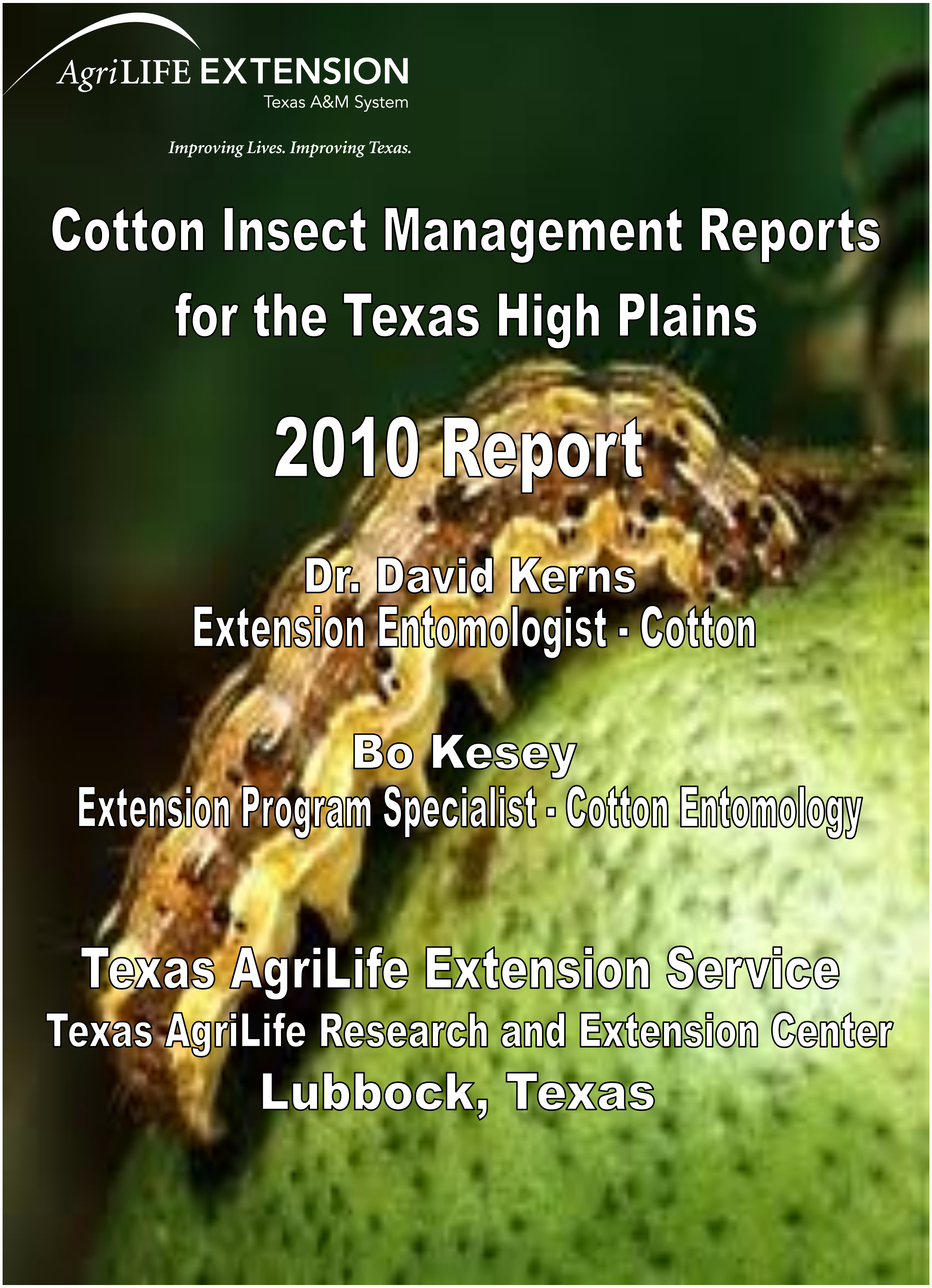

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Cotton Insect Management Reports for the Texas High Plains

2010 Report

Dr. David Kerns
Extension Entomologist - Cotton

Bo Kesey
Extension Program Specialist - Cotton Entomology

Texas AgriLife Extension Service
Texas AgriLife Research and Extension Center
Lubbock, Texas

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January, 2011

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Interaction Between Insecticides Targeting Western Flower Thrips and Fungicides in Cotton in the High Plains Region of Texas, 2010

Cooperators: Texas AgriLife Research Center – Halfway, TX

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Summary:

In this study we investigated the interaction between thrips control using Temik, Gaucho Grande or Orthene, with and without a premium fungicide under light and heavy disease pressure. The seedling cotton disease *Rhizoctonia solani* resulted in significant stand loss and subsequent yield reduction where disease pressure was high. Within the Premium seed treatment (Premium fungicide + Gaucho Grande) with disease inoculated seed, Temik had a higher plant stand than the untreated suggesting that the stress of thrips in conjunction with heavy disease pressure caused increased stand loss. Orthene was intermediate in this effect. Thus, the superior thrips treatment for preventing stand loss under heavy disease pressure was Temik + Premium seed treatment, while Orthene performed equally to Temik with or without the Premium seed treatment under low disease pressure.

Objective:

The objective of this test was to determine if controlling thrips helps prevent stand loss due to seedling diseases.

Materials and Methods:

This test was conducted at the Halfway Research Station at Halfway, TX. The field was planted on 3 May on 40-inch rows, and irrigated using pivot sprinkler irrigation. Crop emergence occurred 18 May. The experimental design was a 3 x 2 x 2 factorial with 4 replicates. Plots were 4-rows wide × 35 ft in length.

Factors A were the insecticide treatments which included: 1) untreated, 2) Temik 15G, and Orthene 97 (Table 1). Temik was applied in-furrow at planting at approximately 1.5-inches in depth. Orthene was applied foliarly on a 50% band with a CO_2 pressurized hand-boom sprayer calibrated to deliver 10 gpa through Teejet XR8003VS extended range flat spray tip nozzles (1 per row) at 30 psi. Factors B were seed treatments consisting of fungicides and insecticide and included: 1) Premium seed treatment and 2) Base fungicide. Factor C was the seedling disease inoculum: 1) untreated and 2) 3-g of ground oat seed containing active *Rhizoctonia solani*. Inoculum was applied with the cotton seed at planting.

Adult and immature thrips were sampled by visually inspecting 10 whole plants per plot. Samples were taken on 26 May, and 1 and 8 Jun.

Plant populations were estimated by counting the number of live plants within each plot. Entire plots were harvested on 28 Oct using a mechanized cotton stripper.

Data were analyzed using ANOVA and the means were separated with an F protected LSD ($P \geq 0.05$).

Results and Discussion:

On 26 May, 23 days after planting (DAP) and 5 days post emergence, thrips were beginning to colonize and Temik and the Premium seed treatment (contained Gaucho Grande insecticide), were providing significant thrips protection over untreated plots (including Orthene) (Table 2). A significant insecticide*seed treatment interaction was detected for adult and total thrips at this time. This interaction simply showed that Temik did not benefit from the inclusion of Gaucho Grande, while the untreated plots did.

At 29 DAP, and 6 days after the first Orthene application, Temik, Gaucho Grande and Orthene were all providing adequate and equal control of thrips (Table 3). The insecticide*seed treatment interaction for thrips was similar to the 26 May interaction. This interaction for damage suggested that Orthene and the Factor A untreated did benefit from the having Gaucho Grande treated seed while Temik did not. An interaction between insecticide and inoculum was also detected for thrips on 1 June. This interaction suggested that in the Orthene-treated plots, seed inoculated with *R. solani* had fewer thrips than non-inoculated seed, while the Temik-treated and untreated were unaffected. The reason for this interaction is uncertain.

There was also an insecticide*seed treatment*inoculum interaction. This interaction was similar to the insecticide*inoculum interaction, but the inclusion of Gaucho Grande negated the inoculum effect on the Orthene-treated plots. Additionally, there was a insignificant affect on where no insecticides were utilized; the inoculated base fungicide treatment had fewer thrips than where no inoculum was used.

These data suggest that under heavy disease pressure (inoculated), cotton plants may be less attractive to thrips (Table 5). Similar results were observed on 8 June (Table 4). However, at this time Temik and Orthene continued to offer excellent thrips control, but Gaucho Grande (Premium seed treatment) was no longer effective. Additionally, there was an insecticide*seed treatment*inoculum interaction on plant stand (Table 6). This interaction demonstrated that the plant stand was always lower where inoculum was used, and where seed was inoculated, the plant stand suffered where Temik was used without the Premium seed treatment, whiles Orthene and the untreated were not affected.

Within the Premium seed treatment with inoculated seed, Temik had a higher plant stand than the untreated suggesting that the stress of thrips in conjunction with heavy disease pressure caused increased stand loss. Orthene was intermediate in this effect. Thus, the superior thrips treatment for preventing stand loss under heavy disease pressure was Temik + Premium seed treatment, while Orthene performed equally to Temik with or without the Premium seed treatment under low disease pressure.

Yield was negatively impacted where *R. solani* inoculum was used and in the absence of the Premium seed treatment (Table 4). Neither Temik nor Orthene significantly increased yield over the untreated.

Acknowledgments:

Appreciation is expressed to the Plains Cotton Improvement Program for financial support of this project.

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Table 1.

Insecticide/formulation		Rate amt product/ac
Temik 15 G		3.5 lbs
Orthene 97		3.0 oz
Seed treatments	**Component/formulation**	**Rate amt product/100lbs seed**
Premium	Fungicides	
	Baytan 30F +	0.5 fl-oz +
	Allegiance FL +	0.75 fl-oz +
	Vortex +	0.075 fl-oz +
	Stamina	3.0 fl-oz
	Insecticide	
	Gaucho Grande 5FS	0.375 mg (AI)/seed
Base	Fungicides	
	Baytan 30F +	0.5 fl-oz +
	Allegiance FL +	0.75 fl-oz +
	Vortex	0.075 fl-oz

Table 2.

Treatment/formualtion[c]	26 May (23 DAP; pre-foliar applications)		
	No. thrips per plant		
	immatures	adults	total
Factor A			
Temik 15G	0.06 b	0.15 b	0.16 b
Orthene 97	1.41 a	0.55 a	1.96 a
Untreated	0.95 ab	0.52 a	1.47 a
Factor B			
Premium	0.03 b	0.12 b	0.14 b
Base	1.55 a	0.70 a	2.25 a
Factor C			
Inoculated	0.49 a	0.35 a	0.84 a
Untreated	1.09 a	0.46 a	1.55 a
A*B interaction	ns	$P < 0.0003$	$P = 0.013$
A*C interaction	ns	ns	ns
B*C interaction	ns	ns	ns
A*B*C interaction	ns	ns	ns

Means in a column within a factor followed by the same letter are not significant based on an F protected LSD ($P > 0.05$).

[a]See Table 1 for treatment components and rates.

Table 3.

Treatment/formualtion[c]	1 June (29 DAP; 6 DAT foliar application 1)				
	No. thrips per plant			Damage rating (1-5)	Plants/ ft-row
	immatures	adults	total		
Factor A					
Temik 15G	0.01 b	0.34 b	0.35 b	1.00 c	1.44 a
Orthene 97	0.04 b	0.35 b	0.40 b	1.38 b	1.64 a
Untreated	0.31 a	0.89 a	1.20 a	2.43 a	1.43 a
Factor B					
Premium	0.04 b	0.42 b	0.46 b	1.30 b	1.67 a
Base	0.20 a	0.64 a	0.84 a	1.89 a	1.35 b
Factor C					
Inoculated	0.13 a	0.44 b	0.73 a	1.67 a	1.01 b
Untreated	0.11 a	0.61 a	0.57 a	1.52 a	2.05 a
A*B interaction	$P < 0.0001$	ns	$P = 0.004$	$P = 0.0001$	ns
A*C interaction	ns	$P = 0.02$	ns	ns	ns
B*C interaction	ns	ns	ns	ns	ns
A*B*C interaction	ns	$P = 0.008$	$P = 0.02$[b]	ns	ns

Means in a column within a factor followed by the same letter are not significant based on an F protected LSD ($P > 0.05$).

[a]See Table 1 for treatment components and rates.

[b]See Table 5 for interaction.

Table 4.

Treatment/ formualtion[c]	8 June (36 DAP; 7 DAT foliar application 2) No. thrips per plant immatures	adults	total	Damage rating (1-5)	Plants/ft-row	28 Oct Yield-lint (lbs/ac)
Factor A						
Temik 15G	0.22 b	1.44 b	1.67 b	2.13 b	1.82 a	1279.10 a
Orthene 97	0.14 b	1.87 ab	2.01 b	1.81 c	1.78 a	1129.80 a
Untreated	0.52 a	2.08 a	2.60 a	4.00 a	1.78 a	1147.30 a
Factor B						
Premium	0.20 b	1.68 a	1.88 a	2.26 b	1.93 a	1303.00 a
Base	0.38 a	1.91 a	2.03 a	3.00 a	1.66 b	1058.61 b
Factor C						
Inoculated	0.35 a	1.65 a	2.00 a	2.71 a	1.20 b	910.87 b
Untreated	0.24 a	1.95 a	2.19 a	2.55 a	2.44 b	1444.58 a
A*B interaction	$P = 0.02$	ns	ns	$P < 0.0001$	ns	ns
A*C interaction	ns	ns	ns	ns	ns	ns
B*C interaction	ns	ns	ns	ns	ns	ns
A*B*C interaction	ns	ns	ns	ns	$P = 0.04$[b]	ns

Means in a column within a factor followed by the same letter are not significant based on an F protected LSD ($P > 0.05$).
[a]See Table 1 for treatment components and rates.
[b]See Table 6 for interaction.

Table 5.

	No. total thrips per plant - 1 June (29 DAP; 6 DAT foliar application 1)			
	Factors B/C			
	Premium[a]		Base[a]	
Factor A	Inoculated	No Inoculum	Inoculated	No Inoculum
Temik 15G	0.30 def	0.28 ef	0.55 c-f	0.25 ef
Orthene 97	0.15 f	0.45 def	0.33 def	0.65 cde
Untreated	0.88 bc	0.70 cd	1.20 b	2.03 a

Means within the table followed by the same letter are not significantly different based on an F protected LSD ($P \geq 0.05$).
[a]See Table 1 for treatment components and rates.

Table 6.

	Plants/ft-row - 8 June (36 DAP; 7 DAT foliar application 2)			
	Factors B/C			
	Premium[a]		Base[a]	
Factor A	Inoculated	No Inoculum	Inoculated	No Inoculum
Temik 15G	1.40 bc	1.96 a	0.50 e	1.84 ab
Orthene 97	1.10 cd	2.02 a	0.96 cde	1.79 ab
Untreated	0.82 de	2.01 a	0.92 cde	1.81 ab

Means within the table followed by the same letter are not significantly different based on an F protected LSD ($P \geq 0.05$).
[a]See Table 1 for treatment components and rates.

Evaluation of Preventative and Foliar Insecticides for Control of Western Flower Thrips in Cotton in the High Plains Region of Texas, 2010

Cooperators: Bryan and Rex Reinert, Growers

David Kerns and Bo Kesey
Extension Entomologist-Cotton, Extension Program Specialist-Cotton

Castro County

Summary:

Temik continues to be the premium thrips management tool, and offered the best protection in this test. The 5 lbs/acre rate of Temik did not provide more protection than the 3.5 lbs/acre rate. We did not detect any benefit from using Temik with Aeris. Following Temik, foliar applications of Bidrin XP appeared to offer the best protection followed by the seed treatments (Aeris and Avicta CC), Orthene and Bidrin. The seed treatments probably failed after 14 days post emergence and should have be oversprayed for a foliar insecticide.

Objective:

The objective of this study was to further evaluate the efficacy of Temik, Avicta Complete Cotton and Aeris as preventative treatments for thrips control, and Orthene, Bidrin and Bidrin XP as foliar treatments.

Materials and Methods:

This test was conducted in a commercial cotton field near Dimmitt, TX. The field was planted on 20 May on 20-inch rows, and irrigated using pivot sprinkler irrigation. The test was a RCB design with four replications. Plots were 4-rows wide × 100 ft in length.

Aeris and Avicta CC were applied as seed treatments, while Temik was applied in-furrow at planting at approximately 1.5-inches in depth. Foliar applications evaluated included Orthene 97, Bidrin and Bidrin XP. Foliar sprays were applied on a 50% band with a CO_2 pressurized hand-boom sprayer calibrated to deliver 10 gpa through

Teejet XR8003VS extended range flat spray tip nozzles (1 per row) at 30 psi. Foliar applications were made on 13 and 20 June.

Adult and immature thrips were sampled by visually inspecting 10 whole plants per plot. In addition to counting thrips, damage was assessed by subjectively rating each plot on a 1 to 5 scale where 1 = no damage, and 5 = extensive damage.

Data were analyzed with ANOVA, and means were separated using an F-protected LSD ($P \leq 0.05$).

Results and Discussion:

On 2 June, 13 days after planting (DAP), although no foliar sprays had been applied, all of the treatments had fewer thrips than the untreated. Temik + Aeris had the fewest total thrips but only differed from the untreated and where the foliar treatments were to be applied (Table 1).

At 20 DAP and 7 days after the first foliar applications, the Aeris-treated plots had the greatest number of thrips, but did not differ from the untreated or Avicta CC; thus indicating that these seed treatments had lost their residual activity. None of the other treatments differed from one another. At this time damage was slight in the untreated and non-detectable where insecticides were used.

At 26 DAP and 6 days following the second foliar application, total thrips remained greatest where Aeris alone and Avicta CC were used, and these did not differ from the untreated. The only treatments that had fewer total thrips than the untreated were Orthene and Bidrin XP.

All of the insecticide treatments had less damage than the untreated on 15 June (Table 2). Temik at 3.5 lbs and Temik + Aeris had no detectable thrips damage, and suffered significantly less damage than all the treatments that did not contain Temik. Bidrin XP had less thrips damage than the other foliar treatments. There were no differences among treatments in leaf area or plant heights.

Overall the thrips did not heavily colonize the cotton in this test. The population was consistently primarily adults. Based on damage, Temik offred the best protection followed by foliar applications of Bidrin XP. The seed treatments offered moderate protection, probably failing after 14 days post emergence.

Acknowledgments:

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Table 1. Thrips counts and damage ratings for 2 June and 9 June.

		2 Jun – cotyledon stage (13 DAP; pre-foliar application)			9 Jun – 2 true leaves stage (20 DAP; 7 DAAP 1)			
		Thrips per plant			Thrips per plant			
Treatment/ formulation[a]	Rate amt product/acre	immatures	adults	total	immatures	adults	total	Damage rating (1-5)
Untreated	--	0.28a	2.78a	3.05a	1.20a	6.05bc	7.25ab	2.00a
Temik 15G	3.5 lbs	0.00c	0.55cd	0.55cd	0.08a	3.78c	3.85bc	1.00b
Temik 15G	5.0 lbs	0.00c	0.50cd	0.50cd	0.15a	3.58c	3.73c	1.00b
Aeris	--[a]	0.05bc	0.40cd	0.45cd	0.15a	9.58a	9.73a	1.00b
Temik 15G + Aeris	3.5 lbs + --[a]	0.03bc	0.18d	0.20d	0.28a	4.15c	4.43bc	1.00b
Avicta CC	--[a]	0.00c	0.65cd	0.65cd	0.48a	8.88ab	9.35a	1.00b
Orthene 97	3 oz	0.13b	1.60b	1.73b	0.05a	3.33c	3.38c	1.00b
Bidrin 8	3.2 fl-oz	0.08bc	0.85c	0.93c	0.33a	3.55c	3.88bc	1.00b
Bidrin XP	3.2 fl-oz[a]	0.03bc	0.88c	0.90c	0.33a	4.15c	4.48bc	1.00b

Values in a column followed by the same letter are not different based a Proc Mixed analysis with an F protected LSD ($P \geq 0.05$).
[a]Avicta Complete Cotton (seed treatment) is a mixture of Avicta 500FS at 0.15 mg(AI)/seed, Cruiser 5FS at 0.34 mg(AI)/seed, and Dynasty CST 125FS at 0.03 mg(AI)/seed; Aeris (seed treatment) is a mixture of Gaucho Grande 5FS at 0.375 mg(AI)/seed and thiodicarb at 0.375 mg(AI)/seed; Temik was applied in-furrow; Bidrin XP is a mixture of Bidrin 8 and Bifenthrin 2EC each applied at 3.2 fl-oz/acre.

Table 2. Thrips counts, damage rating and plant map data for 15 June.

		15 Jun – 4 true leaves stage (26 DAP; 6 DAAP2)					
Treatment/	Rate amt	Thrips per plant			Damage rating		Plant
formulation[a]	product/acre	immatures	adults	total	(1-5)	Leaf area (cm^2)	height (cm)
Untreated	--	0.25bc	2.53ab	2.78ab	3.00a	58.32a	6.85a
Temik 15G	3.5 lbs	0.10c	2.43abc	2.53abc	1.00d	61.89a	6.21a
Temik 15G	5.0 lbs	0.08c	2.10bcd	2.18bcd	1.25cd	63.08a	6.30a
Aeris	--[a]	0.60a	2.90ab	3.50a	2.25b	66.85a	7.76a
Temik 15G + Aeris	3.5 lbs + --[a]	0.08c	2.15a-d	2.23bcd	1.00d	56.42a	6.38a
Avicta CC	--[a]	0.43ab	3.18a	3.60a	2.00b	61.74a	6.85a
Orthene 97	3 oz	0.05c	1.38cd	1.43cd	2.00b	57.55a	6.03a
Bidrin 8	3.2 fl-oz	0.13c	2.15a-d	2.28bcd	2.00b	59.83a	6.06a
Bidrin XP	3.2 fl-oz [a]	0.05c	1.20d	1.25d	1.50c	59.92a	5.96a

Values in a column followed by the same letter are not different based a Proc Mixed analysis with an F protected LSD ($P \geq 0.05$).
[a]See Table 1 for full listing of treatment components and rates.

Developing an Action Threshold for Thrips in the Texas High Plains, 2010

Cooperators: Chad Harris, Brad Heffington, Brad Boyd, Casey Kimbral, Tim Black, Robert Boozer, Texas AgriLife Research and Extension Center – Halfway

David Kerns, Megha Parajulee, Monti Vandiver, Manda Cattaneo, Kerry Siders, Dustin Patman and Bo Kesey
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High Plains

Summary:

In the Texas high plains and most of the cotton growing areas of the United States, thrips are a dominating pest during the pre-squaring stage of cotton. The most dominate thrips species affecting irrigated cotton fields in the Texas high plains is the western flower thrips, *Frankliniella occidentalis* (Pergande). In irrigated cotton where thrips populations are historically high (usually areas where there is significant acreage of wheat), many growers opt to utilize preventative insecticide treatments such as in-furrow applications or seed treatments to control thrips. However, where thrips populations are not "guaranteed" to be especially troublesome, preventive treatments may not be necessary and represent an unnecessary expense. In these situations, well timed banded foliar insecticide applications for thrips control may be more profitable. Currently, the treatment threshold for thrips on irrigated cotton in the Texas high plains occurs when the average total thrips per plant equals or exceeds the number of true leaves. This was the fourth year conducting this study. This study was conducted in irrigated cotton across the Texas high plains. Based on the data collected thus far, cotton appears to be most susceptible to thrips at the cotyledon stage and susceptibility decreases as the plant grows. It has been commonly observed that cotton suffers more damage from thrips under cool temperatures. However, cool temperatures do not make the thrips more damaging, rather the plant's growth is slowed and remains at a more susceptible stage for a longer period of time. Although not certain, the current Texas action

threshold for thrips requires revamping to cotyledon stage = 0.5 thrips per plant, 1 true leaf = 1 thrips per plant, 2 true leaves = 1-1.5 thrips per plant, and 3-4 true leaves = 2 thrips per plant. However, more data is required to confirm these thresholds.

Objective:

To determine at what population density western flower thrips should be subjected to control tactics to prevent yield reduction and significant delayed maturity, to compare two action thresholds for thrips and to determine whether there is a relationship between thrips induced yield reduction and temperature.

Materials and Methods:

This study was conducted on irrigated cotton during 2007-2010 across 19 locations (Table 1). However, not all sites yielded usable data. In 2007-08, plots at all locations were 2-rows wide × 100-ft long, while in 2009-10 all plots were 4-rows wide × 100-ft. Plots were arranged in a RCB design with 4 replicates. The foliar treatment regimes are outlined in (Table 2). These treatments were simply a means of manipulating the thrips populations at different times in an attempt to focus on when thrips feeding is most damaging.

All foliar sprays consisted of Orthene 97 (acephate) applied at 3 oz-product/acre with a CO_2 pressurized hand boom calibrated to deliver 10 gallons/acre. Thrips were counted weekly by counting the number of larvae and adult thrips from 10 plants per plot. Whole plants were removed and inspected in the field. Each plot was harvested in its entirety in 2007, using a stripper with a burr extractor. In 2008-2009, a 1/1000th acre portion was harvested from each plot using an HB hand stripper. Yields were converted to proportion of yield relative to the highest yielding plot for each test site. Data were analyzed using linear regression (Sigma Plot 2008). Total thrips by crops stage and temperature were correlated with yield. Crops stages included cotyledon, 1 true leaf, 2 true leaves, 3 true leaves and 4 true leaves. Only leaves approximately the size of a quarter were counted as true leaves. Temperature was segregated based on minimum daily temperature. Those with minimum daily temperatures of 60° F or less were considered cold and those above that threshold were considered warm. A 10% reduction in yield was considered unacceptable.

Results and Discussion:

Under cool conditions, yield of cotton in Moore County was negatively correlated with thrips at the cotyledon stage (Figure 1, top). At this stage, based on the regression model, approximately 0.5 thrips per plant resulted in a 10% yield reduction. Results were similar for the Gaines County in 2008 (Figure 1, bottom). However, the cotton in Gaines County was approaching the 1 true leaf stage when the thrips were counted.

At the 1 true leaf stage under cool conditions, approximately 1 thrips per plant was correlated with a 10% yield reduction (Figure 2), while approximately 2 thrips per plant were required at the 2 true leaf stage (Figure 3). None of the sites experienced temperatures ≤ 60° F at the 3-4 true leaf stage.

Under warm conditions (minimum daily temperatures > 60° F), the relationship between thrips at the cotyledon stage and yield was negatively correlated, although the R^2 was low (Figure 4). Similar to the data collected under cool conditions, the model suggests that 0.4 thrips per plant resulted in a 10% yield reduction. Also, similar to the relationships observed under cool conditions, at the 1 and 2 true leaf stages, 0.9 and 1.4 thrips per plant respectively to result in a 10% yield reduction, respectively.

After 2 true leaves, under warm conditions, the cotton at all locations was rapidly growing and relationships were difficult to discern. However, in Hale County in 2008 when the cotton was a mixture of 3 and 4 true leaves, a weak but significant relationship between thrips and yield was detected (Figure 5). At this point, 2 thrips per plant appeared to result in a 10% yield reduction.

Based on these correlations, temperature did not appear to affect the number of thrips necessary to cause a 10% reduction in yield, regardless of crop stage. Because of this lack of differences, the data were pooled across temperature and sites in accordance with stage of growth (Figure 6). Although statistically significant, the R^2 values for the pooled data were much lower than desired. This was unavoidable and due to differences in field conditions, varieties, etc. across test sites. However, the pooled data continued to reflect similar trends observed at individual sites with some exception. The number of thrips necessary to result in a 10% yield reduction by crop stage were as follows: cotyledon stage = 0.65 thrips per plant, 1 true leaf stage = 0.7 thrips per plant, 2 true leaf stage = 1 thrips per plant and 3-4 true leaf stage = 2.1 thrips per plant.

It is obvious that thrips are most damaging to cotton during the early stages of growth, particularly cotyledon to 1 true leaf, and that susceptibility declines with plant growth. Additionally, common observation suggests that thrips damage is most severe during periods of cool conditions. However, the impact of cool temperatures does not appear to be an effect on the thrips as much as an impact on the plant. Additionally, cool temperatures do not necessarily make the cotton more susceptible to thrips, but appears to suppress cotton development, thus keeping the plant at a more susceptible stage for a longer period of time.

Based on the data collected thus far, it is obvious that the Texas action threshold for thrips in cotton does need to be altered, but should remain dynamic based on plant growth stage (Table 3).

Acknowledgments:

This project was funded by Cotton Incorporated, Texas State Support, and in part by the Plains Cotton Improvement Program.

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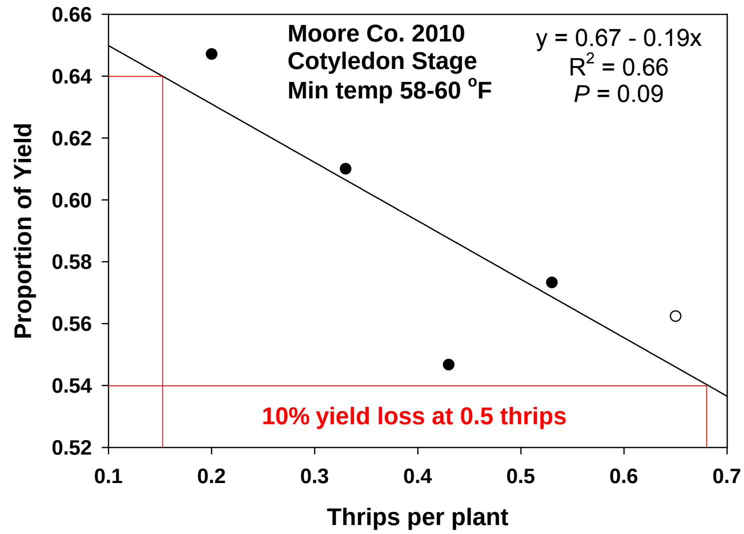
Table 1. Tests sites and reliability of data.							
2007		2008		2009		2010	
Bailey	Acceptable	Bailey	Acceptable	Bailey	Hailed out	Bailey	Nematodes
		Crosby	Acceptable	Crosby	Hailed out	Crosby	Acceptable
		Gaines	Acceptable	Gaines	Insufficient thrips	Dawson	Insufficient thrips
		Hale	Acceptable	Hale	Weedy	Lamb	Acceptable
		Hockley	Acceptable	Moore	Herbicide damage	Moore	Acceptable
		Lubbock	Insufficient thrips	Lubbock	Insufficient thrips	Castro	Insufficient irrigation
						Hale	Poor stand

Table 2. Foliar treatment regime timings.			
	2007	2008	2009-10
1) Untreated check	X	X	X
2) Automatic treatment on week 1	X	X	X
3) Automatic treatment on weeks 1 and 2 (only week 2 in 2008)	X		X
4) Automatic treatment on weeks 1, 2 and 3	X	X	X
5) Automatic treatment on week 2		X	X
6) Automatic treatment on weeks 2 and 3	X	X	X
7) Treatment based on the Texas AgriLife Extension Threshold[a]	X	X	X
8) Treatment based on the above threshold with 30% larvae	X	X	
[a]One thrips per plant from plant emergence through the first true leaf stage, and one thrips per true leaf thereafter until the cotton has 4 to 5 true leaves			

Table 3. Threshold comparison		
Threshold	Cotton Stage	No. Thrips per Plant
Old Threshold	Cotyledon – 1 true leaf	1
	2 true leaves	2
	3 true leaves	3
	4 true leaves	4
Possible New Threshold	Cotyledon	0.5
	1 true leaf	1
	2 true leaves	1-1.5
	3-4 true leaves	2



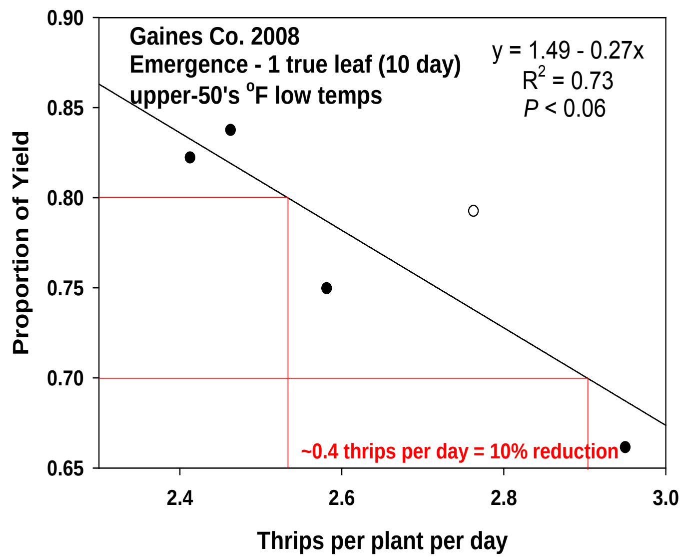


Figure 1. Relationship between thrips per plant and proportion of yield at the cotyledon stage under cool conditions in Moore (top) and Gaines (bottom) counties.

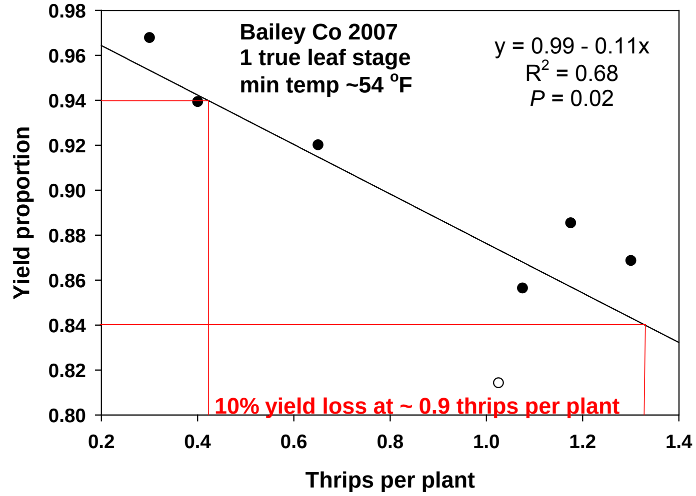
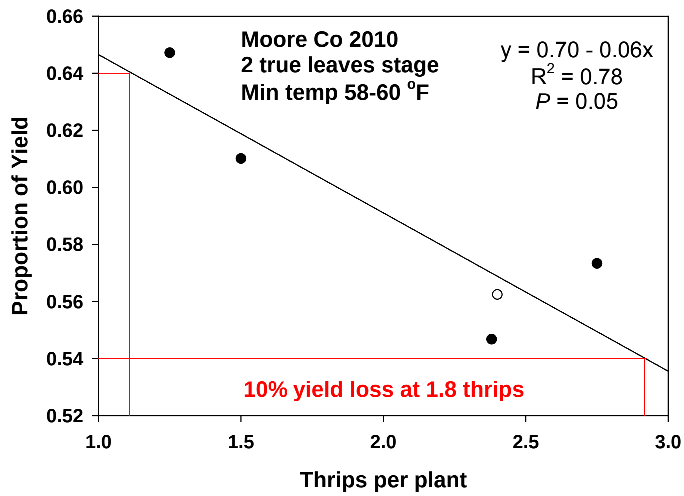


Figure 2. Relationship between thrips per plant and proportion of yield at the 1 true leaf stage under cool conditions in Bailey county.



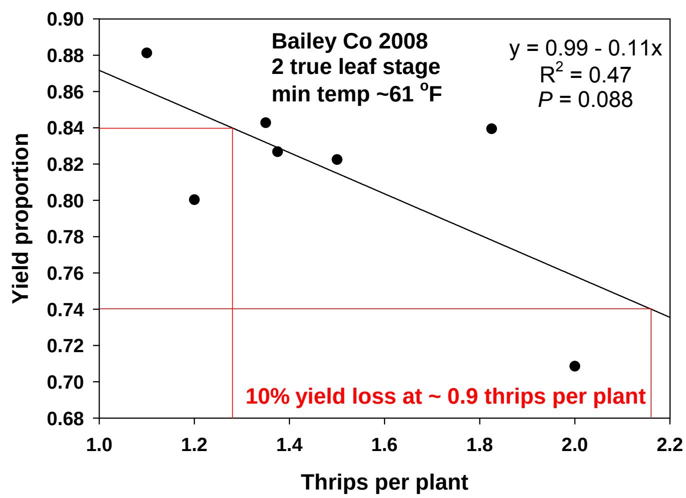


Figure 3. Relationship between thrips per plant and proportion of yield at the 2 true leaf stage under cool conditions in Moore (top) and Bailey (bottom) counties.

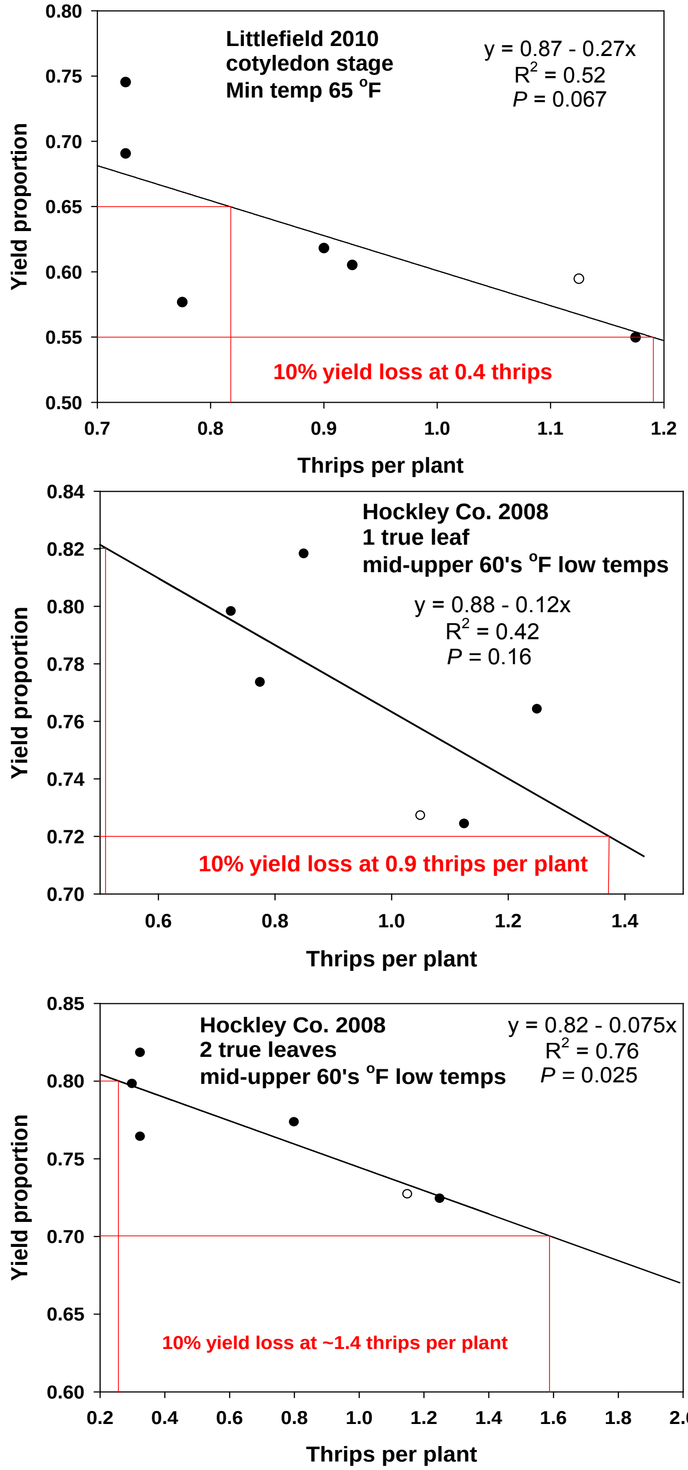


Figure 4. Relationship between thrips per plant and proportion of yield under warm conditions at the 1 true leaf stage (top), 2 true leaf stage (middle) and 3-4 true leaf stage (bottom).

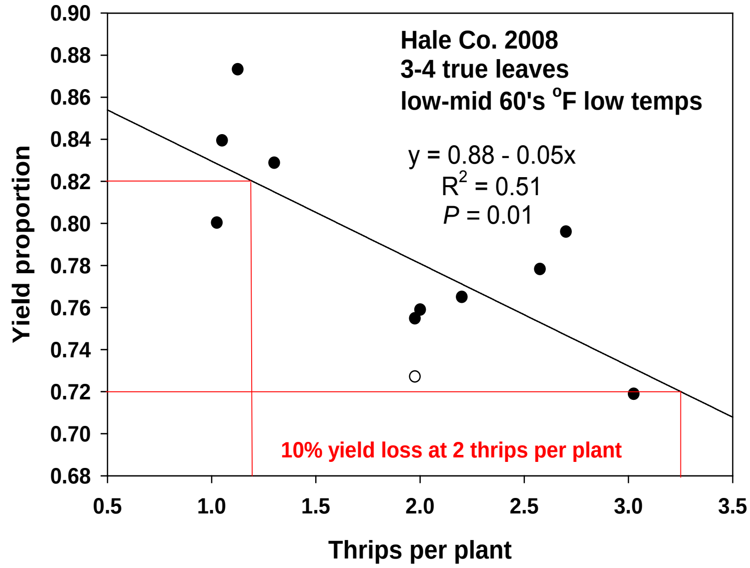


Figure 5. Relationship between thrips per plant and proportion of yield under warm conditions at the 3-4 true leaf stage.

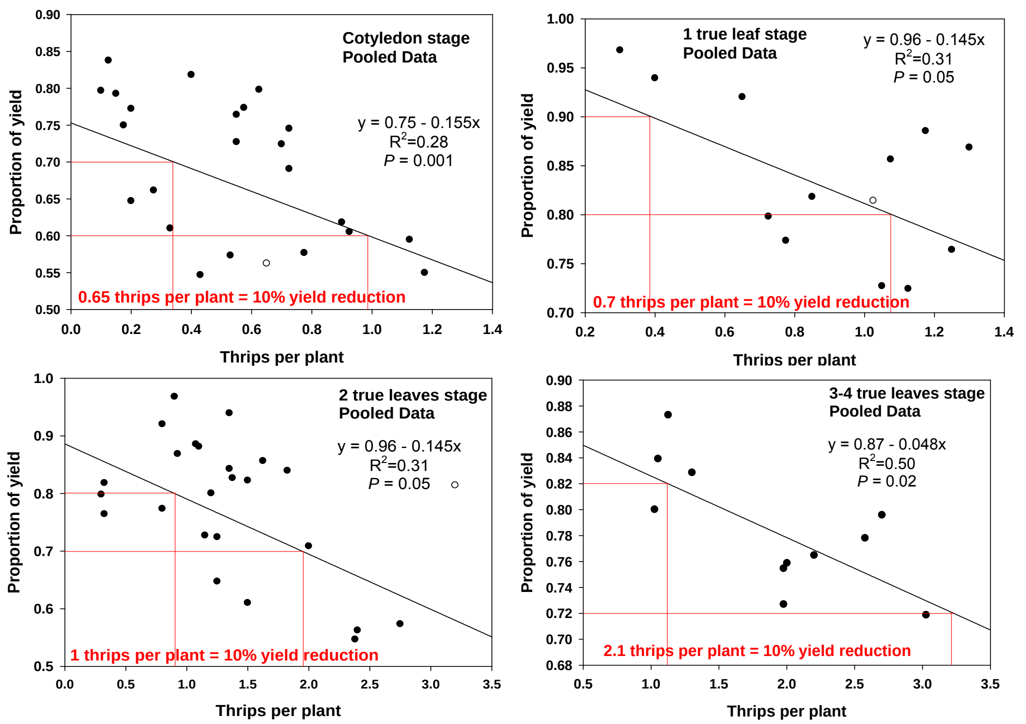


Figure 6. Relationship between thrips per plant and proportion of yield from pooled temperature data (cool and warm) at various stages of crop development.

Development of a Binomial Sampling Plan to Estimate Thrips Populations in Cotton to Aid in IPM Decision Making

Cooperators: Bryan Bentley, Tim Black, Robert Boozer, Chad Harris, Jerry and Aaron Vogler, Russell Halfmann, Rodney Gully

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Extension Entomologist-Cotton, Extension Entomologist-Cotton, EA-IPM Bailey/Parmer Counties, EA-IPM Glasscock/Reagan/Upton Counties, EA-IPM Lynn/Dawson Counties, EA-IPM Crosby/Floyd Counties, EA-IPM Terry/Yoakum Counties, EA-IPM Hockley/Cochran Counties, Extension Demonstration Technician-Cotton, Research Entomologist-Cotton

South Plains, High Plains, Permian Basin, Trans Pecos

Summary:

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. The binomial sample plan will be field tested in 2011.

Objective:

Objectives of this study are as follows: 1. Develop and compare enumerative and binomial sampling plans for estimating thrips densities in seedling cotton, 2. Evaluate to thrips sampling techniques (visual & cup), 3. Develop the most cost reliable sample plan and method for making thrips management decisions in seedling cotton.

Materials and Methods:

This study took place in a number of commercial cotton fields located across far west Texas and the Texas High Plains. Western flower thrips were sampled in each cotton field that was left untreated by foliar and/or preventative insecticides. Individual plants were examined for thrips from crop emergence to the five true leaf stage. 50 sampling bouts per field were conducted for each sampling method. Each sampling bout consisted of three plants.

Two sample plans (enumerative and binomial) and two methods (visual and 16oz plastic cup) were evaluated (Figure 1). Individual plants were removed from the soil by gently grasping the cotton stem at the soil line and pulling straight up. Then, the cotton plant was either subjected to the visual or cup sample method. Visual inspection was accomplished using a sharpened pencil to pry apart folded or creased leaf tissue to expose hidden thrips. Adults and nymphs were then counted and recorded. The cup method was employed by inserting the cotton plant into the cup and shaking vigorously for several seconds to dislodge any thrips into the cup. Adult and nymph thrips dislodged into the cup were counted, recorded and discarded.

Taylor's parameters were determined for thrips adult and nymph age classes and were pooled across age classes. Different age classes may have different spatial patterns, resulting in substantial differences in required sample number for estimating population densities. Sample data from both methods were used to determine the proportion of cotton leaves infested to mean thrips density (Wilson and Room 1983). The relationship of the mean and proportion of thrips infested cotton leaves was determined by:

$$P(I)=1-e^{-m[LN(amb-1)/(amb-1-1)]}$$

Where P(I)=the proportion of thrips infested leaves, a and b are parameters from Taylor's power law (1961) and m=the mean density at which a management decision is needed. Taylor's power law parameters were determined by iterative non-linear regression. Science based economic thresholds have not been established for thrips in cotton. Therefore, an empirically derived nominal threshold of 1 thrips per true cotton leaf was used in this study. The optimal sample size for estimating this threshold for enumerative and binomial sampling was determined using the following equations presented by Wilson et. al. (1983b).

Enumerative sampling: $n=t^2_\alpha*d^{-2}*amb^{-2}$; Binomial sampling: $n=t^2_\alpha*d^{-2}*q*p^{-1}$

Where n=sample size, t_α=standard normal variate, d=a fixed level of precision (defined as a proportion of the ratio of half the desired confidence interval to the mean). A and b are Taylor's coefficients, q=1-p and p=the proportion of thrips infested leaves.

A consideration of cost, expressed as time to collect the sample, is especially important in selecting sampling methods and plans for use in commercial field monitoring programs. Relative-cost reliability (Wilson 1994) is the ratio of the costs of two or more sampling methods and was computed as:

$$C_1/C_2 = n_1(T_1 + t_1)/n_2(T_2 + t_2)$$

Where C = cost per sample for each sample method or sample unit size, n = required number of samples needed to provide a density estimate with a specified level of precision, T = time required to collect a sample for each sample method or sample unit size and t = time to move from sample unit to sample unit. The time in seconds to move from one sample unit to the next was standardized at t = 15 sec. The visual sampling method employeed in Texas was used as the standard to which the other sample methods/plans were compared. Relative cost-reliability was used to select the optimum sample method and plan. The lowest relative cost reliability value represents the optimum sample method.

Results and Discussion:

Taylor's power law effectively modeled the mean/variance relationship for all thrips age classes and both sample methods (Table 1). Except for visual sampling of thrips nymphs, Taylor's a-coefficient was less than one for all thrips age classes and sample methods. This result is likely an artifact of curve fitting or random sample variability (Wilson 1994).

The effect of age class on thrips aggregation was evident for both sample methods. Higher values of Taylor's parameters for nymphs relative to adults, and the decrease in the proportion of immature thrips infested plants for a given mean, indicate that immature thrips exhibit a more aggregated spatial pattern relative to adult thrips (Table 1). This behavioral attribute was not unexpected, as immature thrips tend to hide in the terminals of the cotton plant and are less mobile than winged adults. Wilson and Room (1983a) reported similar findings for *Heliothis* spp. age classes.

The relationship between observed and estimated proportion of infested leaves was strong, with R^2 values in excess of 0.83 for both sample methods across all age classes. The estimated P(I) for the nominal economic threshold of one thrips per leaf was very similar between the two sample methods and thrips age classes (Table 2). Nevertheless, these slight differences resulted in significant differences in the required number of samples needed to estimate a mean thrips density of one thrips per leaf. As a means of simplification, the estimated P(I) was standardized across all cotton maturity stages. The cup sample method would require a maximum sample number of 28, compared to 31 for the visual. However, the time needed to take a sample for the binomial plans has yet to be calculated, so the most cost reliable sample method remains to be determined.

Regardless of sample method, the enumerative sample plans required a >56% increase in the number of samples needed to estimate the same density as the binomial sample plans (Table 3 and Figure 2). The average sample times for the enumerative sample plans were 79.1 and 43.6 seconds per sample for the visual and cup sample methods, respectively. Sample number requirements were similar for both sample methods, however, the cup sample method was more cost effective, with a relative efficiency of 0.55. Even though the cup sample method is more cost efficient when using enumerative sampling, the binomial sampling plan requires far fewer samples to make a management decision and will undoubtedly be much more cost effective.

Acknowledgments:

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Table 1. a and b of Taylor's power law and coefficient of determination.

Thrips age classes	a	b	R^2
Cup Sample Method			
Adult	0.6147	1.0760	0.92
Nymph	0.9389	1.3149	0.95
Pooled	0.7166	1.2205	0.89
Visual Sample Method			
Adult	0.6889	1.1291	0.96
Nymph	1.1608	1.4473	0.88
Pooled	0.9171	1.1569	0.86

Table 2. Relationship between proportion infested cotton leaves and a mean thrips density of one per cotton leaf.

	Proportion Infested (PI)	
Thrips age classes	Cup	Visual
Adult	0.73	0.72
Nymph	0.69	0.67
Pooled	0.72	0.67

Table 3. Required number of samples needed to estimate the nominal threshold of one thrips per cotton leaf.

	Enumerative Sampling		Binomial Sampling	
	Cup	Visual	Cup	Visual
Adult	47	43	26	25
Nymph	72	72	28	31
Combined	54	57	24	30

Figure 1. Visual sampling method (left) and cup sampling method (right).

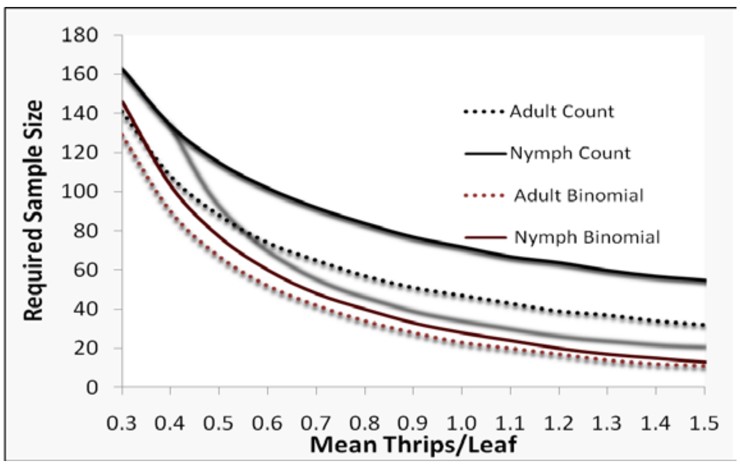

Figure 2. Sample size as a function of thrips mean density per cotton leaf (cup sample method).

Evaluation of Preventative Treatments and Foliar Over Sprays for Control of Thrips in Cotton in the High Plains Region of Texas, 2010 – Test A

Cooperators: Casey Kimbral, Grower

David Kerns and Bo Kesey
Extension Entomologist-Cotton and Extension Program Specialist-Cotton

Moore County

Summary:

The field where this test was conducted was subjected to extraordinarily heavy rainfall in 2010 which may have affected the performance of the foliar, soil and seed applied insecticides. Additionally, the thrips species composition was not as we expected. Most of the thrips surveys have suggested that western flower thrips makes up more than 90% of the population. Our data suggests that there may be a great deal more fluctuation in the thrips population year to years. In 2009, our test in Sunray was comprised of 100% western flower thrips, but in 2010 the dominate species was onion thrips (69%). In 2010, thrips control among the preventative treatments was similar until 24 days after planting. Among the preventative treatments Aeris was the only treatment with fewer adult and total thrips than the untreated, but all of the preventative treatment had less damage than the untreated. At 31 DAP, Avicita CC failed to differ from the untreated in total and adult thrips. Most of the thrips at this time were adults. There were no difference among preventative treatments in immature thrips, and Aeris did not differ from the untreated in damage. Plots treated with Orthene at the 3-4 TL stage, had fewer total and adult thrips than the 1-2 TL timed application, but did not differ from the untreated. All of the foliar timed sprays had fewer immature thrips than the untreated, indicating that they were inhibiting colonization. No differences were detected in plant height or leaf area, but a significant interaction in yield was detected between preventative and foliar applications. Temik appeared to benefit from the 3-4 TL timed foliar applications, while Avicta CC benefited from the 1-2 TL application. Foliar over sprays did not affect yield where Aeris or no preventative treatment was used.

Objective:

The objective of this study was to determine the benefits of using foliar oversprays behind preventative applications of Temik, Aeris and Avicta Complete Cotton.

Materials and Methods:

This test was conducted in a commercial cotton field near Sunray, TX. The field was planted on 24 May on 30-inch rows, and irrigated using pivot sprinkler irrigation. The experimental design was a 4 x 4 factorial with 4 replicates. Plots were 4-rows wide × 100 ft in length.

The main factors were the preventative treatments which included: 1) untreated, 2) Aeris 3) Avicta Complete Cotton and 3) Temik at 5 lbs-product/acre. Aeris and Avicta CC are seed treatments, while Temik was applied in-furrow at planting at approximately 1.5-inches in depth. The secondary factors were applications of foliar applied Orthene 97 at 3.0 oz-product/acre at: 1) untreated, 2) 1-2 true leaves (TL) stage, 3) 3-4 TL stage and 4) 1-2 and 3-4 TL stages. Foliar sprays were applied on a 50% band with a CO_2 pressurized hand-boom sprayer calibrated to deliver 10 gpa through Teejet XR8003VS extended range flat spray tip nozzles (1 per row) at 30 psi.

Beginning at the 1 TL stage, 5 plants per plot were collected into 1-pt jars containing 50% isopropyl alcohol. These samples were filtered and the thrips were counted using a stereo microscope. Adult thrips were collected from the non-Orthene treated plots and sent to Dr. Jack Reed, Mississippi State University for identification.

In addition to counting thrips, damage was assessed by subjectively rating each plot on a 1 to 5 scale where 1 = no damage, and 5 = extensive damage. Plant height and leaf area was estimated on 24 Jun. Ten plants per plot were collected and height was determined by measuring the distance from the cotyledons to the terminal. Leaf area was estimated using a leaf area indexer.

A 1/1000th acre portion was harvested from each plot using an HB hand stripper on 18 October, and ginned at the Texas AgriLife Research and Extension Center at Lubbock.

Data were analyzed with ANOVA, and means were separated using an F-protected LSD ($P \leq 0.05$).

Results and Discussion:

For many years surveys have indicated the western flower thrips, *Frankliniella occidentalis,* are by far the most common species of thrips infesting cotton on the Texas High Plains. Most of the thrips surveys have suggested that western flower thrips makes up more than 90% of the population. Our data suggests that there may be a great deal more fluctuation in the thrips population year to years. In 2009, our test in Sunray was comprised of 100% western flower thrips, but in 2010 the dominate species was onion thrips, *Thrips tabaci* (Figure 1). This fluctuation in thrips species composition may explain in part why we see better control out of our seed treatment some years relative to others. In general, western flower thrips are considered much more difficult to control than onion thrips.

At 10 days after planting (DAP) and prior to foliar applications, no immature thrips were collected (Table 1). All of the preventative treatments contained fewer adult thrips than the untreated.

At 17 DAP and prior to foliar applications, colonization by thrips was evident by the presence of immatures. All of the preventative treatments had fewer thrips and less damage than the untreated, and Temik contained fewer adults than Avicta CC and Aeris. Temik also had less damage than Avitca CC.

At 24 DAP and 7 DAT (1-2 TL timed application), there were no differences among the foliar applications and the untreated (Table 2). A significant interaction for immature thrips between preventative and foliar applications was detected on 17 Jun. However, the number of immature thrips was very low and the meaning of this interaction is questionable. Among the preventative treatments Aeris was the only treatment with fewer adult and total thrips than the untreated, but all of the preventative treatment had less damage than the untreated (Table 2).

At 31 DAP, and 7 DAT (3-4 TL timed application), Avicita CC failed to differ from the untreated in total and adult thrips. Most of the thrips at this time were adults. There were no difference among preventative treatments in immature thrips, and Aeris did not differ from the untreated in damage. Plots treated at the 3-4 TL stage, had fewer total and adult thrips than the 1-2 TL timed application, but did not differ from the untreated. All of the foliar timed sprays had fewer immature thrips than the untreated, indicating that they were inhibiting colonization.

No differences were detected in plant height or leaf area, but a significant interaction in yield was detected between preventative and foliar applications (Table 3). Temik appeared to benefit from the 3-4 TL timed foliar applications, while Avicta CC benefited from the 1-2 TL application (Table 4). Foliar over sprays did not affect yield where Aeris or no preventative treatment was used.

Acknowledgments:

Appreciation is expressed to National Cotton Council and the Plains Cotton Improvement Program for financial support of this project.

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Table 1.

Treatment/ formualtion[c]	3 Jun cotyledon stage (10 DAP & pre-foliar)[a]				10 Jun 2 true leaves stage (17 DAP & pre-foliar 1)[a]			
	No. thrips per 5 plants			Damage rating (1-5)	No. thrips per 5 plants			Damage rating (1-5)
	adults	immatures	total		adults	immatures	total	
Factor A								
Temik 15G	0.69 b	0.00 a	0.69 b	1.00 a	6.94 c	0.44 b	7.38 b	1.44 b
Avicta CC	0.25 b	0.00 a	0.25 b	1.00 a	11.88 b	0.63 b	12.50 b	1.00 c
Aeris	0.19 b	0.00 a	0.19 b	1.00 a	13.50 b	0.69 b	14.19 b	1.19 bc
Untreated	3.00 a	0.00 a	3.00 a	1.00 a	24.50 a	13.13 a	37.63 a	2.75 a
Factor B								
1-2 TL	1.19 a	0.00 a	1.19 a	1.00 a	13.56 a	4.13 a	17.69 a	1.63 a
3-4 TL	1.50 a	0.00 a	1.50 a	1.00 a	15.31 a	3.69 a	19.00 a	1.56 a
1-2 & 3-4 TL	0.81 a	0.00 a	0.81 a	1.00 a	12.69 a	3.94 a	16.63 a	1.56 a
Untreated	0.63 a	0.00 a	0.63 a	1.00 a	15.25 a	3.13 a	18.38 a	1.63 a
A*B interaction	ns	ns	ns	ns	ns	ns	ns	ns

Means in a column within a factor followed by the same letter are not significantly different based on an F protected LSD ($P \geq 0.05$).
[a]DAP = days after planting; DAAP = days after foliar application.
[b]Avicta Complete Cotton is a mixture of Avicta 500FS at 0.15 mg(AI)/seed, Cruiser 5FS at 0.34 mg(AI)/seed, and Dynasty CST 125FS at 0.03 mg(AI)/seed; Aeris is a mixture of Gaucho Grande 5FS at 0.375 mg(AI)/seed and thiodicarb at 0.375 mg(AI)/seed; Avicta CC and Aeris were applied as a seed treatments; Temik was applied in-furrow at planting at 5 lbs-product per acre; foliar treatments consisted of Orthene 97 at 3 oz-product per acre.

Table 2.

Treatment/ formualtion[c]	17 Jun 3 true leaves stage (24 DAP & 7 DAAP 1)[a]				24 Jun 6 true leaves stage (31 DAP & 7 DAAP 2)[a]			
	No. thrips per 5 plants				No. thrips per 5 plants			
	adults	immatures	total	Damage rating (1-5)	adults	immatures	total	Damage rating (1-5)
Factor A								
Temik 15G	2.13 a	0.13 a	2.25 a	1.69 b	3.44 ab	0.50 a	3.94 b	1.50 b
Avicta CC	1.81 a	0.06 a	1.88 a	1.50 b	7.44 a	0.88 a	8.31 a	1.56 b
Aeris	0.75 b	0.00 a	0.75 b	1.31 b	6.06 ab	0.31 a	6.38 ab	2.19 a
Untreated	2.32 a	0.13 a	2.44 a	3.25 a	6.63 a	0.69 a	7.31 a	2.31 a
Factor B								
1-2 TL	1.63 a	0.19 a	1.81 a	2.06 a	8.31 a	0.38 b	8.69 a	1.81 a
3-4 TL	2.13 a	0.00 a	2.13 a	2.06 a	4.19 b	0.25 b	4.44 b	1.88 a
1-2 & 3-4 TL	1.25 a	0.00 a	1.25 a	1.75 a	5.06 b	0.31 b	5.38 b	1.69 a
Untreated	2.00 a	2.13 a	2.13 a	1.90 a	6.00 ab	1.44 a	7.44 ab	2.19 a
A*B interaction	ns	*P* = 0.02[c]	ns	ns	ns	ns	ns	ns

Means in a column within a factor followed by the same letter are not significantly different based on an F protected LSD ($P \geq 0.05$).
[a]DAP = days after planting; DAAP = days after foliar application.
[b]Avicta Complete Cotton is a mixture of Avicta 500FS at 0.15 mg(AI)/seed, Cruiser 5FS at 0.34 mg(AI)/seed, and Dynasty CST 125FS at 0.03 mg(AI)/seed; Aeris is a mixture of Gaucho Grande 5FS at 0.375 mg(AI)/seed and thiodicarb at 0.375 mg(AI)/seed; Avicta CC and Aeris were applied as a seed treatments; Temik was applied in-furrow at planting at 5 lbs-product per acre; foliar treatments consisted of Orthene 97 at 3 oz-product per acre.
[c]See Table 4 for interaction.

Table 3.

	24 Jun 6 true leaves stage (31 DAP & 7 DAAP 2)[a]		18 Oct
Treatment/ formualtion[c]	Leaf area (cm^2)	Height (cm)	Yield (lint-lbs/acre)
Factor A			
Temik 15G	76.18 a	7.07 a	820.58 a
Avicta CC	82.12 a	7.44 a	859.61 a
Aeris	87.23 a	7.44 a	782.12 a
Untreated	75.86 a	6.88 a	758.59 a
Factor B			
1-2 TL	84.40 a	7.48 a	839.26 a
3-4 TL	86.07 a	7.26 a	860.80 a
1-2 & 3-4 TL	77.52 a	7.03 a	788.03 a
Untreated	73.39 a	7.07 a	732.81 a
A*B interaction	ns	ns	$P = 0.05$ [c]

Means in a column within a factor followed by the same letter are not significantly different based on an F protected LSD ($P \geq 0.05$).
[a]DAP = days after planting; DAAP = days after foliar application.
[b]Avicta Complete Cotton is a mixture of Avicta 500FS at 0.15 mg(AI)/seed, Cruiser 5FS at 0.34 mg(AI)/seed, and Dynasty CST 125FS at 0.03 mg(AI)/seed; Aeris is a mixture of Gaucho Grande 5FS at 0.375 mg(AI)/seed and thiodicarb at 0.375 mg(AI)/seed; Avicta CC and Aeris were applied as a seed treatments; Temik was applied in-furrow at planting at 5 lbs-product per acre; foliar treatments consisted of Orthene 97 at 3 oz-product per acre.
[c]See Table 4 for interaction.

Table 4.

Treatment/formualtion[a]	18 Oct – Yield lint (lbs/acre) Foliar application timing			
In-furrow & seed treatments	1-2 TL	3-4 TL	1-2 & 3-4 TL	untreated
Temik 15G	816.48 bcd	895.53 abc	895.13 abc	675.18 d
Avicta CC	1083.45 a	781.45 bcd	753.78 bcd	819.78 bcd
Aeris	724.98 bcd	928.00 ab	742.03 bcd	733.48 bcd
Untreated	732.14 bcd	838.23 bcd	761.20 bcd	702.80 cd

Means within the table followed by the same letter are not significantly different based on an F protected LSD ($P \geq 0.05$).

[a]Avicta Complete Cotton is a mixture of Avicta 500FS at 0.15 mg(AI)/seed, Cruiser 5FS at 0.34 mg(AI)/seed, and Dynasty CST 125FS at 0.03 mg(AI)/seed; Aeris is a mixture of Gaucho Grande 5FS at 0.375 mg(AI)/seed and thiodicarb at 0.375 mg(AI)/seed; Avicta CC and Aeris were applied as a seed treatments; Temik was applied in-furrow at planting at 5 lbs-product per acre; foliar treatments consisted of Orthene 97 at 3 oz-product per acre.

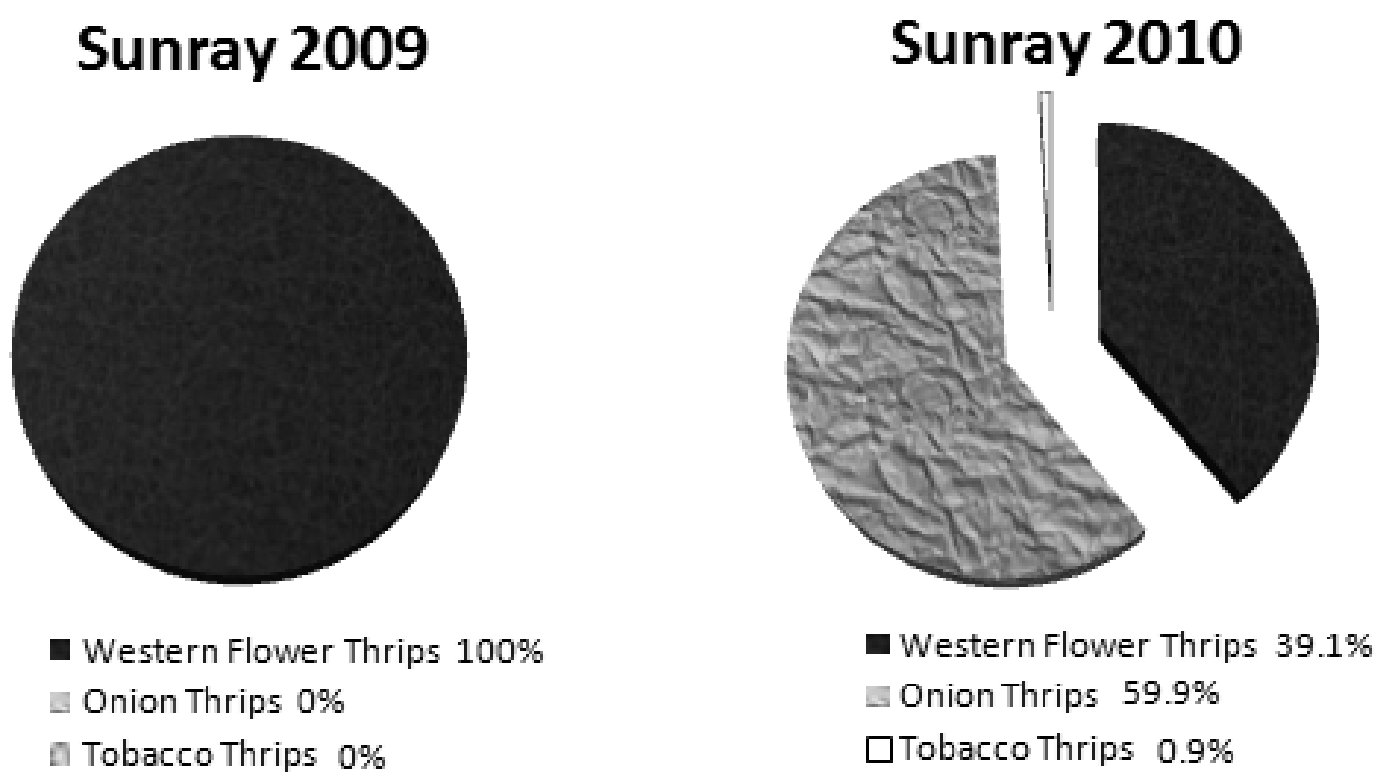

Figure 1. Proportion of thrips species in area in 2009-10.

Evaluation of Preventative Treatments and Foliar Over Sprays for Control of Thrips in Cotton in the High Plains Region of Texas 2010 – Test B

Cooperators: Robert Boozer, Grower

David Kerns, Bo Kesey
Extension Entomologist-Cotton, Extension Program Specialist-Cotton

High Plains

Summary:

Previous thrips species surveys have suggested that more than 90% of the thrips infesting cotton on the Texas High Plains are western flower thrips. In 2009, our test in Dimmitt was comprised of 78% western flower thrips and 22% onion thrips. In 2010 the dominate species was onion thrips, making up 65% of the population while 34% was western flower thrips. At 19 DAP and prior to foliar applications, Temik had the fewer adult thrips than Avicta CC, but did not differ from the untreated or Aeris. Neither Avicta CC nor Aeris appeared to offer protection by 19 DAP. All of the preventative treatments had slightly less damage than the untreated. Neither Avicta CC nor Aeris appeared to offer protection by 19 DAP. By 25 and 31 DAP, there were no differences in thrips among the preventative treatments and the untreated, suggesting that by 25 DAP Temik had also lost its residual efficacy. Foliar application did appear to offer protection from thrips where preventative protection had failed. Based on damage ratings, Temik benefited only when foliar over sprays were applied at both the 1-2 and 3-4 TL stages. Avicta CC and where no preventative applications were used had less damage when foliar applications occurred at the 1-2 TL stage. Aeris suffered less damage with all foliar applications relative to no foliar over sprays. There were no differences in leaf area or height among treatments and a significant interaction was detected in yield between the preventative and foliar applications. Neither Temik nor Aeris benefited in yield from over sprays of Orthene. For unknown reasons, yields were significantly lower where Avicta CC was over sprayed at the 1-2 TL stage relative to the untreated. Yield where there was no preventative treatment was greatest when Orthene was timed at the 1-2 TL stage. Where treated only at the 3-4 TL stage, the yield did not differ from the untreated.

Objective:

The objective of this study was to determine the benefits of using foliar oversprays behind preventative applications of Temik, Aeris and Avicta Complete Cotton.

Materials and Methods:

This test was conducted in a commercial cotton field near Dimmitt, TX. The field was planted on 21 May on 40-inch rows, and irrigated using pivot sprinkler irrigation. The experimental design was a 4 x 4 factorial with 4 replicates. Plots were 4-rows wide × 100 ft in length.

The main factors were the preventative treatments which included: 1) untreated, 2) Aeris 3) Avicta Complete Cotton and 3) Temik at 5 lbs-product/acre. Aeris and Avicta CC are seed treatments, while Temik was applied in-furrow at planting at approximately 1.5-inches in depth. The secondary factors were applications of foliar applied Orthene 97 at 3.0 oz-product/acre at: 1) untreated, 2) 1-2 true leaves (TL) stage, 3) 3-4 TL stage and 4) 1-2 and 3-4 TL stages. Foliar sprays were applied on a 50% band with a CO_2 pressurized hand-boom sprayer calibrated to deliver 10 gpa through Teejet XR8003VS extended range flat spray tip nozzles (1 per row) at 30 psi.

Beginning at the 1 TL stage, 5 plants per plot were collected into 1-pt jars containing 50% isopropyl alcohol. These samples were filtered and the thrips were counted using a stereo microscope. These samples were filtered and the thrips were counted using a stereo microscope. Adult thrips were collected from the non-Orthene treated plots and sent to Dr. Jack Reed, Mississippi State University for identification.

In addition to counting thrips, damage was assessed by subjectively rating each plot on a 1 to 5 scale where 1 = no damage, and 5 = extensive damage. Plant height and leaf area was estimated on 24 Jun. Ten plants per plot were collected and height was determined by measuring the distance from the cotyledons to the terminal. Leaf area was estimated using a leaf area indexer.

A 1/1000th acre portion was harvested from each plot using an HB hand stripper on 9 November, and ginned at the Texas AgriLife Research and Extension Center at Lubbock.

Data were analyzed with ANOVA, and means were separated using an F-protected LSD ($P \leq 0.05$).

Results and Discussion:

For many years surveys have indicated the western flower thrips, *Frankliniella occidentalis,* are by far the most common species of thrips infesting cotton on the Texas High Plains. Most of the thrips surveys have suggested that western flower thrips makes up more than 90% of the population. Our data suggests that there may be a great deal more fluctuation in the thrips population year to years. In 2009, our test in Dimmitt was comprised of 78% western flower thrips and 22%

onion thrips, *Thrips tabaci* (Figure 1). In 2010 the dominate species was onion thrips, making up 65% of the population while 34% was western flower thrips.

At 12 days after planting (DAP) and prior to foliar applications, no immature thrips were collected and there were no significant differences for thrips among any of the treatments (Table 1).

At 19 DAP and prior to foliar applications, Temik had the fewer adult thrips than Avicta CC, but did not differ from the untreated or Aeris. Neither Avicta CC nor Aeris appeared to offer protection by 19 DAP. All of the preventative treatments had slightly less damage than the untreated.

At 25 and 31 DAP, there were no differences in thrips among the preventative treatments and the untreated, suggesting that by 25 DAP Temik had also lost its residual efficacy (Table 2).

At 25 DAP, all of the preventative treatments had less damage than the untreated, and Temik has less damage than Avicta CC and Aeris. Results for damage were similar at 31 DAP, but Aeris did not differ from Temik at that time.

At 6 DAT, foliar application 1, all of the foliar treatments contained fewer thrips than the untreated, although the 3-4 TL application had not been applied. However, damage was slightly reduced where Orthene had been applied. At 7 DAT, foliar application 2, there were fewer total thrips where the most recent application of Orthene were applied relative to the untreated. Damage at this time was least where the 1-2 TL foliar applications occurred. A significant interaction for damage between preventative and foliar applications was detected on 22 Jun. Based on damage ratings, Temik benefited only when foliar over sprays were applied at both the 1-2 and 3-4 TL stages (Table 4). Avicta CC and where no preventative applications were used had less damage when foliar applications occurred at the 1-2 TL stage. Aeris suffered less damage with all foliar applications relative to no foliar over sprays.

There were no differences in leaf area or height among treatments and a significant interaction was detected in yield between the preventative and foliar applications (Table 3).

Neither Temik nor Aeris benefited in yield from over sprays of Orthene (Table 5). For unknown reasons, yields were significantly lower where Avicta CC was over sprayed at the 1-2 TL stage relative to the untreated. Yield where there was no preventative treatment was greatest when Orthene was timed at the 1-2 TL stage. Where treated only at the 3-4 TL stage, the yield did not differ from the untreated.

Acknowledgments:

Appreciation is expressed to National Cotton Council and the Plains Cotton Improvement Program for financial support of this project.

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Table 1.

	2 Jun cotyledon stage (12 DAP & pre-foliar)[a]				9 Jun 2 true leaves stage (19 DAP & pre-foliar)[a]			
	No. thrips per 5 plants			Damage rating (1-5)	No. thrips per 5 plants			Damage rating (1-5)
Treatment/ formualtion[c]	adults	immatures	total		adults	immatures	total	
Factor A								
Temik 15G	2.56 a	0.00 a	2.56 a	1.00 a	5.38 b	2.63 a	8.00 a	1.06 b
Avicta CC	1.25 a	0.00 a	1.25 a	1.00 a	11.81 a	1.38 a	13.19 a	1.00 b
Aeris	2.81 a	0.00 a	2.81 a	1.00 a	9.06 ab	1.13 a	10.19 a	1.00 b
Untreated	2.63 a	0.00 a	2.63 a	1.00 a	7.69 ab	4.06 a	11.75 a	1.75 a
Factor B								
1-2 TL	1.88 a	0.00 a	1.88 a	1.00 a	7.06 a	1.81 a	8.88 a	1.19 a
3-4 TL	2.99 a	0.00 a	2.99 a	1.00 a	8.00 a	2.19 a	10.19 a	1.19 a
1-2 & 3-4 TL	2.38 a	0.00 a	2.38 a	1.00 a	0.75 a	1.44 a	10.19 a	1.25 a
Untreated	2.31 a	0.00 a	2.31 a	1.00 a	10.13 a	3.75 a	13.88 a	1.19 a
A*B interaction	ns	ns	ns	ns	ns	ns	ns	ns

Means in a column within a factor followed by the same letter are not significantly different based on an F protected LSD ($P \geq 0.05$).

[a]DAP = days after planting; DAAP = days after foliar application.

[b]Avicta Complete Cotton is a mixture of Avicta 500FS at 0.15 mg(AI)/seed, Cruiser 5FS at 0.34 mg(AI)/seed, and Dynasty CST 125FS at 0.03 mg(AI)/seed; Aeris is a mixture of Gaucho Grande 5FS at 0.375 mg(AI)/seed and thiodicarb at 0.375 mg(AI)/seed; Avicta CC and Aeris were applied as a seed treatments; Temik was applied in-furrow at planting at 5 lbs-product per acre; foliar treatments consisted of Orthene 97 at 3 oz-product per acre.

Table 2.

Treatment/ formualtion[c]	15 Jun 3 true leaves stage (25 DAP & 6 DAAP 1)[a]				22 Jun 6 true leaves stage (31 DAP & 7 DAAP 2)[a]			
	No. thrips per 5 plants			Damage rating (1-5)	No. thrips per 5 plants			Damage rating (1-5)
	adults	immatures	total		adults	immatures	total	
Factor A								
Temik 15G	14.44 a	3.19 a	17.63 a	1.00 c	3.00 a	1.00 a	4.00 a	1.13 c
Avicta CC	15.06 a	3.63 a	18.69 a	1.38 b	2.50 a	0.69 a	3.19 a	1.50 b
Aeris	18.81 a	3.81 a	22.63 a	1.31 b	2.44 a	2.19 a	4.63 a	1.31 bc
Untreated	15.69 a	4.81 a	20.05 a	1.81 a	3.38 a	1.50 a	4.88 a	1.94 a
Factor B								
1-2 TL	15.19 b	2.38 b	17.56 b	1.25 b	2.94 a	1.06 b	4.00ab	1.06 b
3-4 TL	13.50 bc	3.31 b	16.81 b	1.56 a	2.25 a	0.25 b	2.50 b	1.69 a
1-2 & 3-4 TL	14.44 bc	1.94 b	16.38 b	1.13 b	3.13 a	0.75 b	3.88 b	1.25 b
Untreated	20.88 a	7.81 a	26.69 a	1.56 a	3.00 a	3.31 a	6.31 a	1.88 a
A*B interaction	ns	ns	ns	ns	ns	ns	ns	$P = 0.003$

Means in a column within a factor followed by the same letter are not significantly different based on an F protected LSD ($P \geq 0.05$).
[a]DAP = days after planting; DAAP = days after foliar application.
[b]Avicta Complete Cotton is a mixture of Avicta 500FS at 0.15 mg(AI)/seed, Cruiser 5FS at 0.34 mg(AI)/seed, and Dynasty CST 125FS at 0.03 mg(AI)/seed; Aeris is a mixture of Gaucho Grande 5FS at 0.375 mg(AI)/seed and thiodicarb at 0.375 mg(AI)/seed; Avicta CC and Aeris were applied as a seed treatments; Temik was applied in-furrow at planting at 5 lbs-product per acre; foliar treatments consisted of Orthene 97 at 3 oz-product per acre.
[c]See Table 4 for interaction.

Table 3.

	24 Jun 5 true leaves stage (31 DAP & 14 DAAP 2)[a]		9 Nov
Treatment/ formualtion[c]	Leaf area (cm^2)	Height (cm)	Yield (lint-lbs/acre)
Factor A			
Temik 15G	88.44 a	9.36 a	773.75 a
Avicta CC	95.39 a	9.18 a	778.35 a
Aeris	85.95 a	9.08 a	792.77 a
Untreated	87.31 a	9.43 a	798.40 a
Factor B			
1-2 TL	92.54 a	9.15 b	747.99 b
3-4 TL	89.93 a	9.83 a	745.95 b
1-2 & 3-4 TL	91.50 a	9.11 b	858.97 a
Untreated	83.11 a	8.96 b	790.37 ab
A*B interaction	ns	ns	$P = 0.05$

Means in a column within a factor followed by the same letter are not significantly different based on an F protected LSD ($P \geq 0.05$).

[a]DAP = days after planting; DAAP = days after foliar application.

[b]Avicta Complete Cotton is a mixture of Avicta 500FS at 0.15 mg(AI)/seed, Cruiser 5FS at 0.34 mg(AI)/seed, and Dynasty CST 125FS at 0.03 mg(AI)/seed; Aeris is a mixture of Gaucho Grande 5FS at 0.375 mg(AI)/seed and thiodicarb at 0.375 mg(AI)/seed; Avicta CC and Aeris were applied as a seed treatments; Temik was applied in-furrow at planting at 5 lbs-product per acre; foliar treatments consisted of Orthene 97 at 3 oz-product per acre.

[c]See Table 5 for interaction.

Table 4.

Treatment/formualtion[a]	22 Jun – Damage rating (1-5) Foliar application timing			
In-furrow & seed treatments	1-2 TL	3-4 TL	1-2 & 3-4 TL	untreated
Temik 15G	1.00 e	1.00 e	1.50 cd	1.00 e
Avicta CC	1.00 e	2.00 b	1.00 e	2.00 b
Aeris	1.00 e	1.50 cd	1.00 e	1.75 c
Untreated	1.25 de	2.25 b	1.50 cd	2.75 a

Means within the table followed by the same letter are not significantly different based on an F protected LSD ($P \geq 0.05$).
[a]Avicta Complete Cotton is a mixture of Avicta 500FS at 0.15 mg(AI)/seed, Cruiser 5FS at 0.34 mg(AI)/seed, and Dynasty CST 125FS at 0.03 mg(AI)/seed; Aeris is a mixture of Gaucho Grande 5FS at 0.375 mg(AI)/seed and thiodicarb at 0.375 mg(AI)/seed; Avicta CC and Aeris were applied as a seed treatments; Temik was applied in-furrow at planting at 5 lbs-product per acre; foliar treatments consisted of Orthene 97 at 3 oz-product per acre.

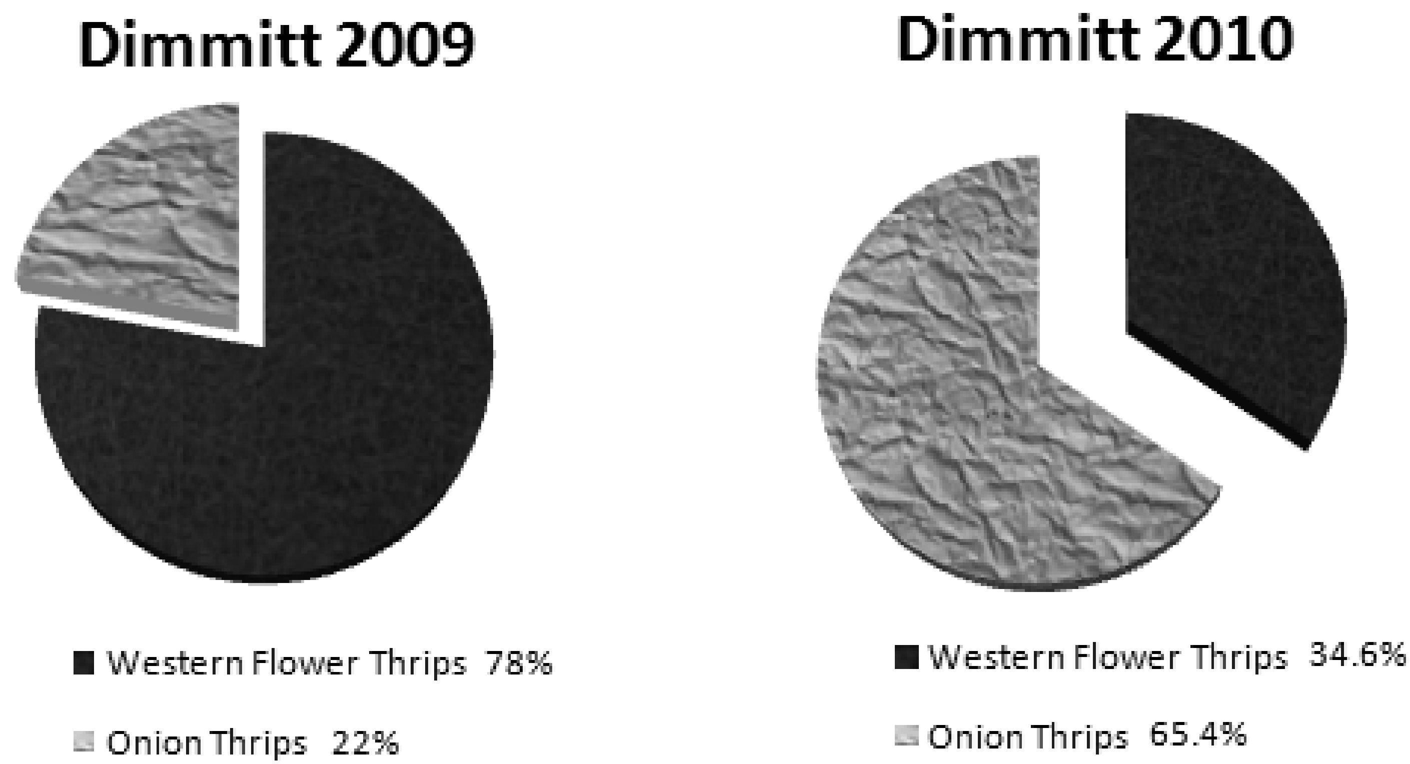

Figure 1. Proportion of thrips species in area in 2009-10.

Evaluation of Poncho as a Potential New Seed Treatment for Control of Thrips in Cotton, 2010

Cooperators: Texas AgriLife Research Center – Halfway

David Kerns and Scott Adair
Extension Entomologist-Cotton and CEA Hale County

Hale County

Summary:

Poncho (clothiadan) is a neonicotinoid insecticide with potential for thrips control in cotton. It is currently being evaluated when mixed with the nematicide Votivo and was compared to and combined with a standard seed treatment, Aeris. All of the treatments had significantly fewer immature thrips than the untreated at 25 days after planting (cotyledon stage), while only those treatments containing Aeris had fewer adult thrips than the untreated. Aeris + Poncho/Votivo had the lowest total number of thrips, but did not differ from the other treatments containing Aeris. All of the treatments appeared to have lost efficacy at 32 days after plants (2 true leaf cotton). Based on damage ratings at 32 days after planting, although all of the treatments had less damage than the untreated, those containing Aeris tended to be least damaged. Based on these limited data, Poncho does not appear to be as effective as Aeris.

Objective:

The objective of this study was to evaluate the efficacy of Poncho/Votivo seed treatment towards western flower thrips.

Materials and Methods:

This test was conducted at the Texas AgriLife Halfway Research Station. The field was planted on 7 May on 40-inch rows, and irrigated using pivot sprinkler irrigation. The test was a RCB design with four replications. Plots were 4-rows wide × 100 ft in length.

All the treatments evaluated were seed treatments. Aeris (Gaucho Grande +

thiodicard) was used as the standard seed treatment. Poncho (clothiadin) was evaluated at several rates combined with Votivo (nematicide). This combination was also combined with Gaucho Grande and Aeris.

Adult and immature thrips were sampled by visually inspecting 10 whole plants per plot. Samples were taken on 1 and 8 Jun. The predominate thrips species in this test was western flower thrips, *Frankliniella occidentalis* (Pergande).

Plant damage was visually assessed on 8 Jun using a 1-5 damage rating scale where 1 = no damage and 5 = extensive damage.

Data were analyzed using ANOVA and the means were separated with an F protected LSD ($P \geq 0.05$).

Results and Discussion:

This test was conducted under very cool conditions and heavy rainfall, which compromised the stand. Additionally, this test received hail at 3 true leaves which further reduced the stand to where it was no longer usable.

On 1 Jun, 25 days after planting (DAP), the untreated check contained 2.38 thrips per plant at the cotyledon stage, which exceeds the action threshold of 1 thrips per plant. All treatments at this time had significantly fewer immature thrips than the untreated, while only those treatments containing Aeris had fewer adult thrips than the untreated. Aeris + Poncho/Votivo had the lowest total number of thrips, but did not differ from the other treatments containing Aeris.

On 8 Jun, 32 DAP, there were no significant differences among any treatments and thrips were averaging more than 2 per plant across treatments. This suggests that by 32 DAP, all of the treatments had lost efficacy.

Based on damage ratings at 32 DAP, although all of the treatments had less damage than the untreated, those containing Aeris tended to be least damaged.

Acknowledgments:

Appreciation is expressed to Bayer CropScience and the Plains Cotton Improvement Program for financial support of this project.

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Table 1.

Treatment/formulation[b]	Rate amt product/100 lbs seed	1 Jun – cotyledon stage (25 DAP) Thrips per plant: immatures	adults	total	8 Jun – 2 true leaf stage (32 DAP) Thrips per plant: immatures	adults	total	Damage rating (1-5)
Aeris	--[a]	0.075c	0.50de	0.58cd	0.38a	2.28a	2.65a	2.00d
Poncho/Votivo	6.35 fl-oz	0.65b	1.50a	2.15ab	0.33a	2.65a	2.98a	3.00b
Poncho/Votivo	12.7 fl-oz	0.40bc	1.43ab	1.83ab	0.23a	1.20a	1.43a	2.75b
Aeris + Votivo 240 FS	--[a] + 7.0 fl-oz	0.20c	0.78cde	0.98cd	0.25a	1.75a	2.00a	2.13cd
Aeris + Poncho/Votivo	--[a] + 6.35 fl-oz	0.15c	0.40e	0.55d	0.13a	1.98a	2.10a	2.00d
Poncho/Votivo + Gaucho Grande 5FS	12.7 fl-oz + 6.39 fl-oz	0.40bc	0.98bcd	1.38bc	0.60a	2.05a	2.65a	2.63bc
Untreated	--	1.35a	1.03abc	2.38a	0.43a	2.55a	2.98a	4.00a

Values in a column followed by the same letter are not different based an F protected LSD ($P \geq 0.05$).

[a]Aeris is a mixture of Gaucho Grande 5FS at 0.375 mg(AI)/seed and thiodicarb at 0.375 mg(AI)/seed.

[b]All treatments included Seed Slik Talc at 3.04 oz and Trilex Advanced FS 300 at 1.6 fl-oz per 100 lbs of seed.

Evaluation of Aldicarb Formulations for Control of Western Flower Thrips in Cotton

Cooperators: Steve Bell, Grower

David Kerns and Monti Vandiver
Extension Entomologist-Cotton and EA-IPM Bailey/Parmer Counties

Bailey County

Summary:

Temik continues to be the premier preventative thrips control product for use in cotton. Although faced with eventual cancellation, all of the formulations evaluated performed similarly. Of all the aldicarb formulations, Temik and Aeris provided control for up to 21 days after planting. At 28 DAP, although the number of thrips had declined across the entire test, Aeris, SP1960, SP24526, SP22902 and SP24525 failed to differ from the untreated for immature thrips. This suggests that these treatments, particularly Aeris which had the highest number of immature thrips, may not provide as long of residual control as some of the other treatments. However, none of the treatments containing aldicarb differed from each other.

Objective:

The objective of this study was to evaluate the efficacy of various formulations of aldicarb to Temik and Aeris towards western flower thrips.

Materials and Methods:

This test was conducted in a commercial cotton field near Muleshoe, TX. The field was planted on 13 May on 30-inch rows, and irrigated using pivot sprinkler irrigation. The test was a RCB design with four replications. Plots were 4-rows wide × 100 ft in length. All the treatments evaluated were either in-furrow or seed treatments.

Adult and immature thrips were sampled by visually inspecting 10 whole plants per plot. Samples were taken on 27 May, and 3 and 10 Jun.

Yields were estimated on 9 November using a HB stripper, harvesting 1/1000 acre from the middle two rows of each plot.

Data were analyzed using ANOVA and the means were separated with an F protected LSD ($P \geq 0.05$).

Results and Discussion:

At 14 days after planting (DAP), no immature thrips were detected, and all of the insecticide treatments contained fewer adults than the untreated.

By 21 DAP, colonization as evident by immature thrips in the untreated was evident, and all of the insecticide treatments appeared to be providing effective control and did not differ from each other.

At 28 DAP, although the number of thrips had declined across the entire test, Aeris, SP1960, SP24526, SP22902 and SP24525 failed to differ from the untreated for immature thrips. This suggests that these treatments, particularly Aeris which had the highest number of immature thrips, may not provide as long of residual control as some of the other treatments. However, none of the treatments containing aldicarb differed from each other.

No differences were detected among treatments in yield (data not presented).

Acknowledgments:

Appreciation is expressed to Bayer CropScience and the Plains Cotton Improvement Program for financial support of this project.

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Table 1.

Treatment/ formulation[b]	Rate amt product/acre	27 May – cotyledon stage (14 DAP) Thrips per plant			3 Jun – 2 true leaf stage (21 DAP) Thrips per plant			10 Jun – 4 true leaf stage (28 DAP) Thrips per plant		
		immatures	adults	total	immatures	adults	total	immatures	adults	total
Untreated	--	0.00a	0.48a	0.48a	5.70a	1.33a	7.03a	0.75ab	1.15a	1.90a
Temik 15G	5 lbs	0.00a	0.00b	0.00b	0.00b	0.20b	0.20b	0.13c	1.05a	1.18a
Aeris	--[a]	0.00a	0.03b	0.03b	0.10b	0.28b	0.38b	1.08a	1.15a	2.23a
Temik 15G + Aeris	3.5 lbs + --[a]	0.00a	0.00b	0.00b	0.13b	0.35b	0.48b	0.13c	1.18a	1.30a
SP1960 15G (grit)	3.5 lbs	0.00a	0.03b	0.03b	0.00b	0.25b	0.25b	0.43bc	1.20a	1.63a
SP22907 15G (grit)	3.5 lbs	0.00a	0.03b	0.03b	0.05b	0.10b	0.15b	0.20c	1.00a	1.20a
SP24526 15G (grit)	3.5 lbs	0.00a	0.03b	0.03b	0.10b	0.40b	0.50b	0.35bc	1.38a	1.73a
SP24528 15G (grit)	3.5 lbs	0.00a	0.00b	0.00b	0.08b	0.23b	0.30b	0.13c	0.80a	0.93a
SP1926 15G (gypsum)	3.5 lbs	0.00a	0.13b	0.13b	0.00b	0.20b	0.20b	0.23c	0.83a	1.05a
SP22902 15G (gypsum)	3.5 lbs	0.00a	0.03b	0.03b	0.08b	0.33b	0.40b	0.35bc	0.88a	1.23a
SP24525 15G (gypsum)	3.5 lbs	0.00a	0.10b	0.10b	0.05b	0.28b	0.33b	0.30bc	0.95a	1.25a
SP24527 15G (gypsum)	3.5 lbs	0.00a	0.00b	0.00b	0.00b	0.30b	0.30b	0.20c	1.43a	1.63a

Values in a column followed by the same letter are not different based an F protected LSD ($P \geq 0.05$).
[a]Aeris is a mixture of Gaucho Grande 5FS at 0.375 mg(AI)/seed and thiodicarb at 0.375 mg(AI)/seed.
[b]grit = corn cob grit carrier, gypsum = gypsum carrier.

AgriLIFE EXTENSION
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Evaluation of Preventive Seed Treatments and Temik for Thrips, Root-knot Nematodes and Disease Control

Cooperators: AGCARES

David Kerns, Jason Woodward, Tommy Doederlein and Bo Kesey
Extension Entomologist-Cotton, Extension Plant Pathologist, EA-IPM Dawson/Lynn Counties, Extension Program Specialist-Cotton

Dawson County

Summary:

Temik continues to be the premier preventative thrips and nematode control product for use in cotton. In this study, Temik, Gaucho Grande, Crusier, Avicta Complete Cotton, Aeris and Gaucho Grande + Poncho all provides at least 18 days post emergence (DAE) control of thrips. The addition of Poncho/Votivo to Gaucho Grande did not appear to enhance thrips control over Gaucho Grande alone. Based on early damage ratings, Gaucho Grande alone may have offered slightly less protection from thrips but, based only on later damage ratings, it appeared that all treatments were losing effectiveness by 25 DAE. There were no differences among treatments in regard to nematode galls or seedling disease. Plots where no insecticides were used, and where Gaucho Grande was used alone, suffered the most from leafminers. Temik had the greatest leaf area, whereas plots that received no insecticide had the smallest leaf area. The insecticide-free plots did not differ from Aeris in terms of leaf area.

Objective:

The objective of this study was to evaluate Temik along with various seed treatments containing insecticides, nematicides and fungicides for thrips, disease and nematode control.

Materials and Methods:

This test was conducted at the Texas AgriLife AGCARES facility in Lamesa, TX. The field was planted on 5 May on 40-inch rows, and irrigated using pivot sprinkler irrigation. Originally, the test was setup as a factorial design using two varieties, DP

0935 B2RF and DP 1034 B2RF. However, the DP 1034 B2RF suffered very poor emergence. Although we are not certain, we think that we may have acquired a poor seed lot for this variety. Because of the poor emergence, we eliminated the DP 1034 B2RF from the analysis. Thus, the test was analyzed as a RCB design with four replications. Plots were 4-rows wide × 30 ft in length. All the treatments evaluated were either in-furrow or seed treatments (Table 1).

Insect sampling

Adult and immature thrips were sampled by visually inspecting 10 whole plants per plot. Samples were taken on 25 May, and 1 and 8 Jun. Vegetable leafminers were sampled on 8 June by counting the number of mines present on 10 plants. Thrips feeding damage was rated on a 0-9 modified Guthrie scale on 25 May and 8 June.

Nematode sampling

Nematodes were sampled by digging up 5 plants per plot and transporting them to the laboratory where the number of galls were counted. A single sample was taken on 16 June.

Disease sampling

Incidence of seedling disease was estimated based on plant stand. The number of plants were counted in the entire plot and converted to plants per acre. Stand counts occurred on 27 May.

Plant characteristics

Vigor was estimated on 25 May and 8 June using a 1-9 scale, where 1-3 is above average vigor, 4-6 is average vigor and 7-9 is below average vigor.

On 16 June, plant height was measured from 5 plants per plot by measuring the distance from the cotyledons to the plant terminal. Leaf area was also estimated at this time using the same plants and a LICOR leaf area indexer.

The plots were harvested on 10 October using a HB stripper, harvesting 1/1000 acre from the middle two rows of each plot. Yields were recorded.

Data were analyzed using ANOVA and the means were separated with an F protected LSD ($P \geq 0.10$).

Results and Discussion:

At 20 days after planting (DAP), or 11 days after emergence (DAE), almost no immature thrips were detected, and all of the treatments that contained insecticides had fewer adults than the untreated (treatment 6) (Table 1). Among the insecticides, Cruiser had the fewest total thrips but differed only from Gaucho Grande. At this time, damage was greater in the untreated than in any other treatment. Gaucho Grande alone, although damage was low, suffered more damage than the other insecticide treatments except Gaucho Grande + Poncho.

Thrips numbers were higher on 1 June (27 DAP, 18 DAE) (Table 2). At this time all of the treatments containing an insecticide had fewer immature, adult and total thrips than the untreated. Thus, it appears that all of the insecticide treatments offered at least 18 days post emergence control of thrips. The addition of Poncho to Gaucho Grande did not appear to enhance thrips control over Gaucho Grande alone.

On 8 June (34 DAP, 25 DAE) the cotton had reached the 4 true leaf stage and the thrips numbers had greatly diminished (Table 4). Because of the low number of thrips, differences among treatments could not be determined. Damage due to thrips had increased significantly, averaging 8 in the untreated. All of the insecticide treatments had less damage than the untreated but did not differ from each other. The fact that damage had increased in the insecticide treated plots suggests that all treatments were losing effectiveness by 25 DAE.

Leafminers were common in this test by 8 June (Table 4). Treatment 6 (the insecticide-free treatment) and Gaucho Grande alone had the highest number of mines, both averaging 2.53 mines per plant. Treatments with the fewest mines included Temik, Gaucho Grande + Poncho, Avicta CC and Crusier.

There were no differences among treatments in the number of root-knot nematode galls or plant height (Table 5). Differences were detected for leaf area which may have been due to thrips, leafminers, disease or nematodes. However, because nematodes and diseases do not appear to impact this study, most of this damage was likely due to thrips and leafminers. The Temik treatment had the greatest leaf area; significantly larger than any other treatment (Table 5). Treatment 6 (no insecticide) had the smallest leaf area but did not differ from Aeris. The remaining treatments were moderate in leaf area.

We detected no difference in yield among treatments (Table 5). However, this test received heavy hail and wind damage in late-June that destroyed a lot of the plant terminals. This made harvest difficult and may have masked yield differences due to pests.

Acknowledgments:

Appreciation is expressed to Monsanto Company for financial support of this project.

Disclaimer Clause:

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Table 1.

	Treatment	Pesticide classification	Rate
1	Diamir-C		0.02 mg-ai/seed
	Allegiance-FL		0.014 mg-ai/seed
	Trilex FL	Fungicide	0.01 mg-ai/seed
	Spera		0.025 mg-ai/seed
	MON 57401		0.001 mg-ai/seed
	Gaucho Grande	Insecticide	0.375 mg-ai/seed
2	Diamir-C		0.02 mg-ai/seed
	Allegiance-FL		0.014 mg-ai/seed
	Trilex FL	Fungicide	0.01 mg-ai/seed
	Spera		0.025 mg-ai/seed
	MON 57401		0.001 mg-ai/seed
	Gaucho Grande	Insecticide	0.375 mg-ai/seed
	Temik	Insecticide/Nematicide	5 lbs/ac
3	Diamir-C		0.02 mg-ai/seed
	Allegiance-FL		0.014 mg-ai/seed
	Trilex FL	Fungicide	0.01 mg-ai/seed
	Spera		0.025 mg-ai/seed
	MON 57401		0.001 mg-ai/seed
	Gaucho Grande	Insecticide	0.375 mg-ai/seed
	Poncho/Votivo	Insecticide/Nematicide	12.7 fl-oz/cwt
4	Diamir-C		0.02 mg-ai/seed
	Allegiance-FL		0.014 mg-ai/seed
	Trilex FL	Fungicide	0.01 mg-ai/seed
	Spera		0.025 mg-ai/seed
	MON 57401		0.001 mg-ai/seed
	Aeris[a]	Insecticide/Nematicide	0.75 mg-ai/seed
5	Avicta Complete Cotton[a]	Fungicide/Insecticide/Nematicide	mixture
6	Diamir-C		0.02 mg-ai/seed
	Allegiance-FL	Fungicide	0.014 mg-ai/seed
	Trilex FL		0.01 mg-ai/seed
	Spera		0.025 mg-ai/seed
7	Cruiser ST	Insecticide	0.34 mg-ai/seed
	Dynasty CST	Fungicide	mixture

[a]Avicta Complete Cotton (seed treatment) is a mixture of Avicta 500FS at 0.15 g(AI)/seed, Cruiser 5FS at 0.34 mg(AI)/seed, and Dynasty CST 125FS at 0.03 mg(AI)/seed; Aeris (seed treatment) is a mixture of Gaucho Grande 5FS at 0.375 mg(AI)/seed and thiodicarb at 0.375 mg(AI)/seed; Temik was applied in-furrow

Table 2. Number of thrips, thrips damage, plant vigor and stand on 25 May (20 DAP, 11 DAE); cotyledon-1 true leaf stage.

		Thrips per plant			Damage	Vigor	Plants/ac[b]
	Treatment[a]	immatures	adults	total	(0-9)	(1-9)	× 1000
1	Diamir-C Allegiance-FL Trilex FL Spera MON 57401 Gaucho Grande	0.00b	0.475bc	0.48bc	0.50b	8.75a	32.66a
2	Diamir-C Allegiance-FL Trilex FL Spera MON 57401 Gaucho Grande Temik	0.00b	0.13bc	0.13cd	0.00c	9.00a	38.69a
3	Diamir-C Allegiance-FL Trilex FL Spera MON 57401 Gaucho Grande Poncho/Votivo	0.00b	0.55b	0.55b	0.25bc	8.75a	31.07a
4	Diamir-C Allegiance-FL Trilex FL Spera MON 57401 Aeris	0.10b	0.08c	0.13cd	0.00c	9.00a	34.72a
5	Avicta Complete Cotton	0.00b	0.08c	0.08cd	0.00c	9.00a	35.04a
6	Diamir-C Allegiance-FL Trilex FL Spera	0.90a	2.10a	2.98a	5.50a	7.00a	33.59a
7	Cruiser ST Dynasty CST	0.00b	0.05c	0.05d	0.00c	9.00a	32.94a

Values in a column followed by the same letter are not different based on ANOVA analysis with an F protected LSD ($P \geq 0.10$).
[a]See Table 1 for treatment details.
[b]Sampled on 27 May.

Table 3. Number of thrips on 1 June (27 DAP, 18 DAE); 2 true leaf stage.

	Treatment[a]	Thrips per plant: immatures	adults	total
1	Diamir-C Allegiance-FL Trilex FL Spera MON 57401 Gaucho Grande	0.23b	0.45b	0.68b
2	Diamir-C Allegiance-FL Trilex FL Spera MON 57401 Gaucho Grande Temik	0.25b	0.23b	0.48b
3	Diamir-C Allegiance-FL Trilex FL Spera MON 57401 Gaucho Grande Poncho/Votivo	0.38b	0.40b	1.78b
4	Diamir-C Allegiance-FL Trilex FL Spera MON 57401 Aeris	0.00b	0.25b	0.25b
5	Avicta Complete Cotton	0.23b	0.58b	0.80b
6	Diamir-C Allegiance-FL Trilex FL Spera	2.68a	1.90a	4.78a
7	Cruiser ST Dynasty CST	0.18b	0.13b	0.30b

Values in a column followed by the same letter are not different based on ANOVA analysis with an F protected LSD ($P \geq 0.10$).
[a]See Table 1 for treatment details.

Table 4. Number of thrips, thrips damage, plant vigor and leafminer mines on 8 June (34 DAP, 25 DAE); 4 true leaf stage.

		Thrips per plant			Damage	Vigor	Leafminer
	Treatment[a]	immatures	adults	total	(0-9)	(1-9)	mines/plant
1	Diamir-C Allegiance-FL Trilex FL Spera MON 57401 Gaucho Grande	0.00a	0.88a	0.88a	3.25b	6.75a	2.53a
2	Diamir-C Allegiance-FL Trilex FL Spera MON 57401 Gaucho Grande Temik	0.08a	0.65a	0.73a	2.50b	7.00a	0.80c
3	Diamir-C Allegiance-FL Trilex FL Spera MON 57401 Gaucho Grande Poncho/Votivo	0.03a	0.48a	0.55a	3.50b	5.50b	1.30bc
4	Diamir-C Allegiance-FL Trilex FL Spera MON 57401 Aeris	0.00a	0.30a	0.33a	3.50b	6.50a	1.75ab
5	Avicta Complete Cotton	0.03a	0.63a	0.63a	3.50b	6.75a	1.45bc
6	Diamir-C Allegiance-FL Trilex FL Spera	0.00a	0.40a	0.43a	8.00a	4.50b	2.53a
7	Cruiser ST Dynasty CST	0.08a	0.45a	0.45a	3.25b	6.50a	1.18bc

Values in a column followed by the same letter are not different based on ANOVA with an F protected LSD ($P \geq 0.10$).
[a]See Table 1 for treatment details.

Table 5. Number of root-knot nematode galls, plant height and leaf area on 16 June (42 DAP, 33 DAE); 6 true leaf stage; Yield (20 October).

	Treatment[a]	Root-knot nematode galls/plant	Plant height cm	Leaf area cm^2	Yield lint-lbs/ac
1	Diamir-C Allegiance-FL Trilex FL Spera MON 57401 Gaucho Grande	28.30a	11.10a	78.58bc	958.53a
2	Diamir-C Allegiance-FL Trilex FL Spera MON 57401 Gaucho Grande Temik	16.40a	12.33a	115.90a	915.05a
3	Diamir-C Allegiance-FL Trilex FL Spera MON 57401 Gaucho Grande Poncho/Votivo	30.35a	10.89a	85.66bc	973.03a
4	Diamir-C Allegiance-FL Trilex FL Spera MON 57401 Aeris	19.80a	11.33a	63.90cd	1096.90a
5	Avicta Complete Cotton	20.70a	11.18a	91.24b	1002.63a
6	Diamir-C Allegiance-FL Trilex FL Spera	11.00a	8.85a	43.48d	967.40a
7	Cruiser ST Dynasty CST	24.40a	11.45a	73.53bc	1052.50a

Values in a column followed by the same letter are not different based on ANOVA with an F protected LSD ($P \geq 0.10$).

[a]See Table 1 for treatment details.

Impact of Cotton Aphids Infesting Pre-Bloom Dry-Land Cotton, 2010

Cooperators: Rob Warren, Grower

David Kerns
Extension Entomologist-Cotton

Gaines County

Summary:

A test on pre-bloom dryland cotton investigating the impact of aphids on yield was conducted. Intruder at 1 oz/ac was effective in mediating an aphid population that was averaging 238 aphids per leaf. However, Intruder was found to reduce the population of Scymnus lady beetle larvae by 84%. Treating pre-bloom cotton did not result in significantly more cotton lint yield. The reason for there not being any difference in yield may have been due to: 1) pre-bloom cotton can tolerate very high aphid populations, 2) since the aphid population was already severe that all the damage that could occur had already happened, or 3) the lady beetles reduced the aphid population in the untreated fast enough that natural control equaled chemical control. Although we can't be certain which of these is the reason, most research suggests that pre-bloom cotton infested with very high aphid numbers may be stunted and somewhat delayed, but will usually not suffer yield reduction under normal circumstances.

Objective:

The objective of this study was to determine if treating a severe infestation of aphids infesting pre-bloom dryland cotton resulted in increased yield. Additionally, the efficacy of Intruder was evaluated and its impact on Scymnus lady beetle larvae was evaluated.

Materials and Methods:

This test was conducted in a commercial cotton field in eastern Gaines County. The field was dry-land production, but at the time of the tested had good moisture. The test was a RCB design with four replications. Plots were 4-rows wide × 60 ft in length. The only treatment evaluated was Intruder at 1 oz/ac. Dyne-Amic non-ionic surfactant was included at 0.25% v/v. Intruder was applied in a broadcast pattern with a CO_2 pressurized hand-boom sprayer calibrated to deliver 10 gpa through Teejet TX-6 hollow cone nozzles (2 per row) at 40 psi. The application was applied on 15 July. At this time the cotton was pre-bloom.

On 15, 19 and 23 July, the number of cotton aphids, *Aphis gossypii* (Glover), were counted on 10, 3 to 4^{th} node leaves. Scymnus lady beetle larvae, *Scymnus loewii* Mulsant were by far the most prevalent lady beetles present in the field (Figure 1). Their population was estimated by counting the number present on 5 consecutive plants using whole plant visual samples.

Data were analyzed using ANOVA and means were separated based on an F-protected LSD ($P \leq 0.05$).

Results and Discussion:

On 15 July the aphid population was extremely high, averaging 238 aphids per leaf (Figure 2). Although aphids have been shown to cause significant yield loss to cotton during boll filling, their ability to damage seedling and pre-bloom cotton is questionable. When cotton is filling bolls it is reasonable to assume that aphids rob the plant of resources that should be directed to filling those bolls; thus causing yield loss. When there are no bolls, the diversion of resources may stunt a plant or delay maturity, but in dry-land cotton with ample moisture at the time of infestation, delayed maturity should have little or no impact.

At 4 day after treatment (DAT), the aphid population was in decline throughout the test. At this time the untreated was averaging 104.58 aphids per leaf, while the Intruder treated plots were averaging 23.8 per leaf. Based on Henderson-Tilton's equation, this equated to 81.44% control.

By 8 DAT, the aphid population had crashed, and the untreated was averaging only 9.73 per leaf. The number of aphids in the Intruder plots were averaging 3.73 per leaf and was not statically different from the untreated.

The reason for the rapid reduction of the aphid population across the test was undoubtedly due in part to the large number of lady beetles present. Scymnus lady beetles were plentiful at the onset of this test, averaging 4.69 larvae per plant (Figure 3). Intruder and other neonicotinoid insecticides are known to be harsh on convergent lady beetle larvae, but their impact on Scymnus lady beetles was not known. At 4 DAT, the lady beetles in the untreated plots had increased to 8.9 larvae per plant, while those in the Intruder plots had declined to 1.95 per plant, an 80.57% reduction.

There was no detectable difference in yield between the untreated and the Intruder plots (Figure 4). HVI analyses indicated no differences in specific lint quality parameters; however there was a slight ($P < 0.10$) difference in loan value. The untreated plots had about a 2-cent higher loan value (Figure 5). The mike in the Intruder treated plots, although not statistically different from the untreated, was consistently higher and hit the more severe loan discount, thus accounting for the higher loan value in the untreated. Therefore, I do not think the difference in loan value is truly significant. Regardless, it was evident that treating this aphid population was not justified. The reason for there not being any difference in yield may have been due to: 1) pre-bloom cotton can tolerate very high aphid populations, 2) since the aphid population was already severe that all the damage that could occur had already happened, or 3) the lady beetles reduced the aphid population in the untreated fast enough that natural control equaled chemical control. Although we can't be certain which of these is the reason, most research suggests that pre-bloom cotton infested with very high aphid numbers may be stunted and somewhat delayed, but will usually not suffer yield reduction under normal circumstances.

Acknowledgments:

Appreciation is expressed to the Plains Cotton Improvement Program for financial support of this project.

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Figure 1. Scymnus lady beetle larva (top) and adult (bottom).

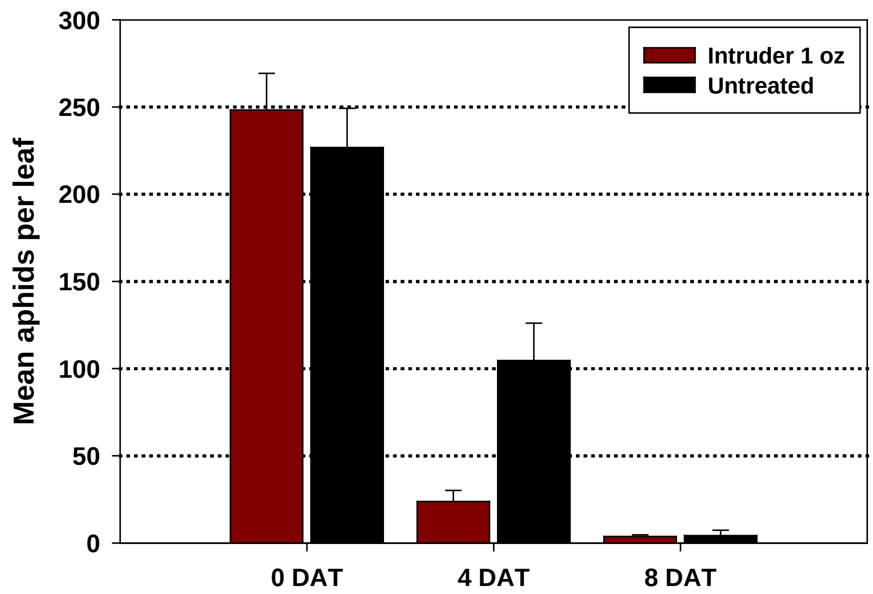

Figure 2. Impact of Intruder insecticide on cotton aphids at 4 and 8 DAT.

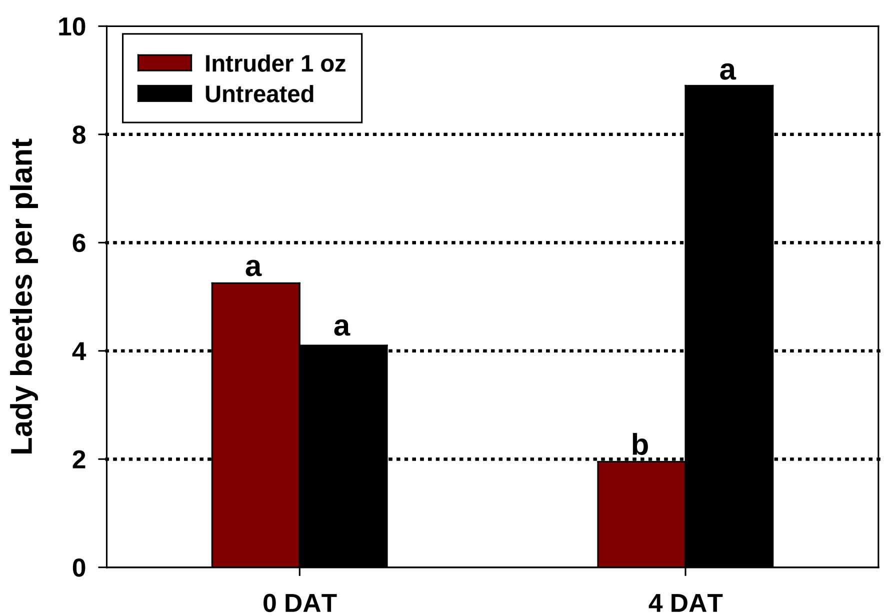

Figure 3. Impact of Intruder on Scymnus lady beetle larvae.

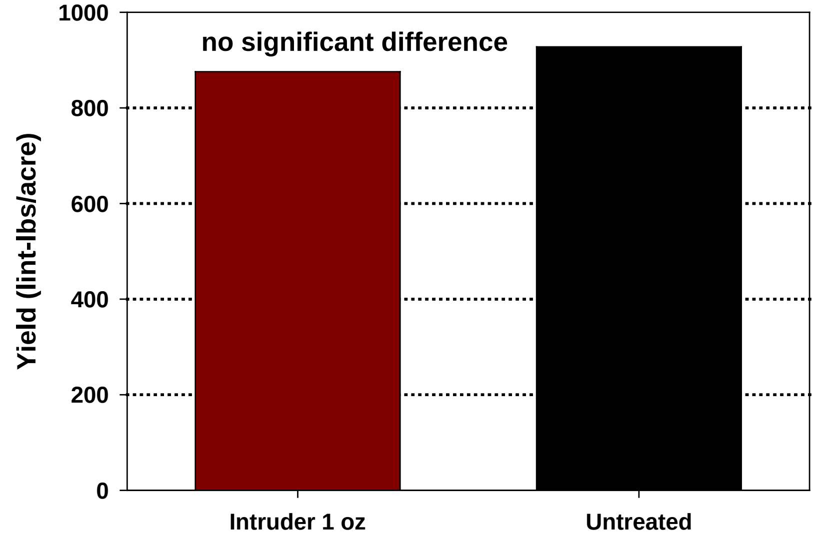

Figure 4. Yield response to controlling aphids in pre-bloom dryland cotton.

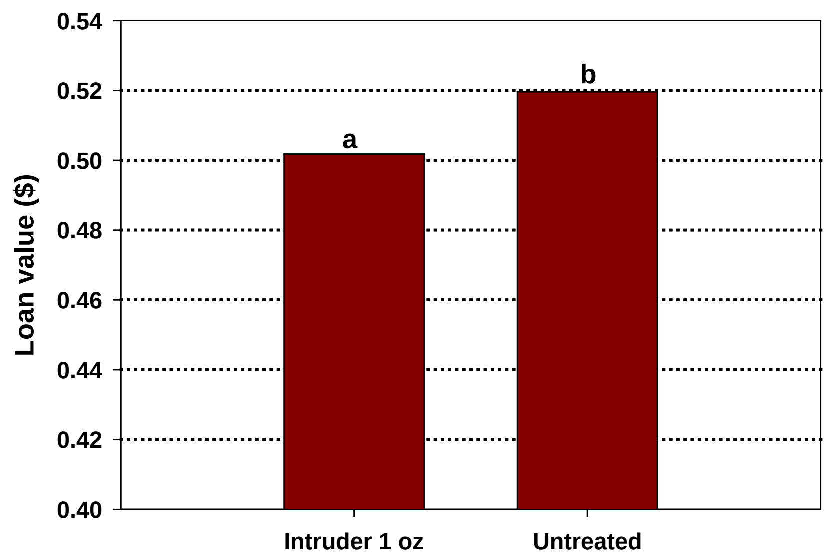

Figure 5. Loan values from cotton where aphids were controlled and left non-treated on pre-bloom dryland cotton.

Evaluation of Insecticides for Aphid Control and Impact on Lady Beetle Larvae, 2010

Cooperators: Texas AgriLife Research and Extension Center, Lubbock

David Kerns, Brant Baugh and Dustin Patman
Extension Entomologist-Cotton, EA-IPM Lubbock County and EA-IPM Crosby/Floyd Counties

Lubbock County

Summary:

The aphid population in this study was averaging over 200 aphids/leaf before curative treatments were applied. The action threshold for aphids is 50 aphids/leaf. Thus this represents a rescue type situation. However, the automatic applications of CMT-4586, applied 21 and 8 days before the other insecticide applications, prevented the aphid outbreak. These automatic applications probably eliminated the early colonizing aphids. Although all of the remaining treatments demonstrated some activity, Centric, Trimax Pro and Belay failed to reduce the aphid population below threshold within 7 days. Curative applications of CMT-4586, Intruder, Carbine, Bidrin and sulfoxaflor all exhibited excellent activity within 7 days. All of the neonicotinoid insecticides (Intruder, Centric, Belay, Trimax Pro and CMT-4586) were extremely harsh towards lady beetle larvae. Bidrin and sulfoxaflor were moderately harsh, while Carbine was least harsh towards lady beetle larvae.

Objective:

The objective of this study was to evaluate the efficacy of various insecticides on aphids infesting cotton, and to evaluate their impact of lady beetle larvae.

Materials and Methods:

This test was conducted at the Texas AgriLife Research and Extension Center in Lubbock, TX. The field was planted on 25 May on 40-inch rows, and was irrigated using row irrigation. The test was a RCB design with four replications. Plots were 4-rows wide × 60 ft in length.

The entire study site was treated with Karate at 5 fl-oz on 20 and 28 Jul. Comparative insecticide treatments were applied with a CO_2 pressurized hand-boom sprayer calibrated to deliver 10 gpa through TX-6 hollow cone nozzles (2 per row) at 40 psi.

One treatment, CMT-4586 (spirotetramat + imidacloprid), received an automatic application at pinhead sized square on 7 Jul and again 15 days later on 22 Jul. The remaining treatments were applied once the action threshold of 50 aphids per leaf was exceeded on 30 July. Evaluations were made on 22 and 30 Jul, and 2, 6 and 11 Aug.

The insecticides evaluated included CMT-4586, Intruder Centric, Bidrin, Trimax Pro, Belay, Carbine and XDE-208. CMT-4586 is a mixture of imidacloprid (same active ingredient as Trimax Pro) and spriotetramat (same active ingredient in Bayer's Movento). Spirotetramat is a true systemic and similar to Vydate will move from the leaf down. It is popular in the vegetable market for aphid and whitefly control. XDE-208 is sulfoxaflor. This is a new chemistry being developed by Dow and will be sold under the name Transform. It has demonstrated excellent activity on Lygus. Belay is a neonicotinoid being marketed by Valent, and thus has the same mode of action as Intruder, Centric, and Trimax Pro.

On 22 Jul, the number of cotton aphids, *Aphis gossypii* (Glover), were counted on 10, 3 to 4^{th} node leaves. On the remaining sample dates, in addition to 5, 3 to 4^{th} node leaves, 5 leaves from the lower 50% of the plant canopy were also sampled.

Predators were estimated on 30 Jul and 2 Aug utilizing a 36-inch x 40-inch black drop cloth. Drop cloths were laid between the rows and approximately 1.5 ft-row of cotton were shaken onto the drop cloth from each row, after which the type and number of predators were counted. Predators counted included lady beetles, minute pirate bugs, big-eyed bugs, damsel bugs, syrphid fly larvae, lacewing larvae and spiders; only lady beetle larvae data are presented. The dominate lady beetle was *Hippodamia convergens* Guérin-Méneville.

Data were analyzed using ANOVA, and means were separated using an F-protected LSD ($P \leq 0.05$).

Results and Discussion:

Differences between the untreated and the automatic applications of CMT-4586 were non-detectable until 8 day following the second application (Table 1). At this time the untreated was averaging 179 aphids per leaf while CMT-4586 was averaging 32.6. It was evident that the two applications of CMT-4586 prevented the aphid outbreak.

At 3 days after the remaining treatments were applied, all of the treatments had fewer aphids than the untreated (Table 2). The automatic applications of CMT-4586 had the fewest aphids at 14.23 per leaf, but did not statistically differ from the threshold applications of CMT-4586, Intruder, Bidrin or XDE-208 (sulfoxaflor).

At 7 days following the threshold application, the threshold timed application of CMT-4586 had the fewest aphids, but was not statistically different from the automatic

CMT-4586 application or Intruder, Centric, Bidrin, Carbine or XDE-208. Although all of the insecticides had significantly fewer aphids than the untreated, Trimax Pro and Belay at 4 and 6 fl-oz did not provide adequate control, and aphids in the Centric treated plots were still slightly above threshold.

At 21 days after the threshold timed applications, the aphid population had declined substantially, averaging only 22.28 per leaf in the untreated (Table 3). At this time the only treatments that differed from the untreated included the threshold timed application of CMT-4586, Intruder, Carbine and XDE-208.

On 30 Jul, prior to the threshold timed applications, there were fewer lady beetle larvae where the automatic CMT-4586 application occurred than in the untreated. None of the other treatment had been applied and did not differ from the untreated.

At 3 days following the threshold applications, all of the insecticide treatments had fewer lady beetle larvae than the untreated. Carbine appeared to have the least impact on lady beetle larvae, averaging 6.13 per ft-row, but did not differ from XDE-208. Belay at 6 fl-oz was harshest to lady beetle larvae, averaging 0.38 pre ft-row and did not differ from any other treatment containing a neonicotinoid (CMT-4586, Intruder, Centric and Trimax Pro). Bidrin appeared moderate in lethality toward lady beetle larvae relative to the other treatments and did not differ from Centric, Carbine or XDE-208.

Acknowledgments:

Appreciation is expressed to Gowan Company Ag Chemicals, Bayer CropScience and the Plains Cotton Improvement Program for financial support of this project.

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Table 1.

			Aphids per leaf			
			22 Jul (15 DAAP 1)	30 Jul (8 DAAP 2)		
Treatment/ formulation	Rate amt product/acre	Timing	3-4th node leaf	3-4th node leaf	Lower canopy leaf	Mean
Untreated	--	--	34.15a	136.75a	221.20a	178.98a
CMT-4586[a] + Dyne-Amic + UAN 28%	8.0 fl-oz + 0.25% v/v + 2.5% v/v	Pinhead + 14 d	33.90a	42.45a	22.75a	32.60b
CMT-4586 + Dyne-Amic + UAN 28%	8.0 fl-oz + 0.25% v/v + 2.5% v/v	threshold	25.30	108.50	265.6	187.05
Intruder 70WP	0.6 oz	threshold	30.20	107.50	361.05	234.28
Centric 40WG	2.5 oz	threshold	27.53	151.05	539.35	345.20
Bidrin 8	8.0 fl-oz	threshold	27.20	116.30	308.85	212.58
Trimax Pro 4.44SC	1.8 fl-oz	threshold	28.03	151.80	487.50	319.65
Belay 2.13SC	4 fl-oz	threshold	26.63	114.00	260.00	187.00
Belay 2.13SC	6 fl-oz	threshold	28.83	88.15	284.75	186.45
Carbine 50WG	1.5 oz	threshold	36.18	160.40	272.90	216.65
XDE-208 50WG	0.35 oz	threshold	22.90	165.15	402.75	283.95

Values in a column followed by the same letter are not significantly different based on an F-protected LSD ($P \leq 0.05$).

[a]Treatment was applied only at pinhead sized square stage (application 1) and again 14 days later (application 2); none of the other treatments were applied at this time and were excluded from analysis.

Table 2.

Treatment/ formulation	Rate amt product/acre	Aphids per leaf: 2 Aug (11 DAAP 2[a]; 3 DAAP 3) 3-4th node leaf	2 Aug Lower canopy leaf	2 Aug Mean	6 Aug (15 DAAP 2[a]; 7 DAAP 3) 3-4th node leaf	6 Aug Lower canopy leaf	6 Aug Mean
Untreated	--	166.80a	666.70a	416.75a	90.70a	525.95a	308.33a
CMT-4586[a] + Dyne-Amic + UAN 28%	8.0 fl-oz + 0.25% v/v + 2.5% v/v	16.55f	11.90e	14.23e	27.05cd	35.75b	31.40cd
CMT-4586 + Dyne-Amic + UAN 28%	8.0 fl-oz + 0.25% v/v + 2.5% v/v	37.55ef	47.65e	42.60e	7.35d	6.15b	6.75d
Intruder 70WP	0.6 oz	43.75def	30.00e	36.88e	26.75cd	14.00b	20.38cd
Centric 40WG	2.5 oz	114.90abc	235.25bcd	175.08bcd	30.80cd	74.85b	52.83bcd
Bidrin 8	8.0 fl-oz	38.35ef	38.65e	38.50e	14.55cd	26.35b	20.45cd
Trimax Pro 4.44SC	1.8 fl-oz	104.75a-d	372.35b	238.55bcd	48.45bc	155.40b	101.93bc
Belay 2.13SC	4 fl-oz	133.60ab	338.55b	236.08b	51.40abc	153.20b	102.30bc
Belay 2.13SC	6 fl-oz	88.60b-e	295.35bc	191.98b	84.55ab	171.65b	128.10b
Carbine 50WG	1.5 oz	101.05b-e	113.20cde	107.13b	20.30cd	19.60b	19.95cd
XDE-208 50WG	0.35 oz	63.00c-f	88.25de	75.63de	18.35cd	18.25b	18.30cd

Values in a column followed by the same letter are not significantly different based on an F-protected LSD ($P \leq 0.05$).

[a]Treatment was applied only at pinhead sized square stage (application 1)and again 14 days later (application 2); remaining treatments were applied on 30 Jul (application 3).

Table 3.

Treatment/ formulation	Rate amt product/acre	Aphids per leaf, 11 Aug (21 DAAP 2 [a]; 12 DAAP 3): 3-4th node leaf	Aphids per leaf, 11 Aug (21 DAAP 2 [a]; 12 DAAP 3): Lower canopy leaf	Aphids per leaf, 11 Aug (21 DAAP 2 [a]; 12 DAAP 3): Mean	Lady beetle larvae per 6 ft-row: 30 Jul (8 DAAP 2) [a]	Lady beetle larvae per 6 ft-row: 2 Aug (11 DAAP 2 [a]; 3 DAAP 3)
Untreated	--	4.90a	39.65ab	22.28a	13.00a	9.25a
CMT-4586[a]	8.0 fl-oz					
+ Dyne-Amic	+ 0.25% v/v	3.70a	31.95abc	17.83ab	2.38b	1.13d
+ UAN 28%	+ 2.5% v/v					
CMT-4586	8.0 fl-oz					
+ Dyne-Amic	+ 0.25% v/v	1.20a	8.30cd	4.75bc	13.50a	1.25d
+ UAN 28%	+ 2.5% v/v					
Intruder 70WP	0.6 oz	2.70a	4.30d	3.50bc	14.13a	1.63d
Centric 40WG	2.5 oz	2.55a	46.05a	24.30a	15.13a	1.88cd
Bidrin 8	8.0 fl-oz	3.05a	18.20bcd	10.63abc	11.00a	4.13bc
Trimax Pro 4.44SC	1.8 fl-oz	6.30a	39.00ab	22.65a	9.38a	1.13d
Belay 2.13SC	4 fl-oz	6.95a	32.10abc	19.53a	11.63a	1.13d
Belay 2.13SC	6 fl-oz	3.90a	35.10ab	19.50a	7.75a	0.38d
Carbine 50WG	1.5 oz	0.95a	2.90d	1.93c	11.00a	6.13b
XDE-208 50WG	0.35 oz	1.30a	2.00d	1.65c	12.13a	5.13b

Values in a column followed by the same letter are not significantly different based on an F-protected LSD ($P \leq 0.05$).

[a]Treatment was applied only at pinhead sized square stage (application 1) and again 14 days later application 2; remaining treatments were applied on 30 Jul (application 3).

Impact of Thiamethoxam Seed Treatments on the Efficacy of Subsequent Foliar Applications of Thiamethoxam Towards Cotton Aphids in Texas, 2010

Cooperators: Texas AgriLife Research and Extension Center – Lubbock, TX

David Kerns, Brant Baugh , Dustin Patman and Bo Kesey
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Lubbock County

Summary:

At 30 days after planting (DAP), prior to the foliar applications, cotton that was planted with Cruiser-treated seed had fewer aphids than the untreated, and most of this activity appeared to be in the lower portion of the plant canopy. However, the aphid population was still high enough in the Cruiser–treated plots to warrant an insecticide application. These data suggest that it is possible for seed treatments to exert selective pressure on mid-season populations of cotton aphids and possibly contribute to selection of resistant individuals. However, we could not detect any impact of Cruiser seed treatment on the efficacy of subsequent foliar applications of Centric. Neither rate of Centric performed very well in this test regardless if Cruiser was used or not which may be indicative of the pre-existing resistance to Centric. The only interaction detected was for yield. All of the treatments yielded significantly more than where no insecticides were used. Centric at 2.5 oz applied over untreated seed had the highest yield, and was significantly greater than where Centric was applied at 1.5 oz without a seed treatment. However, it was not significantly different from Centric at 1.5 oz applied over Cruiser-treated seed. Why Centric at 2.5 oz without the seed treatment yielded more than Centric at 2.5 oz applied over the top of Cruiser-seed treatment is not certain. Cruiser applied with no foliar over sprays yielded equally to where Cruiser received over sprays.

Objective:

The objective of this study was to determine if using a neonicotinoid seed treatment affected our ability to control aphids with similar chemistry later in the season

Materials and Methods:

This test was conducted at the Texas AgriLife Research and Extension Center in Lubbock, TX. The field was planted on 25 May on 40-inch rows, and was irrigated using row irrigation. The variety used was DP 174RF. The test was a 2×3 factorial design with four replications. Factor A treatments were an untreated and a seed treatment of Centric. Factor B consisted of an untreated and foliar applications of Cruiser at 1.5 and 2.5 oz per acre. Plots were 4-rows wide × 60 ft in length. The entire study site was treated with Karate at 5 fl-oz on 20 and 28 Jul.

Foliar insecticide treatments were applied with a CO_2 pressurized hand-boom sprayer calibrated to deliver 10 gpa through TX-6 hollow cone nozzles (2 per row) at 40 psi. on 30 Jul. Evaluations were made on 30 Jul, and 2, 6 and 11 Aug. The number of cotton aphids per leaf were estimated by sampling 5, 3 to 4th node leaves and 5 leaves from the lower 50% of the plant canopy. Entire plots were harvested on 11 Nov using a cotton stripper.

Data were analyzed using ANOVA, and means were separated using an F-protected LSD ($P \leq 0.05$).

Results and Discussion:

At 30 days after planting (DAP), prior to the foliar applications, cotton that was planted with Cruiser-treated seed had fewer aphids than the untreated, and most of this activity appeared to be in the lower portion of the plant canopy (Table 1). Thus it is possible for seed treatments to exert selective pressure on mid-season populations of cotton aphids and possibly contribute to selection of resistant individuals.

At 3 day after the foliar applications (DAT), both rates of Centric had fewer aphids than the untreated with the exception of the 1.5 oz rate within the lower canopy. However, the cotton aphid populations were high across all plots, exceeding the action threshold of 50 aphids per leaf.

By 7 DAT, the aphid populations had declined across the entire test but were still above the action threshold within all treatments; no differences were detected among any of the treatments (Table 2).

At 12 DAT, the cotton aphids had declined to sub-threshold levels. The influence of Cruiser seed treatment on the ability of subsequent applications of Centric to control cotton aphids was not certain and no interactions were detected. Neither rate of Centric performed very well in this test regardless if Cruiser was used or not which may be indicative of the pre-existing resistance to Centric.

The only interaction detected was for yield (Tables 2 and 3). All of the treatments yielded significantly more than where no insecticides were used (Table 2). Centric at 2.5 oz applied over untreated seed had the highest yield, and was significantly greater than where Centric was applied at 1.5 oz without a seed treatment. However, it was not significantly different from Centric at 1.5 oz applied over Cruiser-treated seed. Why Centric at 2.5 oz without the seed treatment yielded more than Centric at 2.5 oz applied over the top of Cruiser-seed treatment is not certain. Cruiser applied with no foliar over sprays yielded equally to where Cruiser received over sprays.

Acknowledgments:

Appreciation is expressed to the Plains Cotton Improvement Program for financial support of this project.

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Table 1.

	Rate amt product/acre	Cotton aphids per leaf					
		30 Jul (30 DAP, pre-foliar)			2 Aug (3 DAT)		
		3-4th node leaf	Lower canopy leaf	Mean	3-4th node leaf	Lower canopy leaf	Mean
Factor A							
Untreated	--	107.58a	354.58a	231.08a	93.10a	256.03a	174.57a
Cruiser ST	0.34[a]	115.38a	154.83b	135.11b	52.55a	234.50a	143.53a
Factor B							
Untreated	--	91.55a	179.88a	135.71a	127.43a	341.25a	234.34a
Centric 40WG	1.5 oz	131.50a	270.85a	201.18a	51.20b	242.83ab	147.01b
Centric 40WG	2.5 oz	111.40a	313.40a	212.40a	39.85b	151.73b	95.79b
A*B Interaction		ns	ns	ns	ns	ns	ns

Table 2.

	Rate amt product/acre	Cotton aphids per leaf						
		6 Aug (7 DAT)			11 Aug (12 DAT)			11 Nov
		3-4th node leaf	Lower canopy leaf	Mean	3-4th node leaf	Lower canopy leaf	Mean	Yield lint (lbs/acre)
Factor A								
Untreated	--	26.88a	120.15a	73.52a	3.27a	22.55a	12.91a	1484.72a
Cruiser ST	0.34[a]	27.13a	119.62a	73.40a	2.60a	17.38a	9.99a	1540.63a
Factor B								
Untreated	--	34.00a	103.25a	68.63a	3.40a	22.03a	12.71a	1350.91b
Centric 40WG	1.5 oz	25.58a	165.13a	95.35a	2.93a	15.58a	9.25a	1550.96a
Centric 40WG	2.5 oz	21.53a	91.13a	56.40a	2.48a	22.30a	12.39a	1636.15a
A*B Interaction		ns	ns	ns	ns	ns	ns	P = 0.01

Table 3.

Factor A	Factor B	Rate amt product/acre	11 Nov Yield lint (lbs/acre)
	Untreated	--	1230.76c
Untreated	Centric 40WG	1.5 oz	1469.14b
	Centric 40WG	2.5 oz	1754.25a
	Untreated	--	1471.05b
Cruiser ST[a]	Centric 40WG	1.5 oz	1632.78ab
	Centric 40WG	2.5 oz	1518.05b

Values in a column followed by the same letter are not significantly different based on an F-protected LSD ($P \geq 0.05$).
[a]rate = 0.34 mg(AI)/seed.

Evaluation of Belay and Endigo for Control of Western Tarnished Plant Bug and Stink Bugs in Cotton, 2010

Cooperators: Lance Horne, Grower

David Kerns and Brant Baugh
Extension Entomologist-Cotton and EA-IPM Lubbock County

Lubbock County

Summary:

Belay (clothiadan) is a neonicotinoid insecticide similar to Intruder, Centric and Trimax Pro that has recently been labeled for use in cotton. Its target pests in cotton include aphids, fleahoppers and Lygus. Belay was also evaluated when mixed with Brigade. Endigo is a mixture of a pyrethroid (Karate) and the neonicotinoid (Centric). Endigo has been widely used for Lygus control in the Mid South. The other insecticides evaluated in this test include Voliam Xpress, which is a mixture of Karate and Coragen, its primary targets are worms, but we needed to determine if the pyrethroid component of the mixture was high enough to control Lygus in cases of mixed pest species. Unlike most neonicotinoids, Belay did demonstrate descent activity toward Lygus, but only at the high rate of 6 oz/ac. Endigo at 3.5 and 5.5 fl-oz/ac was initially effective towards Lygus but the higher rate provided control for 11 days. Belay at 3 oz/ac mixed with the pyrethoid, Brigade, was highly effective and similar to the high rate of Endigo. The pyrethoid component of Voliam Xpress did provide good initial control of Lygus, but did not provide as long of residual control as the high rate of Endigo or the Belay + Brigade mixture. The stink bug population was not as high as desired for this test, thus there is not a great deal of confidence in the results. Based on the available data, Belay + Brigade appeared to have the best activity towards stink bugs and was the only treatment to differ from the untreated.

Objective:

The objective of this study was to evaluate the efficacy of Belay and Endigo towards western tarnished plant bug and stink bugs.

Materials and Methods:

This test was conducted in a commercial cotton field near Lubbock, TX. The field was planted on 23 May on 40-inch rows and was drip irrigated. The test was a RCB design with four replications. Plots were 4-rows wide × 60 ft in length.

Belay (clothiadan) is a neonicotinoid insecticide similar to Intruder, Centric and Trimax Pro that has recently been labeled for use in cotton. Its target pests in cotton include aphids, fleahoppers and Lygus. Belay was also evaluated when mixed with Brigade. Endigo is a mixture of a pyrethroid (Karate) and the neonicotinoid (Centric). Endigo has been widely used for Lygus control in the Mid South. The other insecticides evaluated in this test include Voliam Xpress, which is a mixture of Karate and Coragen, its primary targets are worms, but we needed to determine if the pyrethroid component of the mixture was high enough to control Lygus in cases of mixed pest species.

Foliar sprays were applied in a broadcast pattern with a CO_2 pressurized hand-boom sprayer calibrated to deliver 10 gpa through Teejet TX-6 hollow cone nozzles (2 per row) at 40 psi. Insecticides were applied on 27 Jul. All treatments included Activator 90 non-ionic surfactant at 0.25% v/v.

Lygus, western tarnished plant bug, *Lygus hesperus* (Knight) and stink bugs, Conchuela stink bug, *Chlorochroa ligata* (Say) and green stink bug, *Acrostermnum hilare* (Say) were sampled by a 36-inch x 40-inch black drop cloth. Drop cloths were laid between the rows and approximately 1.5 row-ft of cotton were shaken onto the drop cloth from each row; four drop cloth samples were taken per plot. Samples were taken on 6, 9, 12, 17 and 23 Aug.

Data were analyzed using ANOVA and means for Lygus were separated based on an F-protected LSD ($P \leq 0.05$) while stink bugs were based on an F-protected LSD ($P \leq 0.10$).

Results and Discussion:

On 6 Aug (pretreatment count), the Lygus population averaged 1.86 per 6 ft-row across all plots, which was below the action threshold of 4 Lygus per 6 ft (Figure 1). No statistical differences were detected among treatments at this time.

At 3 days after treatment (DAT), the Lygus had increased in the untreated plots to 6.63 Lygus per 6 ft-row, which was significantly greater than in all of the insecticide treatments (Figure 2). Lygus populations did not differ among the insecticide treatments at this time. By 6 DAT, both rates of Endigo, Voliam Xpress and Belay + Brigade had the fewer nymphs and total Lygus but did not differ from Belay at 3 or 4 fl-oz (Figure 3).

At 11 DAT, Endigo at 5.5 fl-oz, Belay at 6 fl-oz and Belay + Brigade all had the fewest nymphs and total Lygus (Figure 4). All of the insecticide treatments had significantly fewer Lygus than the untreated. At 17 DAT, there were no significant differences among treatments at $P = 0.05$, however differences were evident if $P = 0.10$ (Figure 5). Using p = 0.10, all of the treatments were exceeding threshold, but were all lower than the untreated. There were no differences among the insecticides.

The stink bug population was not as high as desired for this test, thus there is not a great deal of confidence in the results (Figure 6). Based on the available data, Belay + Brigade appeared to have the best activity towards stink bugs and was the only treatment to differ from the untreated.

Acknowledgments:

Appreciation is expressed to Valent U.S.A. Corporation, Syngenta Crop Protection and the Plains Cotton Improvement Program for financial support of this project.

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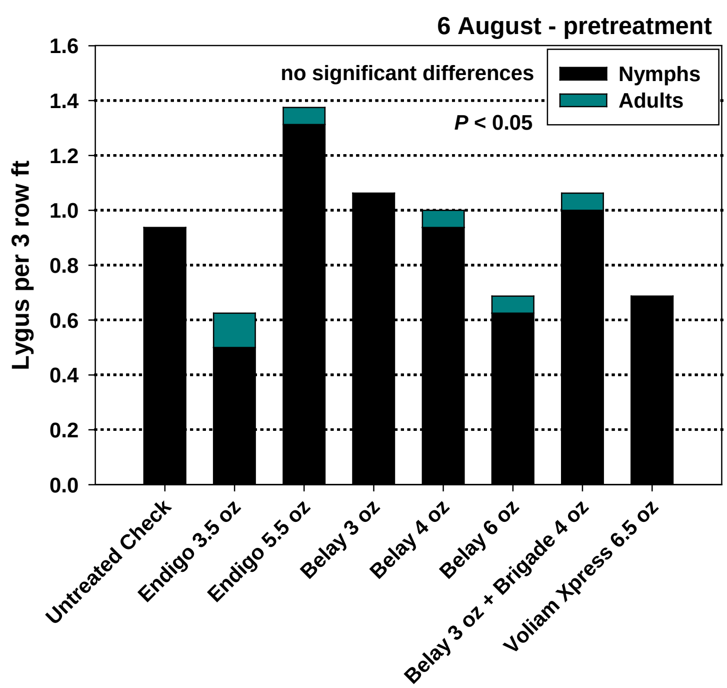

Figure 1. Lygus numbers prior to insecticide application.

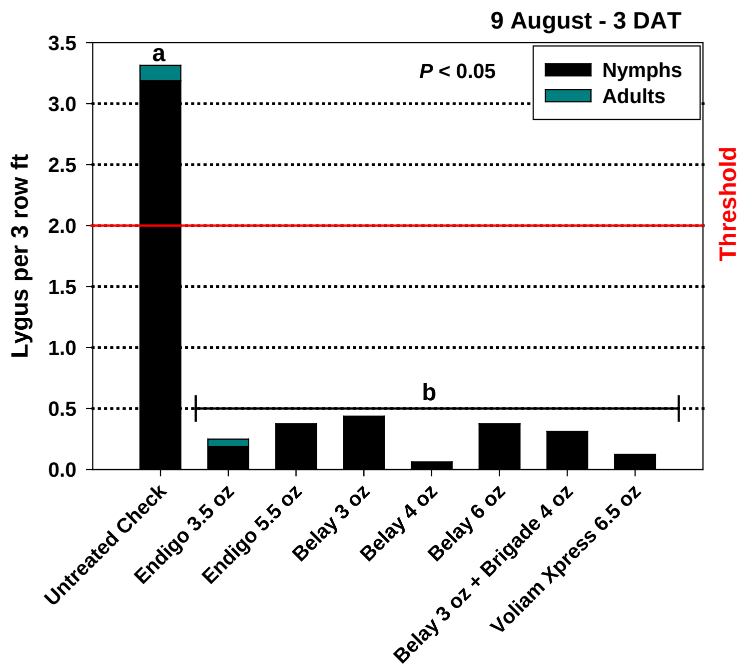

Figure 2. Lygus at 3 days after treatment; Bars capped by the same letter are not significantly different.

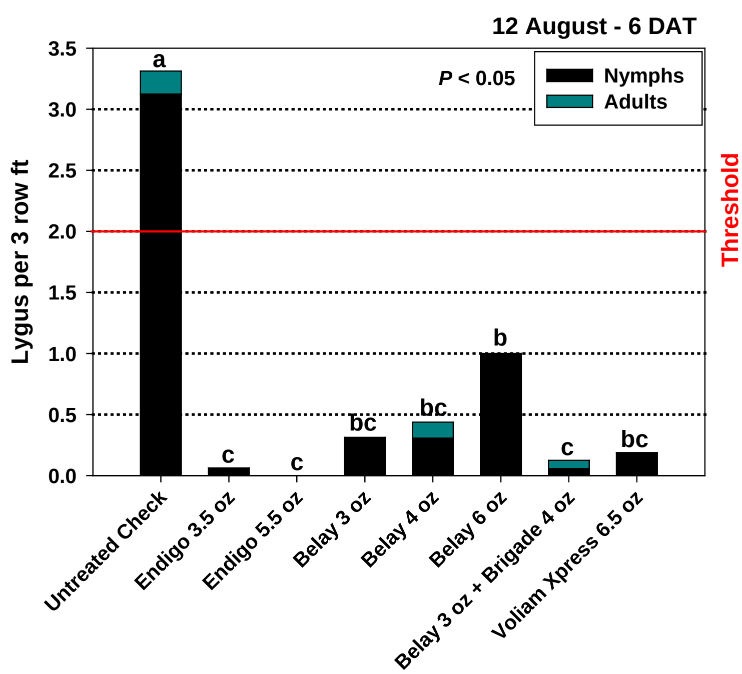

Figure 3. Lygus at 6 days after treatment; Bars capped by the same letter are not significantly different.

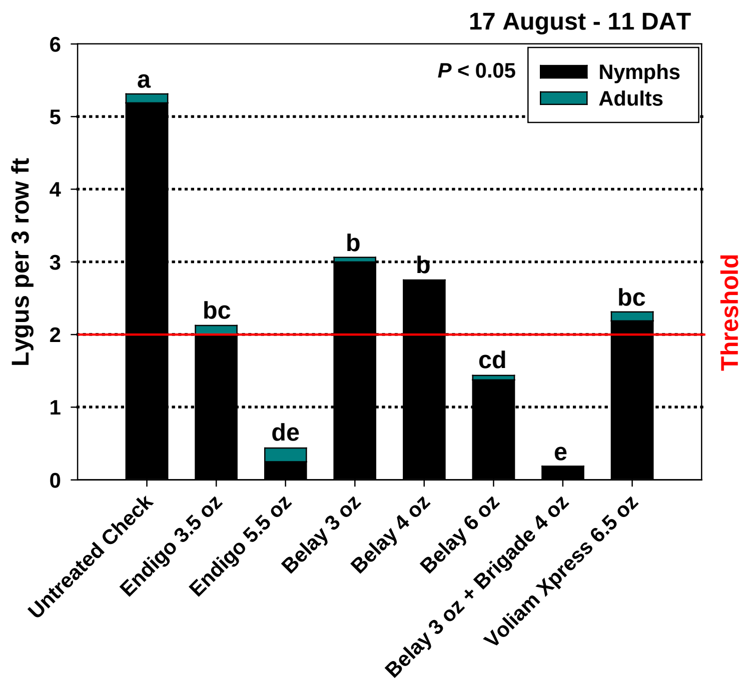

Figure 4. Lygus at 11 days after treatment; Bars capped by the same letter are not significantly different.

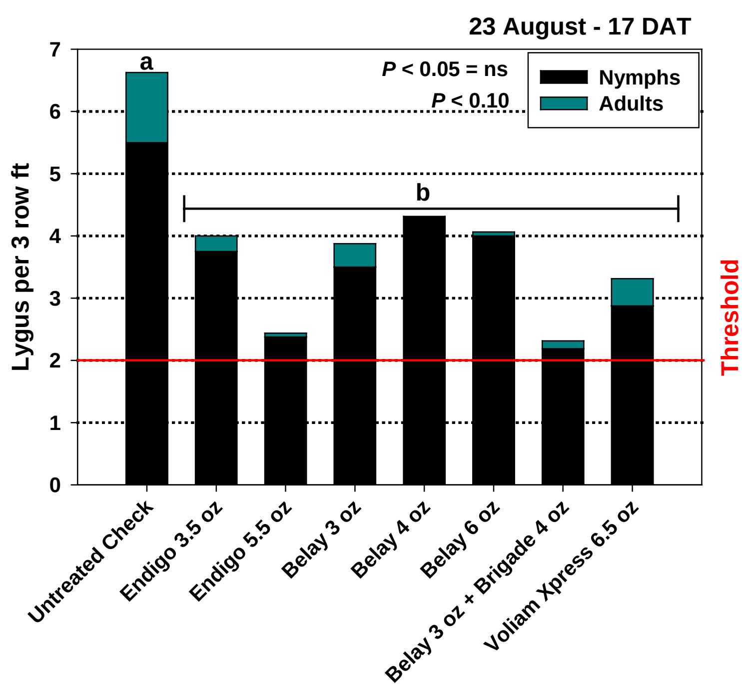

Figure 5. Lygus at 17 days after treatment; Bars capped by the same letter are not significantly different.

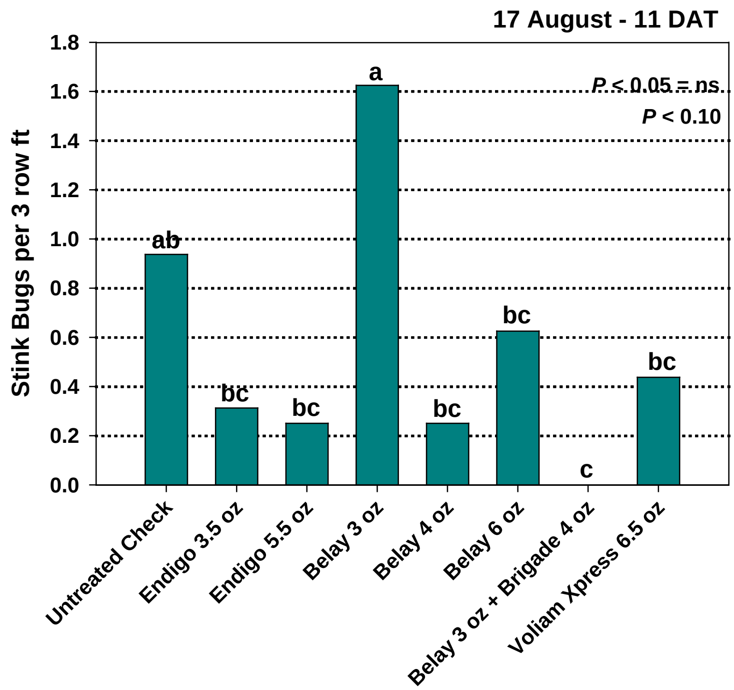

Figure 6. Stink bugs at 11 days after treatment; Bars capped by the same letter are not significantly different.

Potential for using Boll Damage as a Threshold Indicator for Lygus in the Texas High Plains, 2010

Cooperators: Texas AgriLife Research and Extension Center, Lubbock

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Extension Entomologist-Cotton, EA-IPM Crosby/Floyd Counties and EA-IPM Lubbock County

Lubbock County

Summary:

These data support the current action threshold during this developmental time period of 4 Lygus per 6 ft-row using the drop cloth sampling method. Based on dime size bolls, our data suggests that 67 internally damaged locules, or 400 external stings per 100 bolls is correlated with the threshold of 4 Lygus per 6 ft-row and has potential utility as a Lygus action threshold. More data is required for confirmation.

Objective:

The objectives of this study were to investigate the relationships between Lygus density, damage and yield, and to determine the possibility of developing an action threshold based on damage.

Materials and Methods:

The data presented were collected from four irrigated cotton fields in the Texas High Plains in 2008-2010. All test sites consisted of insecticide efficacy tests in cotton that were beyond cutout, with the nodes above white flower = 2-4. Thus, all of the yield loss associated with these sites was the result of Lygus feeding on bolls rather than squares.

All test sites were RCB designs with 4 replicates. Plots were 4 rows X 60 ft in length. The Lygus population at each site was estimated by the drop cloth method (3 ft x 2 ft) and expressed as mean density/6 ft-row. The Lygus populations at all locations were predominately nymphs and counts were made at 0, 7, 14 and 21 DAT. To assess boll damage, 10-15 dime size bolls that were approximately 15 to 20-mm diameter (~150 to 200 HU maturity) were collected at random from each plot for damage assessment at 0 and 7 DAT. Ten to fifteen bolls were collected, sealed in Ziploc bags and stored in a refrigerator until damage observations could be made.

The external damage assessment was made by counting the number of feeding punctures using a 10x magnifying lens. For internal damage, bolls were cut cross sectional with two cuts, one at about one-third and one at two-thirds of the distance from the tip. The number of damaged locules were counted and recorded as internal damage.

In 2008 and 2009, three of the tests had their plots harvested using an 28" hand basket stripper. Six samples were pulled from the middle two rows of each plot totaling 1/1000 acre. The 2010 test site had each plot harvested in its entirety using a mechanized cotton stripper. All harvest samples were ginned at the Texas AgriLife Ginning Facility in Lubbock.

In order to produce more data points, data from all four locations were pooled for analysis and the yields were normalized by converting the yields at each site into a proportion of the highest yielding plot. For correlation purposes, data from the 7 DAT evaluations and yield (lint-lbs per acre) were used for analysis. Beyond seven days, the Lygus populations at all sites did not return and should not have impacted our results. Data were analyzed using simple linear regression models (Sigma Plot 10, Systat Software Inc, 2006).

Results and Discussion:

The current action threshold for Lygus on cotton after peak bloom is 4 per 6 ft-row (Table 1). However, this threshold was developed prior to cutout and represents damage associated primarily with square feeding. It is not known whether this threshold fits cotton that has reached cutout, when damage is solely from boll feeding.

Based on our test sites, yield was negatively correlated with Lygus density (Figure 1). Although the *P*-value was significant at 0.01, the R^2 value was relatively low, accounting for only 23% of the differences in yield. The reason for the low R^2 value is undoubtedly the variability in yield when Lygus densities were less than 1 per 6 ft-row. Additionally, because we are pooling data from four locations over a three year period, variability in data is expected. Thus, the low R^2 value is not necessarily indicative of a weak relationship. Using this linear relationship, we can determine the approximate number of Lygus necessary to cause various degrees of associated yield loss. Using our model, and a 10% yield reduction as the initial point of unacceptable yield loss, we find that we can tolerate no more than approximately 5 Lygus per 6 ft-row. Thus, our current threshold appears to be acceptable. However, much more data needs to be added to the model to strengthen it and increase the R^2 value.

Lygus feeding on bolls results in external feeding injury or stings. However, not all stings result in boll damage, and its internal boll damage that is of economic concern. Because of the difficulty of utilizing drop cloth or sweep net samples to estimate late season Lygus populations, many consultants have stated that they would prefer a Lygus action threshold based on damage. Also, due to the timeliness associated with boll dissection for internal damage, there is much interest in a threshold based on external stings, which are quick and easy to assess.

Before we can utilize a threshold based on external stings, we must first understand the linear relationship between external and internal damage to bolls that measure 15-20 mm in diameter (target size of the bolls to sample). As expected, there is a close relationship between external and internal injury (Figure 2). Based on this model, it appears that approximately 16% of external stings result in a damaged locule.

Internal boll damage was correlated with Lygus density (Figure 3A). Using our current action threshold of 4 Lygus per 6 ft-row, we can estimate that an insecticide application is justified if 67 damaged locules are detected per 100 bolls along with the presence of Lygus. Similarly, based on external stings, we can deduce that if 400 or more external stings are detected per 100 bolls, along with the presence of Lygus, an insecticide application is justified (Figure 3B). The number of external stings needed to trigger an insecticide application in this experiment, based on the relationship between external stings and internal damage (16% of stings result in a damaged locule) (Figure 2), equals 418 external stings.

Based on the above relationships, it appears that 67 internal damaged locules, or 400 external stings, per 100 dime to nickel size bolls along with the presence of Lygus, may be a viable action threshold. However, more data is needed to strengthen these models, especially the relationship between Lygus density and yield production.

Acknowledgments:

This project was funded in part by the Plains Cotton Improvement Program.

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Table 1. Texas action threshold for lygus damage.

	Sampling method*	
Cotton stage	**Drop cloth**	**Sweep net**
1st two weeks of squaring	1-2 per 6 ft-row with unacceptable square set	8 per 100 sweeps with unacceptable square set
3rd week of squaring to 1st bloom	2 per 6 ft-row with unacceptable square set	15 per 100 sweeps with unacceptable square set
After peak bloom	4 per 6 ft-row with unacceptable fruit set the first 4-5 weeks	15- 20 per 100 sweeps with unacceptable fruit set first 4-5 weeks

*Sweep net – standard 15-inch net, sample 1-row at a time taking 15-25 sweeps. Recommended before peak bloom.

Drop cloth – black is recommended; 3-ft sampling area, sample 2-rows. Recommended after peak bloom.

Cease sampling and treating when NAWF = 5+ 350 DD60's.

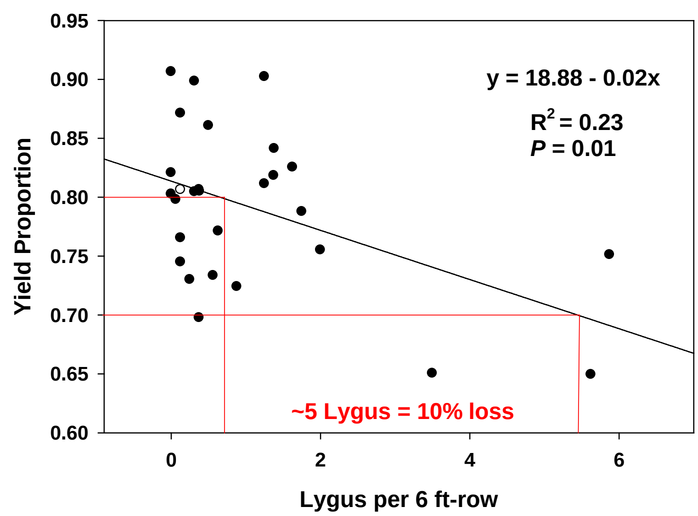

Figure 1. Linear relationship between yield and Lygus density.

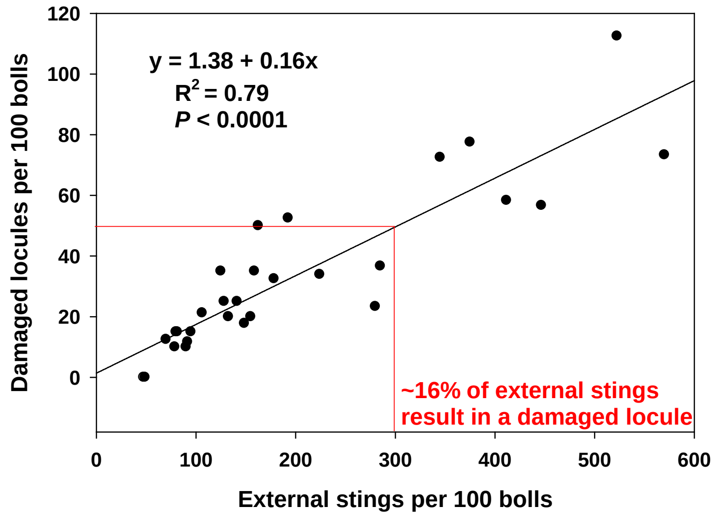

Figure 2. Relationship between the external and internal Lygus damage to dime sized (15-20 mm diameter) bolls.

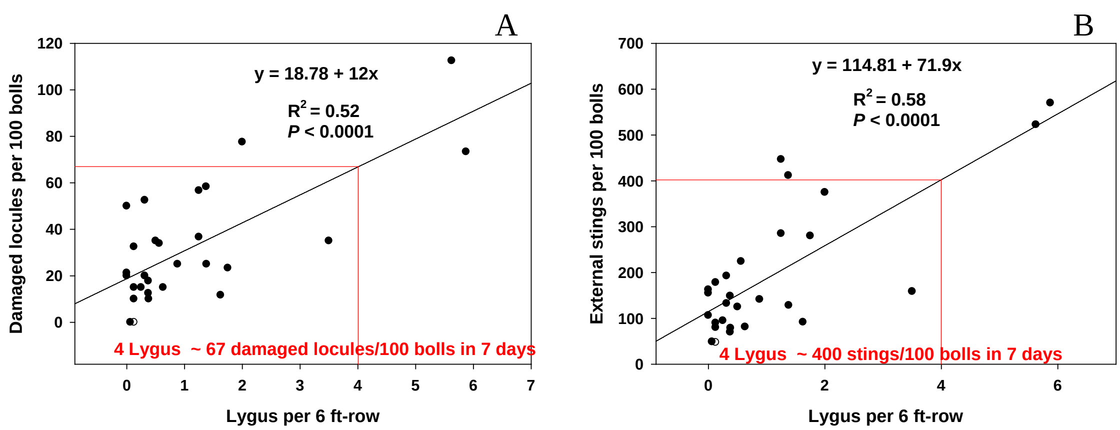

Figure 3. (A) Relationship between damaged locules and Lygus density (B) relationship between external stings and Lygus density.

Evaluation of Insecticides for Control of Western Tarnished Plant Bug in Cotton, 2010

Cooperators: Blayne Reed, Consultant; Kerry Don Adams, Joe Byrd, Growers

David Kerns
Extension Entomologist-Cotton

Swisher County

Summary:

Because of the low initial lygus population it was difficult to separate treatments. However, the lower percentage control by Intruder supports previous studies demonstrating that this product is marginally effective towards lygus. Any product containing a pyrethroid (Endigo, Ammo and Bidrin XP), continues to be efficacious toward High Plains lygus. Bidrin at a high rate also appears efficacious, but residual control is uncertain, and lower rates need to be evaluated. GWN-9857 has good potential as a lygus management tool in Texas.

Objective:

The objective of this study was to evaluate the efficacy of several insecticides towards western tarnished plant bug.

Materials and Methods:

This test was conducted in a commercial cotton field near Tulia, TX. The field was planted on 23 May on 40-inch rows, and irrigated using row water irrigation. The test was a RCB design with four replications. Plots were 4-rows wide × 60 ft in length.

Foliar sprays were applied in a broadcast pattern with a CO_2 pressurized hand-boom sprayer calibrated to deliver 10 gpa through Teejet TX-6 hollow cone nozzles (2 per row) at 40 psi. Insecticides were applied on 27 Jul.

Insecticides evaluated included: Intruder at 1.1 oz/ac, Endigo (mix of Centric + Karate) at 5.5 fl-oz/ac, Bidrin at 8 fl-oz, Bidrin at 2.8 fl-oz (equal parts Bidrin and Brigade), Ammo at 5 fl-oz, and GWN-9857 (constituents unknown). All treatments included Dyne-Amic non-ionic surfactant at 0.25% v/v.

Adult and immature western tarnished plant bugs, *Lygus hesperus* (Knight), were sampled by a 36-inch x 40-inch black drop cloth. Drop cloths were laid between the rows and approximately 1.5 row-ft of cotton were shaken onto the drop cloth from each row; four drop cloth samples were taken per plot. Samples were taken 27 Jul 2 and 9 Aug.

Yields were estimated on 7 October using a HB stripper, harvesting 1/1000 acre from the middle two rows of each plot.

Percent control of total lygus relative to the untreated was based on Henderson-Tilton's equation and all data were analyzed using ANOVA and the means were separated with an F protected LSD ($P \geq 0.05$).

Results and Discussion:

The lygus population appeared to have just recently colonized the cotton from nearby weeds that had been treated with glyphosate. On 27 Jul (pretreatment count), the lygus population was averaging 5.05 Lygus per 6 ft-row across all plots, which was slightly higher than the action threshold of 4 per 6 ft-row (Figure 1). No statistical differences were detected among treatments at this time.

At 6 days after treatment (DAT), all treatment had significantly fewer nymphs and total lygus than the untreated check, but did not differ from each other (Figure 2). Based on Henderson-Tiltons equation for percent control, GWN-9857 provided the greatest control at 97.14%, but statistically differed from only Intruder and the untreated (Figure 3).

At 13 DAT, the plant bug population had declined substantially throughout the entire test. At the time all of the insecticide treatments contained fewer lygus than the untreated but did not differ from each other (Figure 4).

There were no differences among treatments in yield (data not presented). The yield across all plots averaged 770 lbs-lint/ac.

Because of the low initial lygus population it was difficult to separate treatments. However, the lower percentage control by Intruder supports previous studies demonstrating that this product is marginally effective towards lygus. Any product containing a pyrethroid (Endigo, Ammo and Bidrin XP) continue to be efficacious toward High Plains lygus. Bidrin at a high rate also appears efficacious, but residual control is uncertain, and lower rates need to be evaluated. GWN-9857 has good potential as a lygus management tool in Texas.

Acknowledgments:

Appreciation is expressed to Gowan Company Ag Chemicals, Amvac Chemical Corp. and the Plains Cotton Improvement Program for financial support of this project.

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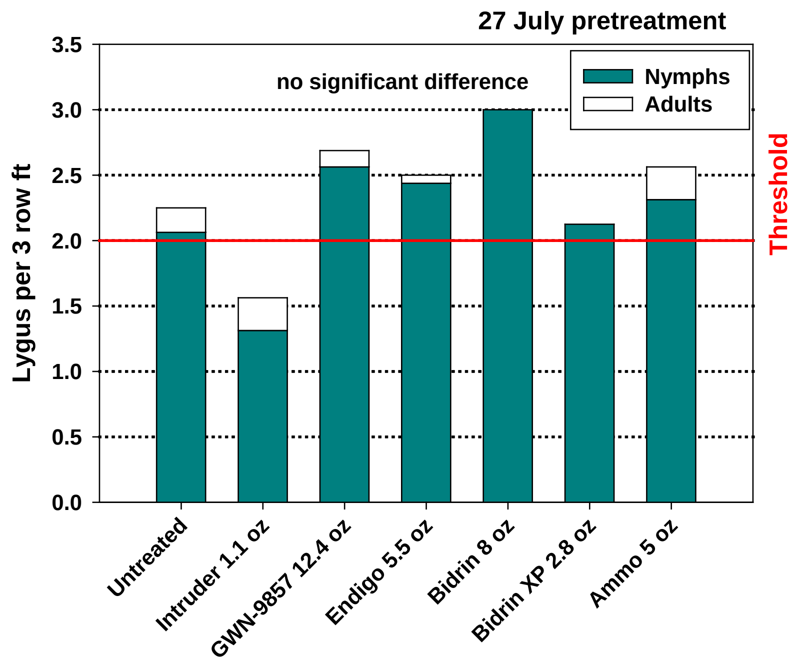

Figure 1. Lygus numbers before treatment.

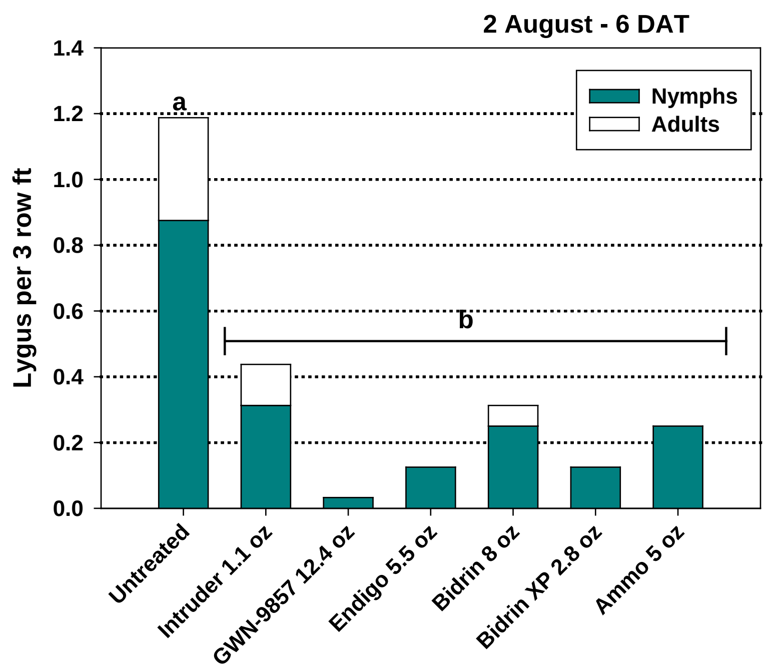

Figure 2. Lygus numbers at 6 days after treatment; bars capped by the same letter are not statistically different.

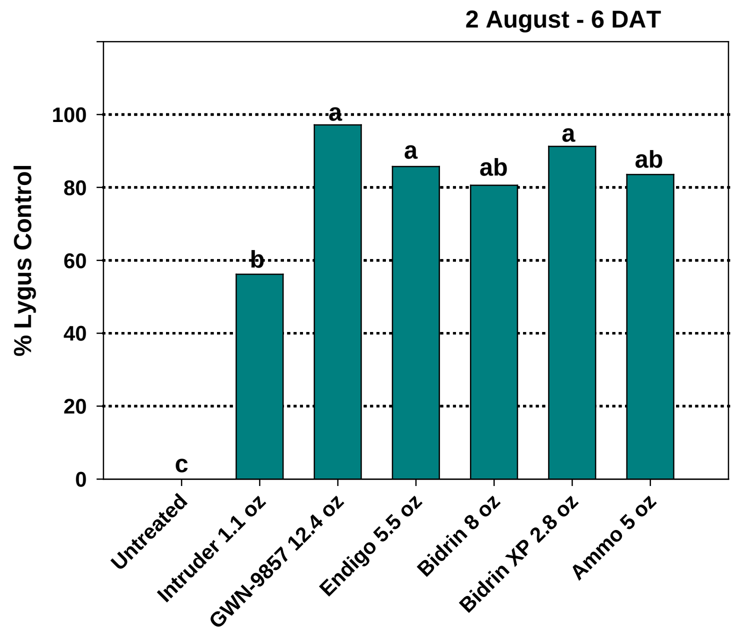

Figure 3. Percent Lygus control at 6 days after treatment based on Henderson-Tilton's equation; bars capped by the same letter are not statistically different.

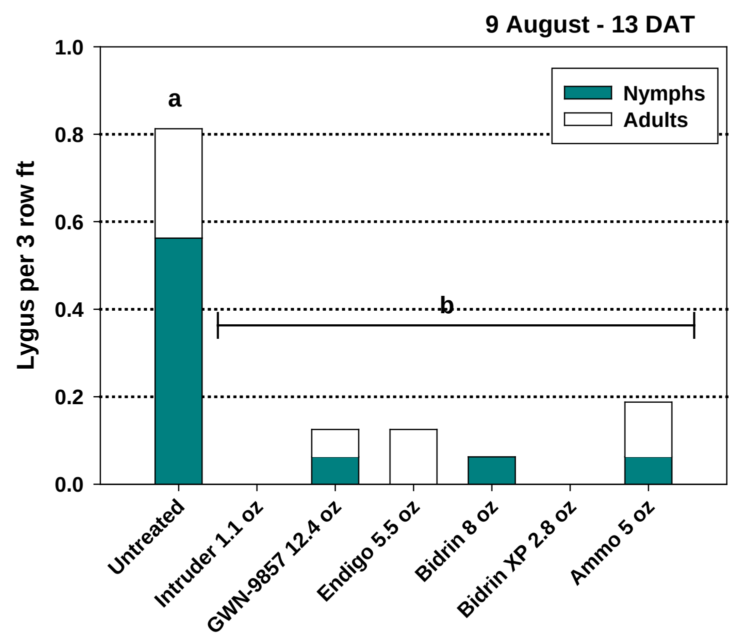

Figure 4. Lygus numbers at 13 days after treatment; bars capped by the same letter are not statistically different.

Evaluation of Sulfoxaflor for Control of Western Tarnished Plant Bug in Cotton

Cooperators: Casey Jones, Grower

David Kerns and Brant Baugh
Extension Entomologist-Cotton and EA-IPM Lubbock County

Lubbock County

Summary:

Sulfoxaflor is a new insecticide chemistry developed by Dow AgroScience. It will be marketed as Transform. Relative to Carbine at 2.5 oz/ac and Orthene 97 at 1.0 lb/ac, sulfoxflor preformed equally at the low rate of 1.43 oz/ac and appeared to have longer residual efficacy at 2.14 oz/ac. At 14 days after treatment, Lygus were averaging 9.25 per 6 ft-row in the untreated, 3.38 and 3.00 per 6 ft-row in the Carbine and Orthene plots respectively; and 0.38 per 6 ft-row in the sulfoxaflor at 2.14 oz/ac plots. Based on these data sulfoxaflor has excellent potential as a Lygus management tool on the Texas High Plains.

Objective:

The objective of this study was to evaluate the efficacy of sulfoxaflor relative to standard insecticides towards western tarnished plant bug.

Materials and Methods:

This test was conducted in a commercial cotton (PHY 375 WRF) field near Lubbock, TX. The field was planted on 40-inch rows, and irrigated using a pivot irrigation system. The test was a RCB design with four replications. Plots were 4-rows wide × 60 ft in length.

Insecticides were applied with a CO_2 pressurized hand-boom sprayer calibrated to deliver 10 gpa through TX-6 hollow cone nozzles (2 per row) at 40 psi. Insecticides were applied to all four rows of each plot on 26 Jul and 10 Aug.

The insecticides evaluated included XDE-208 (sulfoxaflor) at 0.71 and 1.07 lb-ai/ac (1.43 oz-product and 2.14 oz-product/ac. respectively), and the standards, Carbine at 1.16 lb-ai/ac (2.5 oz-product/ac)and Orthene 97 at 1.0 lb/ac. All treatments included Dyne-Amic non-ionic surfactant at 0.25% v/v.

Lygus populations were estimated on 29 Jul, and 2, 9 12, 16 and 23 Aug utilizing a 36-inch x 40-inch black drop cloth. Drop cloths were laid between the rows and approximately 1.5 row-ft of cotton were shaken onto the drop cloth from each row; four drop cloth samples were taken per plot.

All plots were hand harvested on 12 Oct using a HB stripper. An area of 1/1000th acre was harvest from the center two rows of each plot.

Data were analyzed using ANOVA, and means were separated using an F-protected LSD ($P \leq 0.05$).

Results and Discussion:

The Lygus in this test were western tarnished plant bugs, *Lygus hesperus* (Knight).

Sulfoxaflor is a new chemistry being developed by Dow AgroScience for control of sucking pests.

On 26 Jul (pretreatment count), the Lygus population was averaging 5.2 per 6 ft-row across all plots, and no statistical differences were detected among treatments (Figure 1). The treatment threshold for Lygus in Texas is 4 Lygus per 6 ft-row.

At 3 and 7 days after treatment (DAT), all of the insecticide treatments had fewer nymphs, adults and total Lygus than the untreated, and were equally effective (Figure 2).

At 14 DAT, all of the insecticides contained fewer Lygus than the untreated, and XDE-208 at 1.07 lb-ai/ac had fewer Lygus than either Orthene or Carbine (Figure 3). This suggests that at the higher rate, sulfloxalfor may provide longer residual control than high rates of Carbine and Orthene.

Following the second application, all of the insecticides had fewer Lygus than the untreated at 2 and 6 DAT (Figure 4). By 7 DAT, application 2, the Lygus population had declined across the entire test and no significant differences were detected (Figure 5).

There were no differences detected for yield among any of the treatments (data not presented). Yield average 1135 lbs-lint/ac across all plots.

Based on these data sulfoxaflor has excellent potential as a Lygus management tool on the Texas High Plains.

Acknowledgments:

Appreciation is expressed to Dow AgroScience and the Plains Cotton Improvement Program for financial support of this project.

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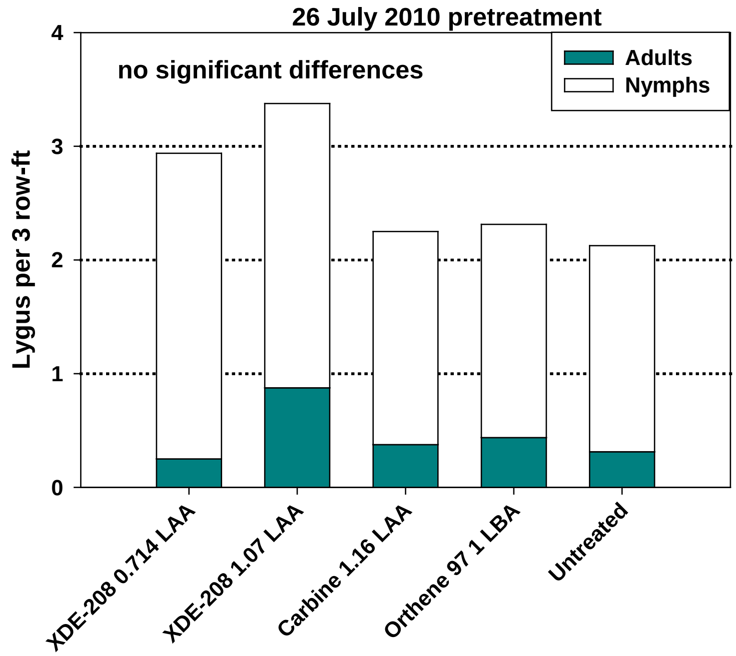

Figure 1. Number of Lygus prior to insecticide treatments.

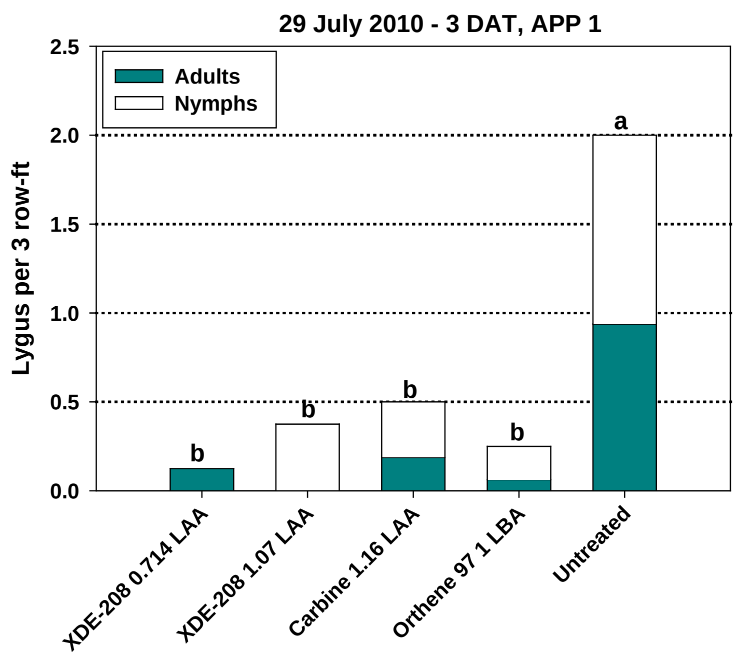

Figure 2. Number of Lygus 3 days after application 1; bars capped by the same letter are not significantly different.

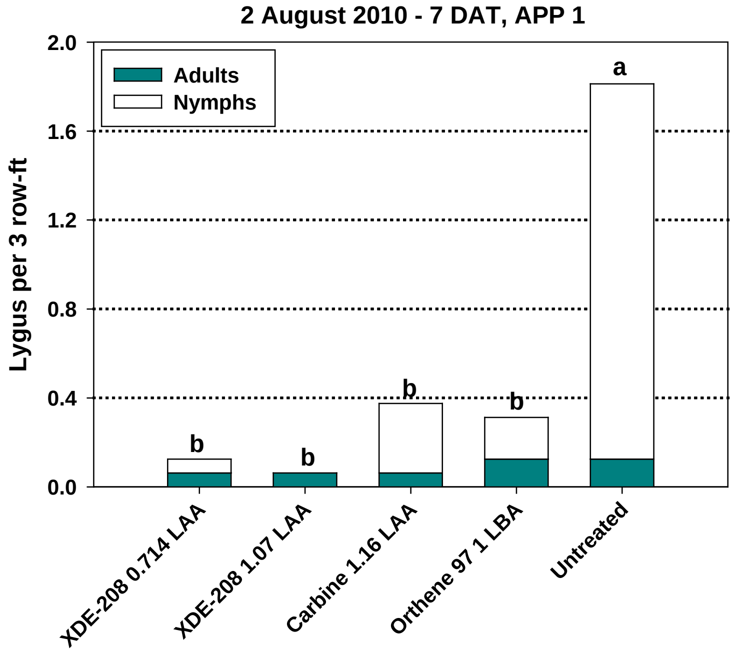

Figure 3. Number of Lygus 7 days after application 1; bars capped by the same letter are not significantly different.

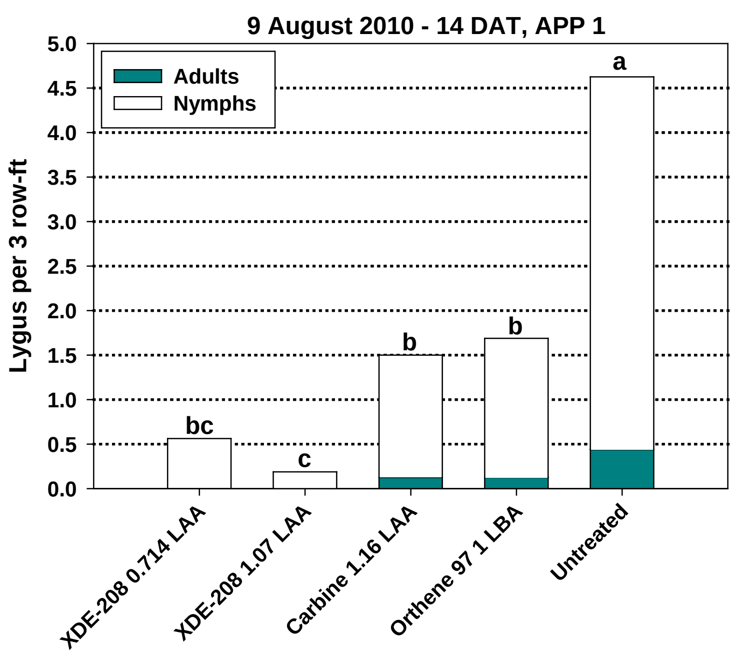

Figure 4. Number of Lygus 14 days after application 1; bars capped by the same letter are not significantly different.

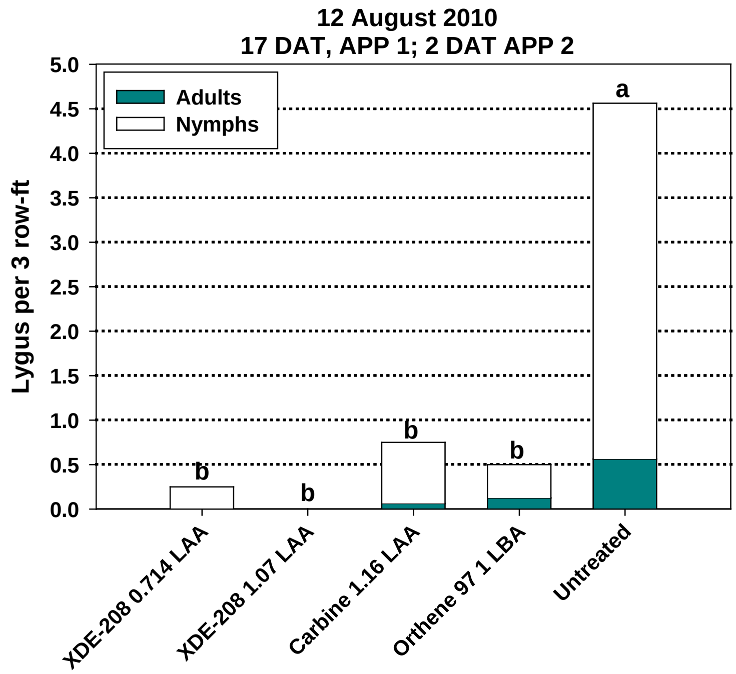

Figure 5. Number of Lygus 2 days after application 2; bars capped by the same letter are not significantly different.

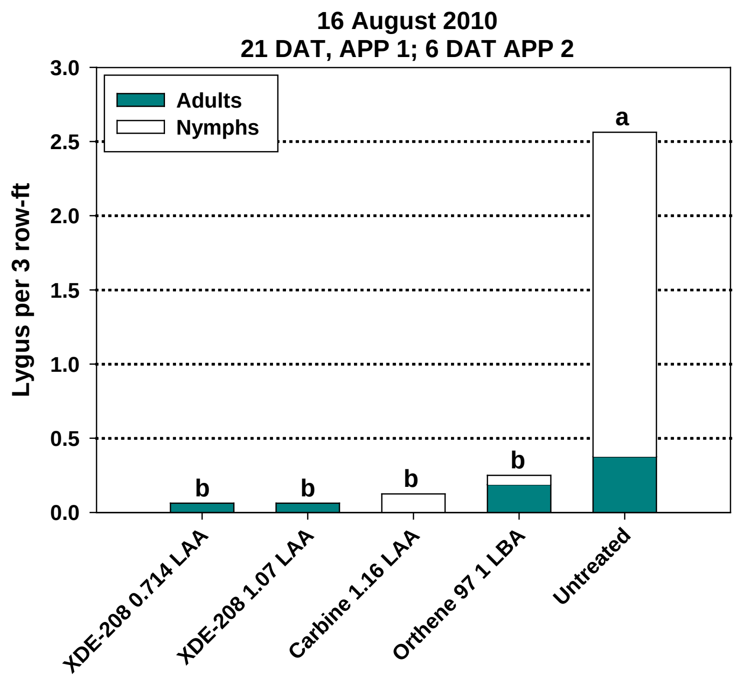

Figure 6. Number of Lygus 6 days after application 2; bars capped by the same letter are not significantly different.

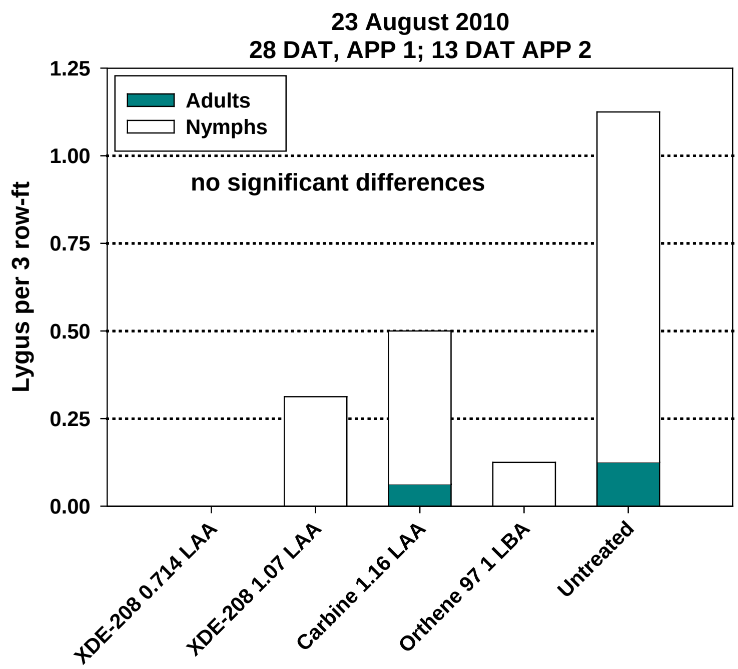

Figure 7. Number of Lygus 13 days after application 2.

Ability of Cotton to Compensate for Early-Season Fruit Loss and Impact on Yield and Lint Quality, 2010

Cooperators: Texas AgriLife Research and Extension Center, Lubbock

David Kerns, Tommy Doederlein, Brant Baugh and Dustin Patman
Extension Entomologist-Cotton, EA-IPM Dawson/Lynn Counties, EA-IPM Lubbock County and EA-IPM Crosby/Floyd Counties

Lubbock County

Summary:

Given sufficient time, similar to that experienced during 2010, cotton can fully compensate yield from 100% square loss at 18 days into squaring. However, compensated lint may be of lower quality than non-compensated lint. Like yield, the degree of lint quality degradation in compensated lint is undoubtedly associated with length of season.

Objective:

The objectives of this test were to assess the ability of cotton to compensate for early season square loss and the impact compensated fruit has on lint quality.

Materials and Methods:

This test was conducted at the Texas AgriLife Research and Extension Center in Lubbock, TX. The cotton variety, ‘Phytogen 375 WRF’, was planted on 1 June 2010 on 40-inch rows and was irrigated as needed using furrow run irrigation. Plots were 1 row wide x 14-feet long. The test was a randomized complete block design with 4 replicates.

Plots were evenly thinned to 28 plants per plot (26,136 plants per acre) on 13 July 2010. All abnormally small or deformed plants were removed leaving a uniform plant population.

Treatments consisted of 0, 20, 40, 60, 80 and 100% manual square removal on pre-bloom cotton. On 13 July 2010, all of the squares in each plot were counted and numbered. The numbered squares from each plot were then randomized and removed based on the treatment percentage. Squares slated for removal were removed using fine forceps on 13 July 2010. At that time the plants were approximately 18 days into squaring and averaged 13.7 nodes across all treatments.

At harvest on 10 November 2010, 10 plants from each plot were plant mapped and the entire plot was hand harvested. Samples were ginned at the Texas AgriLife Ginning Facility in Lubbock. Lint samples were submitted to the International Textile Center at Texas Tech University for HVI analysis, and USDA Commodity Credit Corporation (CCC) loan values were determined for each treatment by plot.

All count data were analyzed using PROC GLM and the means were separated using an F protected LSD ($P \leq 0.05$). Relationships were determined by using linear regression models.

Results and Discussion:

Impact on Yield

The 2010 growing season in Lubbock was marked by wet weather in June and July, dry conditions in August, and a prolonged warm fall that facilitated cotton maturation. Thus, the possibility of achieving full compensation for yield and fiber maturity were high during this test. Consequently, we could not detect any differences in yield among the treatments. This suggests that even the 100% square removal treatment was able to compensate (Figure 1).

Impact on Bolls and Node Quantity

Although plots had as much as 100% of their early squares removed, there were no significant differences among treatments in the total number of bolls produced or the number of fruiting nodes per plant (Figures 2A & B). Thus, it appears that compensation in yield was primarily from adding bolls to replace missing fruit rather than increasing the size or quantity of the surviving fruit.

Impact on Fruiting Pattern

Plants in the 20, 40 and 100% square removal treatments had fewer bolls on the lower portion of the plant (nodes 11+) than plants where there were no squares removed (Figure 3A). This would be expected since we physically removed squares from this area. However, if the plant compensated by adding second and third position squares, primarily in this area, one would expect there to be no differences. Additionally, there were no differences among treatments in the ratio of lower bolls to upper bolls, which further supports the conclusion that replacement fruit was uniformly distributed from top to bottom (Figure 3B).

There were more first position bolls where no squares were removed, no differences in second position squares, and it appeared that third position squares increased relative to the number of squares removed . (Figure 4A). This is also evident when comparing boll distribution relative to total bolls per plant (Figure 4B). Thus, it appears that the compensated fruit were third position bolls and, based on vertical distribution (Figure 3A & B), were uniformly distributed from top to bottom.

Impact on Lint Quality

Significant differences in qualitative parameters among the square removal treatments were not detected based on GLM ($P > 0.05$), but trends were observed.

Compensated bolls tended to have lower micronaire and higher fiber strength qualities (Figures 5A and B). Lower micronaire is indicative of immature cotton fibers and suggests that compensated bolls did not have sufficient time to mature. This is not uncommon for cotton with a truncated growing season, especially for fruit produced later in the season (i.e. third position bolls).

The trend detected for increased fiber strength with more square removal is a function of micronaire (Figure 5B). Increased strength is commonly associated with decreasing micronaire.

A trend was also detected for the degree of yellowness (+b) (Figure 6). Yellowness increased with increasing early square removal. Similar to low micronaire, increased yellowness is indicative of immature cotton fibers. Thus, further supporting the premise that compensated bolls are more likely to suffer qualitatively.

Although we detected trends in reduced lint quality with regard to increasing square removal (Figures 5 & 6), it did not significantly impact loan value based on GLM ($P > 0.05$) (Figure 7). Thus, even 100% pre-bloom square removal did not significantly affect yield or overall quality as it relates to loan values. However, keep in mind that these data are representative of the Lubbock area during a year with a prolonged growing season. In coolers climates or in situations favoring a shorter growing season, the impact on lint maturity and/or yield may be adversely affected.

Acknowledgments:

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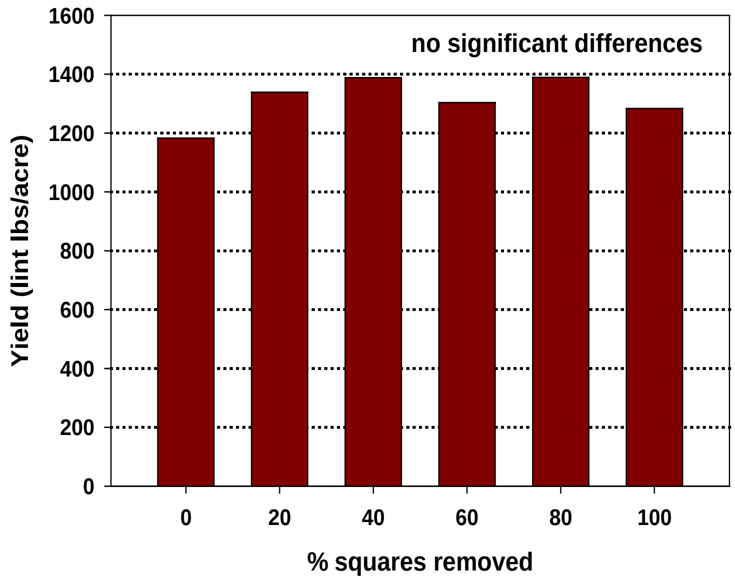

Figure 1. Impact of pre-bloom square removal on yield; no significant differences among treatments based on an F protected LSD (*P* > 0.05).

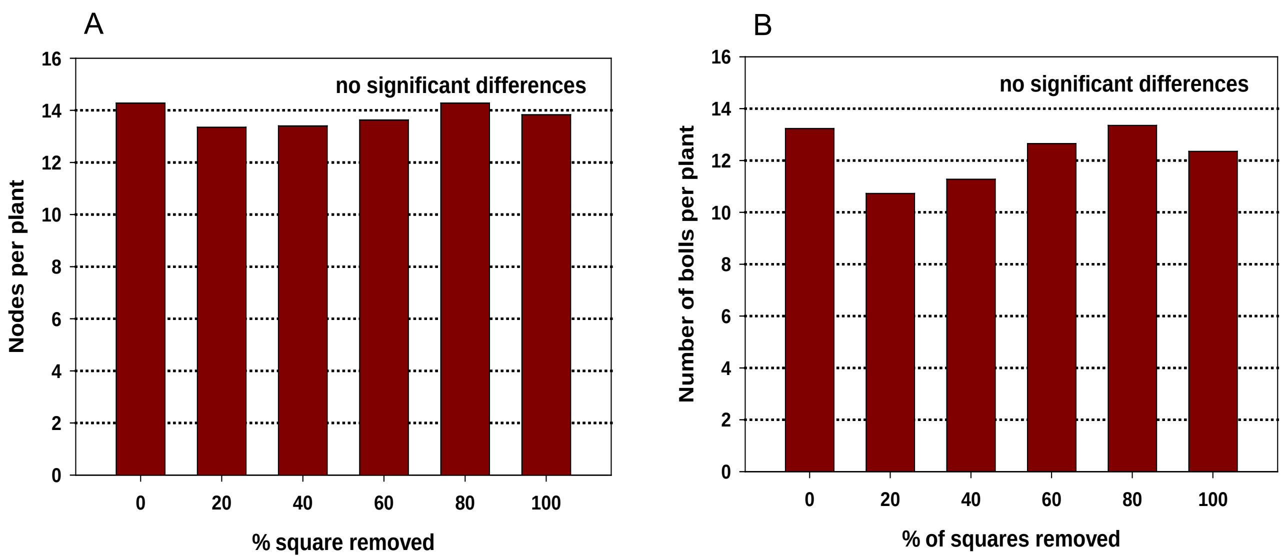

Figure 2 (A) Impact of pre-bloom square removal on the number of nodes per plant and (B) bolls per plant; no significant differences among treatments based on an F protected LSD (*P* > 0.05).

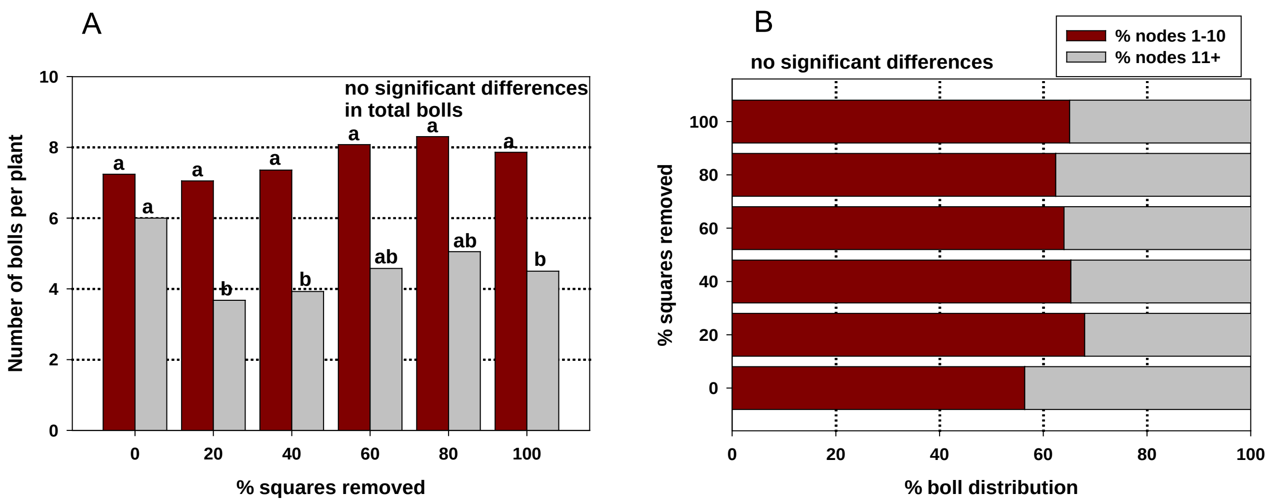

Figure 3. A) Number of bolls in the upper (nodes 1-10) and lower (nodes 11+) portions of the plant and B) vertical distribution as % of bolls within the top and bottom portions of the plant; similar colored bars capped by the same letter are not different based on an F protected LSD (*P* > 0.05).

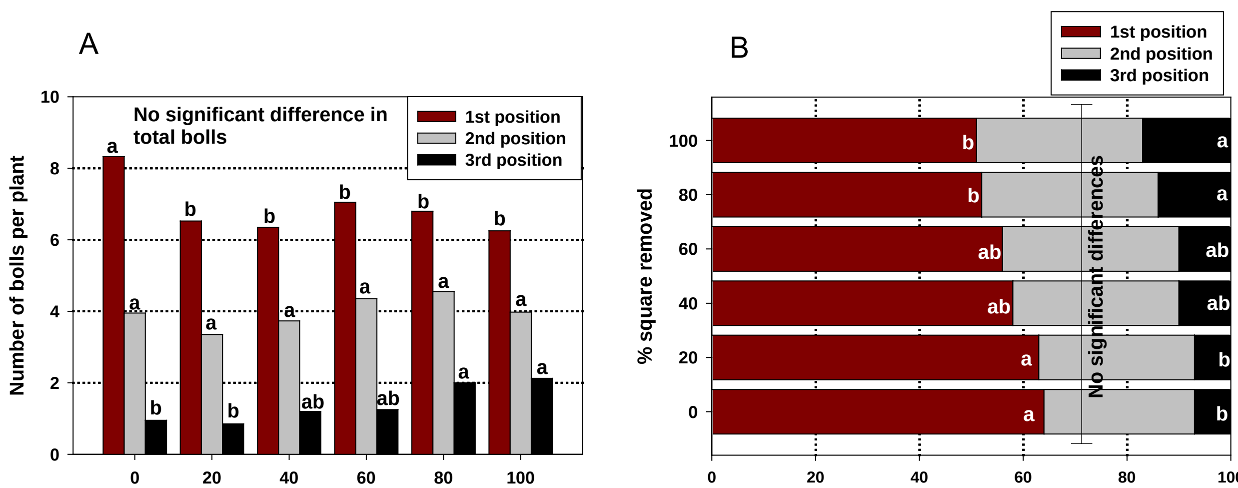

Figure 4. (A) Number of bolls in the upper (nodes 1-10) and lower (nodes 11+) portions of the plant and (B) vertical distribution as % of bolls within the top and bottom portions of the plant; similar colored bars capped by the same letter are not different based on an F protected LSD (*P* > 0.05).

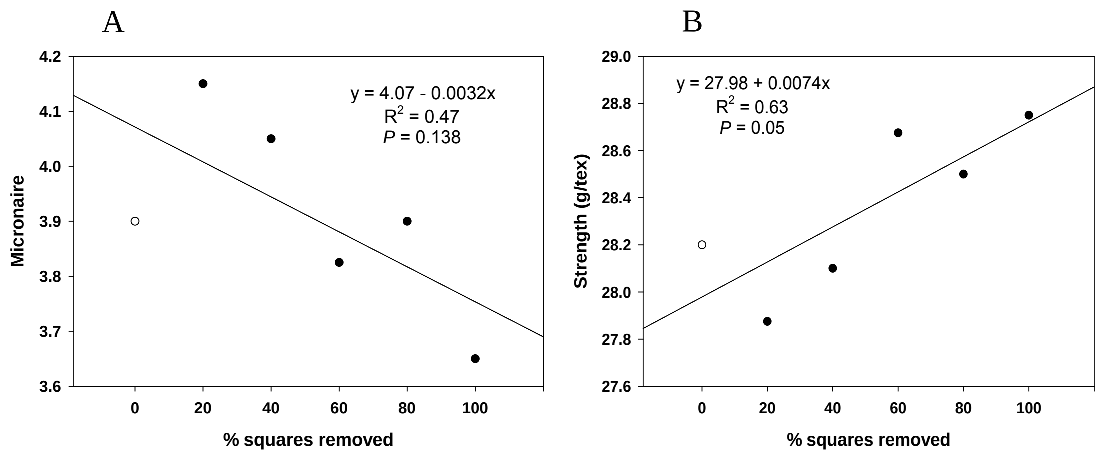

Figure 5. Linear relationships between % of squares removed and fiber (A) micronaire and (B) strength

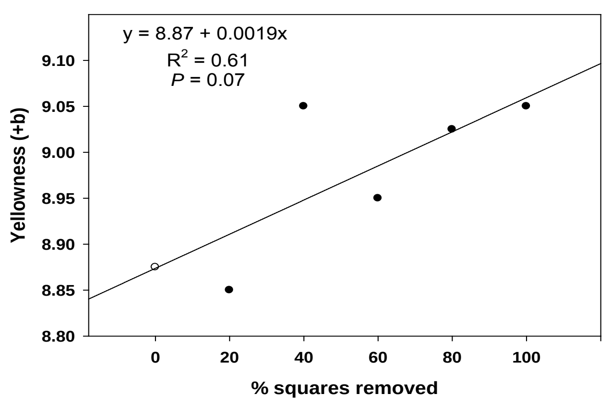

Figure 6. Linear relationship between % of squares removed and fiber yellowness.

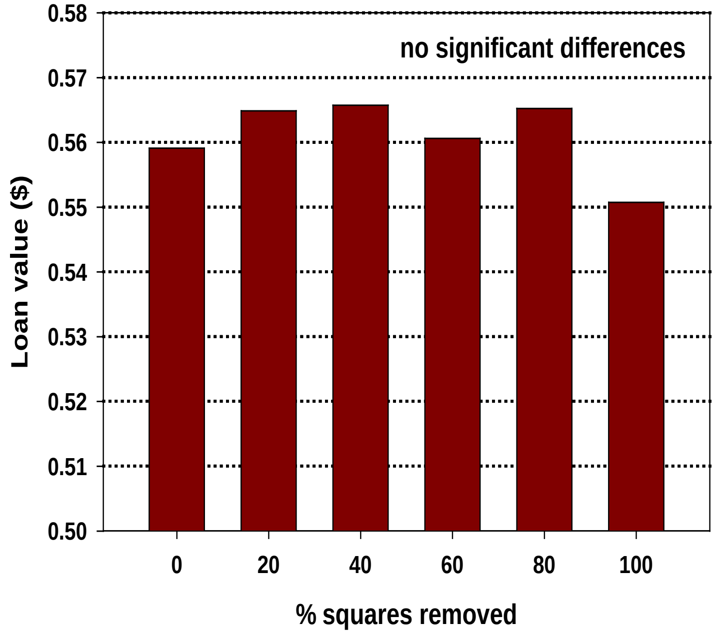

Figure 7. Impact of early square removal on loan values; no significant differences among treatments based on an F protected LSD (P > 0.05).

Field Validation of the Texas Cotton Spider Mite Action Threshold, 2010

Cooperators: Rex Isom, Grower

David Kerns, Brant Baugh and Bo Kesey
Extension Entomologist-Cotton, EA-IPM Lubbock County, Extension Program Specialist-Cotton

Lubbock County

Summary:

Spider mites are an occasional pest of cotton in the Texas High Plains. Outbreaks of mites in cotton tend to be associated with high early-season rainfall and insecticide applications targeting other pests. There are two types of classifications for spider mite damage, phase I and phase II. Phase I is early stages of damage where only stipules appear on the leaves. Phase II damage is actual reddening of the leaves. Phase II damage is associated with decreased photosynthesis and yield loss. The current Texas action threshold is to treat when 50% of the plants observed show noticeable signs of reddening (phase II damage). However, there has not been sufficient data supporting this threshold. Based on our data, the current Texas threshold of a treatment at 50% damage is probably valid. The 50% hits treatment was the highest yielding; producing over 1250 lbs of lint per acre. The 70 and 90% hits treatments did not differ from the untreated. Future testing will determine if treatments under 50% hits are advised.

Objective:

The objective of this study was to field validate the current Texas spider mite action threshold.

Materials and Methods:

This test was conducted on a farm near Idalou, TX. The variety FM 9180 B2F was grown on forty-inch rows irrigated with a sub-surface drip system. The test was a randomized complete block design with four replicates. Treatments were 30, 50, 70 and 90% phase II damage. A “glance and go” method was used to calculate the ratio of hits to misses. A “hit” was recognized as apparent phase II damage and a "miss" was recognized as no apparent damage. 25 samples were recorded per plot. When the ratio of "hits" to "misses" reached the designated percentage, a treatment of Oberon at 4 fl-oz. per acre was initiated. Oberon was applied with a CO_2 pressurized hand-boom sprayer calibrated to deliver 10 gpa through TX-6 hollow cone nozzles (2 per row) at 40 psi. Lint samples were taken using a hand basket stripper on 8 October. One one-thousandth of an acre was harvested and ginned at the ginning facility at the Texas AgriLife Research and Extension Center in Lubbock, TX and yields were then recorded. All data were analyzed using ANOVA, and means were separated using an F protected LSD ($P \leq 0.05$).

Results and Discussion:

Based on our data, treatments initiated at each percentage stopped the damage from progressing further, while the untreated continued to increase (Figure 1). In this test, the 30% treatment was missed. The ratio of hits to misses was already over 30% when we entered the field.

Yield data suggests that the current Texas threshold of a treatment at 50% damage is probably valid. The 50% hits treatment was the highest yielding plot, yielding over 1250 lbs of lint per acre (Figure 2). The 70 and 90% hits treatments did not differ from the untreated. Future testing will determine if treatments under 50% hits are advised.

Acknowledgments:

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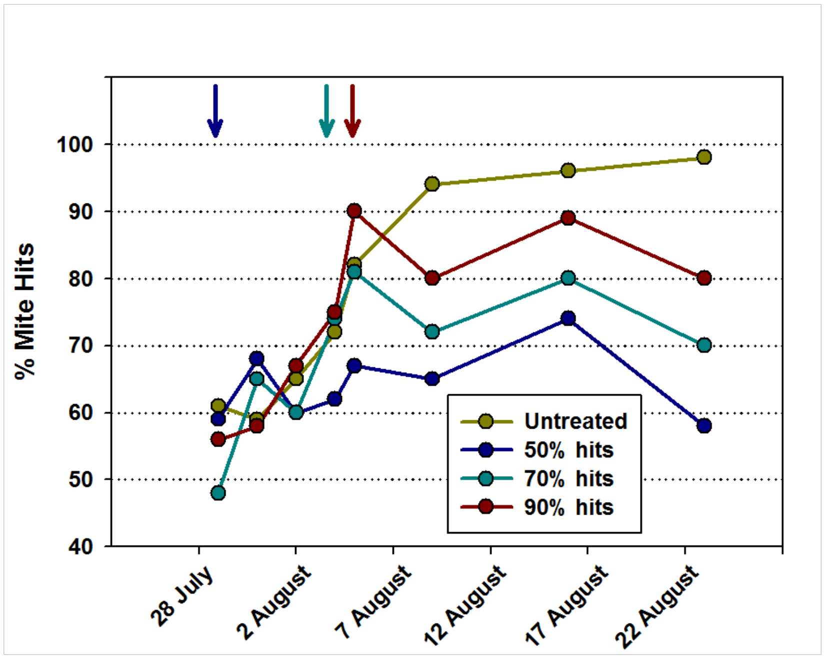

Figure 1. Percent of plants with spider mite hits in the form of leaf reddening.

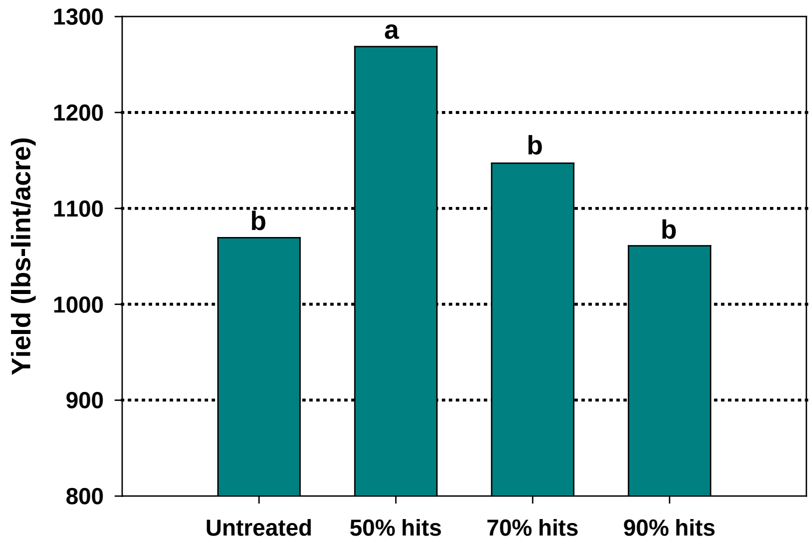

Figure 2. Columns capped with the same letter are not significantly different based on an F protected LSD (*P* > 0.05).

Evaluation of Miticides for Spider Mite Control in Cotton in the South Plains Region of Texas 2010 – Test A

Cooperators: Rex Isom, Grower

David Kerns, Brant Baugh and Bo Kesey
Extension Entomologist-Cotton, EA-IPM Lubbock County, Extension Program Specialist-Cotton

Lubbock County

Summary:

Portal at 1 pt/ac, GWN-1708 (fenazaquin) at 24 fl-oz/ac, and Athena at 13.45 fl-oz all provided exceptional control of twospotted spider mites in cotton. Athena needs to be evaluated at lower rates. Brigade provided initial knockdown but experienced some mite resurgence. Although we were unable to detect differences in yield among treatments, we were able to show that yield decreased with increasing mite days. This suggests that mites negatively impacted yield at the population, and length of time experienced in this test.

Objective:

The objective of this study was to investigate the efficacy of miticides at mitigating spider mite outbreaks in cotton.

Materials and Methods:

This test was conducted in a commercial cotton field grown near Idalou, TX. The field was on 40-inch rows, and was irrigated using a subsurface drip irrigation system. The test was a RCB design with four replications. Plots were 4-rows wide × 60 ft in length.

Miticides were applied with a CO_2 pressurized hand-boom sprayer calibrated to deliver 10 gpa through TX-6 hollow cone nozzles (2 per row) at 40 psi. Insecticides were applied to all four rows of each plot on 4 Aug. Miticides evaluated included: GWN-1708 (fenazaquin) Portal (fenproximate), Athena (abamectin + bifenthrin) and Brigade (bifenthrin).

A pre-treatment count was made on 3 Aug. Post treatment evaluations were made at 6, 12 and 19 days after treatment (DAT). Treatments were evaluated by collecting 5, mid-canopy leaves per plot and returning these to the laboratory where the mites were removed onto a liquid detergent coated glass plate with a mite brush. Mite eggs, larvae and adults were counted from the middle 1-inch diameter area of the glass plate. Mite population data discussed is the number per 1-inch diameter mite brush sample per leaf.

Mite days were calculated where : Mite-day = ((mean mites/sample on day X + mean mites/sample on day Y) / 2) Y-X. Mite days were accumulated for the time of the test.

All plots were hand harvested on 8 Oct using a HB stripper. An area of 1/1000th acre was harvest from the center two rows of each plot.

Data were analyzed using ANOVA and means were separated using an F-protected LSD ($P \leq 0.05$). Mite days were correlated with yield using a simple linear regression model.

Results and Discussion:

The predominate mite species in the test appeared to be twospotted spider mite, *Tetranychus urticae*. On 3 Aug, prior to miticide application, the mite population was high, averaging 52.88 motiles across all treatments, and there were no significant differences among treatments for any mite stage (Table 1).

At 6 days after treatment (DAT), the mite population had increased in the untreated to 169.5 motiles, and all of the miticides had fewer mites of all stages than the untreated.

By 12 DAT, the mite population was in general decline (Table 2). At this time GWN-1708 at 16 fl-oz (low rate) did not differ from the untreated in eggs. Athena had the fewest eggs but was not significantly better than Portal or Brigade. Results were similar toward larvae, adults and motiles. Against motiles, Athena did not differ from Portal, Brigade or GWN-1708 at 24 fl-oz (high rate). Athena should be evaluated at lower rates.

Although lower than at the 6 DAT evaluation, the number of mites at 19 DAT remained relatively high averaging 51.75 motiles in the untreated. At this time the number of eggs and adult mites in the Brigade treated plots had increased and no longer differed from the untreated. The remaining treatments were equivalent.

All of the miticides evaluated appeared to have good knockdown activity of the mite population. However, the efficacy of Brigade appeared transitory. We have observed this with Brigade in grower fields where initial control would look good, but the mite population would resurge and require re-treatment. As long as the mite population is in or near decline, Brigade would probably demonstrate acceptable performance.

Although we were unable to detect differences in yield among treatments (Table 2), we were able to show that yield decreased with increasing mite days (Figure 1). This suggests that mites negatively impacted yield at the population, and length of time experienced in this test.

Acknowledgments:

Appreciation is expressed to the Gowan Company Ag Products and the Plains Cotton Improvement Program for financial support of this project.

Disclaimer Clause:

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Table 1.

Treatment /formulation	Rate amt product/acre	3 Aug (pre-treatment)[a] eggs	larvae	adults	motiles	10 Aug (6 DAT)[a] eggs	larvae	adults	motiles
Untreated	--	75.25a	30.25a	9.50b	39.75a	70.25a	128.75a	40.75a	169.50a
GWN-1708 20SC	16 fl-oz	73.75a	36.00a	20.75b	56.75a	28.50b	31.00b	18.50b	49.50b
GWN-1708 20 SC	20 fl-oz	144.75a	54.75a	40.75a	95.50a	26.50b	27.75b	10.25b	38.00b
GWN-1708 20 SC	24 fl-oz	69.75a	21.25a	13.25b	34.50a	20.25b	18.75b	12.00b	30.75b
Portal 4 EC	1.0 pt	76.00a	31.50a	18.50b	50.00a	23.00b	22.75b	12.75b	35.50b
Athena	13.45 fl-oz	86.25a	43.00a	21.00b	64.00a	18.00b	14.75b	9.25b	24.00b
Brigade 2EC	6.4 fl-oz	77.75a	51.00a	14.50b	65.50a	18.00b	15.50b	10.50b	26.00b

Values in a column followed by the same letter are not significantly different based on an F-protected LSD ($P \leq 0.10$).
[a]Values represent the number of mites per leaf sampled using a mite brush and counting the number within a 1-inch diameter area.

Table 2.

Treatment/ formulation	Rate amt product/acre	16 Aug (12 DAT)[a] eggs	larvae	adults	motiles	23 Aug (19 DAT)[a] eggs	larvae	adults	motiles	8 Oct Yield Lint (lbs/acre)
Untreated	--	48.75a	19.75a	17.75a	37.50a	53.50a	32.00a	19.75a	51.75a	929.96a
GWN-1708 20SC	16 fl-oz	32.50ab	10.50bcd	11.00b	21.50bc	12.25b	7.50bc	8.50bc	16.00c	1067.60a
GWN-1708 20 SC	20 fl-oz	30.50b	14.25ab	8.75bc	23.00b	5.50b	7.25bc	12.75ab	20.00bc	1019.80a
GWN-1708 20 SC	24 fl-oz	24.75bc	7.75cd	5.75c	13.50cd	1.00b	2.00c	2.50bc	4.50c	1150.45a
Portal 0.4 EC	1.0 pt	18.75bcd	12.50bc	7.50bc	20.00bcd	8.00b	1.25c	7.00bc	8.25c	1199.24a
Athena	13.45 fl-oz	2.50d	6.75d	6.00c	12.75d	2.50b	2.25c	1.50c	3.75c	1068.21a
Brigade 2EC	6.4 fl-oz	8.25cd	10.75bcd	9.25bc	20.00bcd	59.25a	15.25b	19.75a	35.00ab	1139.09a

Values in a column followed by the same letter are not significantly different based on an F-protected LSD ($P \leq 0.10$).
[a]Values represent the number of mites per leaf sampled using a mite brush and counting the number within a 1-inch diameter area.

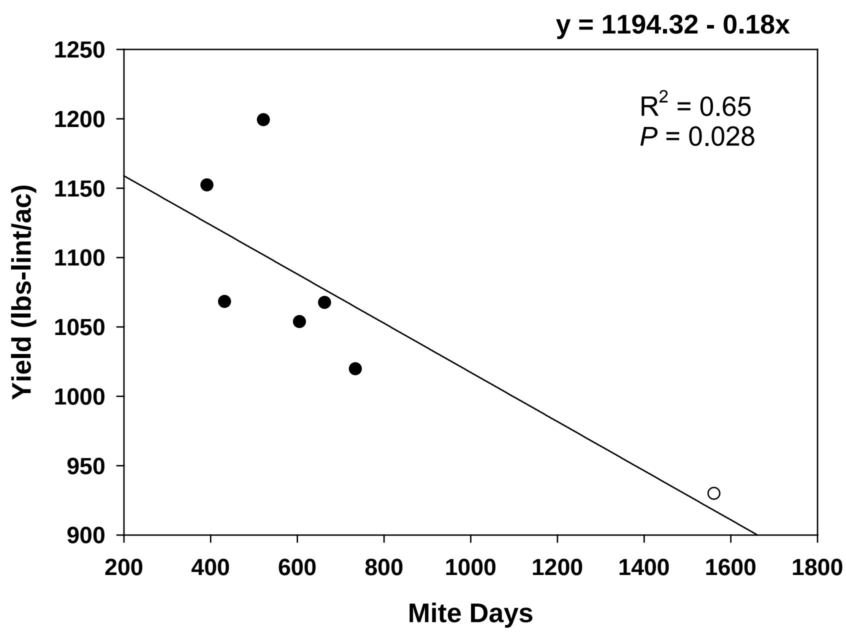

Figure 1. Relationship between mite population and length of infestation on yield.

Evaluation of Miticides for Spider Mite Control in Cotton in the South Plains Region of Texas 2010 – Test B

Cooperators: Rex Isom, Grower

David Kerns, Brant Baugh, Bo Kesey
Extension Entomologist-Cotton, EA-IPM Lubbock County, Extension Program Specialist-Cotton

Lubbock County

Summary:

Oberon at 4 or 8 fl-oz/ac, Epi-Mek at 8 fl-oz/ac and Zeal at 1 oz/ac all provided acceptable control of two-spotted spider mites in cotton. The addition of 28% UAN to Oberon did not increase its efficacy, and may in fact have hindered it. Zeal was the only miticide that did not differ from the untreated in the number of mite eggs. Zeal is known to cause mites to lay sterile eggs and thus the accumulation and presence of eggs is not necessarily indicative of poor activity.

Objective:

The objective of this study was to investigate the efficacy of miticides at mitigating spider mite outbreaks in cotton.

Materials and Methods:

This test was conducted in a commercial cotton field grown near Idalou, TX. The field was planted on 40-inch rows, and was irrigated using a subsurface drip irrigation system. The test was a RCB design with four replications. Plots were 4-rows wide × 60 ft in length.

Miticides were applied with a CO_2 pressurized hand-boom sprayer calibrated to deliver 10 gpa through TX-6 hollow cone nozzles (2 per row) at 40 psi. Insecticides were applied to all four rows of each plot on 4 Aug. Miticides evaluated included: Oberon (spiromesifin) Epi-Mek (abamectin) and Zeal (etoxazole). Oberon was evaluated at 4 and 8 fl-oz/ac with and without the addition 28% UAN, which was added to determine if it increased absorption and efficacy. All treatments included Dyn-Amic at 0.25% v/v.

A pre-treatment count was made on 3 Aug. Post treatment evaluations were made at 6, 12 and 19 days after treatment (DAT). Treatments were evaluated by collecting 5, mid-canopy leaves per plot and returning these to the laboratory where the mites were removed onto a liquid detergent coated glass plate with a mite brush. Mite eggs, larvae and adults were counted from the middle 1-inch diameter area of the glass plate. Mite population data discussed is the number per 1-inch diameter mite brush sample per leaf.

Mite days were calculated where : Mite-day = ((mean mites/sample on day X + mean mites/sample on day Y) / 2) Y-X. Mite days were accumulated for the time of the test.

All plots were hand harvested on 8 Oct using a HB stripper. An area of 1/1000th acre was harvest from the center two rows of each plot.

Data were analyzed using ANOVA and means were separated using an F-protected LSD ($P \leq 0.05$). Mite days were correlated with yield using a simple linear regression model.

Results and Discussion:

The predominate mite species in the test appeared to be two-spotted spider mite, *Tetranychus urticae*. On 3 Aug, prior to miticide application, the mite population was high averaging 54.14 motiles across all treatments, and there were no significant differences among treatments for any mite stage (Table 1).

At 6 days after treatment (DAT), the mite population had declined to 31.5 motiles in the untreated, but all of the miticides had fewer motiles and larvae than the untreated. Among the miticides, Oberon at 8 fl-oz had the fewest motiles, but was not statistically different from Oberon at 4 fl-oz, Oberon at 8 fl-oz + UAN, or Epi-Mek. Zeal was the only miticide that did not differ from the untreated in the number of mite eggs. Zeal is known to cause mites to lay sterile eggs and thus the accumulation and presence of eggs is not necessarily indicative of poor activity.

At 12 DAT, all of the miticides had fewer mites of all life stages than the untreated (Table 2). Epi-Mek and Oberon at 8 fl-oz had the fewest motiles, but did not differ from any other miticides expect Zeal. Zeal-treated plots contained more eggs than Oberon at 4 fl-oz.

By 19 DAT, the mite population had declined substantially and there were no differences among treatments. Overall, as expected Zeal appeared slower acting than the other miticides, and the inclusion of UAN with Oberon did not enhance activity.

Although we were unable to detect differences in yield among treatments (Table 2), we were able to show that yield decreased with increasing mite days (Figure 1). This suggests that mites negatively impacted yield at the population, and length of time experienced in this test.

Acknowledgments:

Appreciation is expressed to Bayer CropScience and the Plains Cotton Improvement Program for financial support of this project.

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Table 1.

Treatment/formulation	Rate amt product/acre	3 Aug (pre-treatment)[a]				10 Aug (6 DAT)[a]			
		eggs	larvae	adults	motiles	eggs	larvae	adults	motiles
Untreated	--	103.00a	39.25a	17.25a	56.50a	55.50a	16.75a	14.75a	31.50a
Oberon 4SC	4 fl-oz	90.00a	39.75a	14.00a	53.75a	3.00c	7.00bc	7.25a	14.25bcd
Oberon 4SC	8 fl-oz	48.50a	22.00a	13.50a	35.50a	3.25c	4.25c	6.25a	10.50d
Oberon 4SC + UAN 28%	4 fl-oz + 0.25% v/v	69.00a	33.50a	13.25a	46.75a	11.00bc	11.00b	13.25a	24.25ab
Oberon 4SC + UAN 28%	8 fl-oz + 0.25% v/v	93.00a	39.00a	18.50a	57.50a	21.75bc	9.00bc	8.00a	17.00bcd
Epi-Mek 0.15 EC	8 fl-oz	56.50a	23.50a	8.75a	32.25a	1.75c	6.50bc	5.75a	12.25cd
Zeal 72WP	1.0 oz	139.25a	79.00a	17.75a	96.75a	35.00ab	7.00bc	14.75a	21.75abc

Values in a column followed by the same letter are not significantly different based on an F-protected LSD ($P \leq 0.10$).
[a]Values represent the number of mites per leaf sampled using a mite brush and counting the number within a 1-inch diameter area.

Table 2.

Treatment/ formulation	Rate amt product/acre	3 Aug (pre-treatment)[a]				10 Aug (6 DAT)[a]			
		eggs	larvae	adults	motiles	eggs	larvae	adults	motiles
Untreated	--	103.00a	39.25a	17.25a	56.50a	55.50a	16.75a	14.75a	31.50a
Oberon 4SC	4 fl-oz	90.00a	39.75a	14.00a	53.75a	3.00c	7.00bc	7.25a	14.25bcd
Oberon 4SC	8 fl-oz	48.50a	22.00a	13.50a	35.50a	3.25c	4.25c	6.25a	10.50d
Oberon 4SC + UAN 28%	4 fl-oz + 0.25% v/v	69.00a	33.50a	13.25a	46.75a	11.00bc	11.00b	13.25a	24.25ab
Oberon 4SC + UAN 28%	8 fl-oz + 0.25% v/v	93.00a	39.00a	18.50a	57.50a	21.75bc	9.00bc	8.00a	17.00bcd
Epi-Mek 0.15 EC	8 fl-oz	56.50a	23.50a	8.75a	32.25a	1.75c	6.50bc	5.75a	12.25cd
Zeal 72WP	1.0 oz	139.25a	79.00a	17.75a	96.75a	35.00ab	7.00bc	14.75a	21.75abc

Values in a column followed by the same letter are not significantly different based on an F-protected LSD ($P \leq 0.10$).

[a]Values represent the number of mites per leaf sampled using a mite brush and counting the number within a 1-inch diameter area.

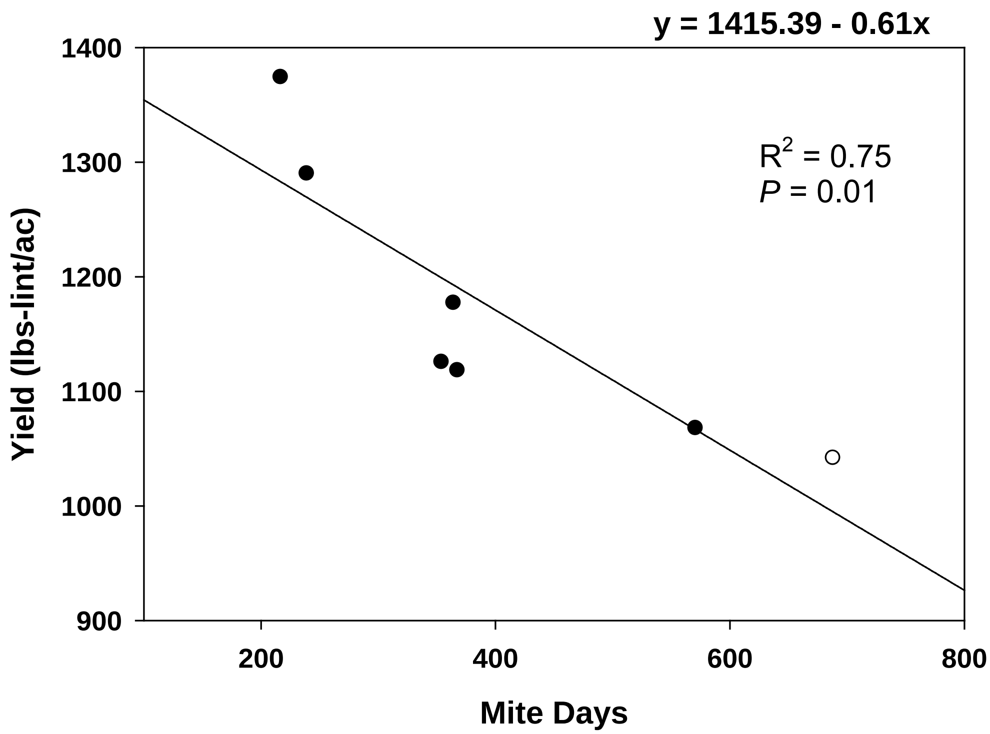

Figure 1. Relationship between mite population and length of infestation on yield

Bollgard II Roundup Flex, Widestrike Roundup Flex and Conventional Systems Comparisons

Cooperators: Sammy Harris, Casey Jones and Bob Melcher, Growers

David Kerns, Kerry Siders and Brant Baugh
Extension Entomologist-Cotton, EA-IPM Hockley/Cochran Counties and EA-IPM Lubbock County

Hockley and Lubbock County

Summary:

Conventional cotton is undoubtedly going to require more intensive weed and insect management than Bollgard II RF and Widestrike RF cotton to avoid yield loss. However, if applications are timed properly and effort is made to maximize efficiency by completing multiple tasks per trip across the field, growing conventional cotton can be cost effective as long as yields based on agronomic characteristic are similar. Management of Bollgard II RF and Widestrike RF cotton varieties appear essentially the same.

Objective:

Quantitatively compare Bollgard II RF (BG2RF), Widestrike RF (WSRF) and conventional cotton systems. Quantify differences in production (e.g. trips across the field, number of applications made for weed control, end of season ratings, yield, etc.) under actual on-farm large scale grower production systems.

Materials and Methods:

Four fields were identified, two in Hockley County and two in Lubbock County for comparison. The Hockley County fields were managed similarly as were the Lubbock County fields. The Hockley County fields consisted of one Bollgard II RF variety (Table 1) and one conventional variety (Table 2). The Lubbock County sites were a Bollgard II RF variety (Table 3) and a Widestrike RF variety (Table 4).

Spray application records were kept consisting of products used, targets, costs, application method, etc. Yield, Loan value data were collected and the number of damaged bolls was estimated by sampling 100 bolls from three locations in each field and counting the number of worm damaged bolls. Weed control was also estimated by inspecting three locations of each field and rating percent control on a 0-100 scale.

These are simply comparison and cannot be statistically analyzed and all results should be interpreted very cautiously.

Results and Discussion:

Hockley County

Neither of the Hockley County sites were treated for Lepidopterous pests although the conventional variety did suffer an estimated 11% worm damaged bolls at the end of the season (Tables 1 and 2). Keep in mind that the 11% value does not reflect squares and bolls that were fed upon and shed. The actually yield loss due to worms is not certain, but it was obvious that the BG2RF variety was protected from significant worm feeding.

Weed control was excellent at both locations. The BG2RF site required two application of Roundup (Table 1). Total herbicide + application costs were $18.00/A. If you calculate the tech fee (estimate $10.00 for Bt and $31.86 for RF), the total herbicide program cost was $49.86, and utilized a single herbicide mode of action. The conventional site required an application of a pre-plant incorporated yellow herbicide, an at-planting application of Staple and an application of Roundup (Table 2). Total herbicide + application costs were $36.75/A, and utilized three herbicide mode of actions.

Although the conventional cotton required one additional trip for herbicide application, because one of the applications was timed at planting, the cost of the application is mitigated.

Lubbock County

Neither of the Lubbock County sites were treated for Lepidopterous pests and both sites had little to no boll damage (Tables 3 and 4). The WSRF variety did suffer an estimated 1% worm damaged bolls, and required an insecticide application targeting Lygus. Endigo was utilized for Lygus control and this product would have reduced the number of bollworms, but it is doubtful if this significantly reduced the number of damaged bolls.

Weed control was exceptional at both locations, with each site requiring two applications of Glyphosate for weed control, and costs were similar.

There were no evident differences in managing the BGIIRF vs the WSRF variety based on weed or Ledidopterous insect control.

Acknowledgments:

Appreciation is expressed to Monsanto for financial support of this project.

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Table 1.

Hockley Co.	Grower:	Consultant:	Variety:	Plant date:	Seed rate:	Acres:	Irrigation:
Levelland, TX	Sammy Harris	Kerry Siders	ST 4288 B2F	17 May 2010	4.1 per ft	33	Center Pivot

Cost of seed = $75.00/A ($41.86 Tech fees)

Date	Product	Rate (amt/A)	Application Method	Target	Product ($/A)	Application ($/A)	Total ($/A)
17 May	Temik 15G	5 lbs	At plant, in-furrow	Nematodes & Thrips	14.00	3.50	17.50
1 June	Roundup	32 oz	Ground, broadcast	Weeds	6.00	3.50	9.50
4 August	Roundup	22 oz	Ground, broadcast	Weeds	5.00	3.50	8.50
13 October	ET + Prep	1.5 oz + 1 qt	Ground, broadcast	Harvest Aid	11.00	3.50	14.50
Insecticide Totals			**1 trip**		**14.00**	**3.50**	**17.50**
Herbicide Totals			**2 trips**		**11.00**	**7.00**	**18.00**
PGR Totals			**0 trips**		**0.00**	**0.00**	**0.00**
Harvest Aid Totals			**1 trip**		**11.00**	**3.50**	**14.50**
Grand Totals			**4 trips**		**36.00**	**14.00**	**50.00**
% Damaged bolls			**0% worm**				
% Weed control			**91%**				
Yield (lint-lbs/A)			**1,415**				
Loan value ($/lb)			**0.5665**				

Table 2.

Hockley Co. Levelland, TX	Grower: Sammy Harris	Consultant: Kerry Siders	Variety: AT Express	Plant date: 11 May 2010	Seed rate: 4.1 per ft	Acres: 40	Irrigation: Center Pivot
Cost of seed = $11.21/A ($0.00 Tech fees)							
Date	**Product**	**Rate (amt/A)**	**Application Method**	**Target**	**Product ($/A)**	**Application ($/A)**	**Total ($/A)**
17 May	Tri 4	1.5 pt	Ground, PPI	Weeds	8.00	3.50	11.50
11 May	Temik 15G	5 lbs	At plant, in-furrow	Nematodes & Thrips	14.00	1.75*	15.75
11 May	Staple	1.2 oz	Ground, broadcast	Weeds	14.00	1.75*	15.75
9 September	Roundup	32 oz	Ground, post directed	Weeds	6.00	3.50	9.50
5 October	ET + Prep	1.5 oz + 1 qt	Ground, broadcast	Harvest Aid	11.00	3.50	14.50
Insecticide Totals			**0.5 trips**		**14.00**	**1.75**	**15.75**
Herbicide Totals			**2.5 trips**		**28.00**	**8.75**	**36.75**
PGR Totals			**0 trips**		**0.00**	**0.00**	**0.00**
Harvest Aid Totals			**1 trip**		**11.00**	**3.50**	**14.50**
Grand Totals			**4 trips**		**53.00**	**14.00**	**67.00**
% Damaged bolls			**11% worm**				
% Weed control			**89%**				
Yield (lint-lbs/A)			**983**				
Loan value ($/lb)			**0.5750**				

*Cost of the 11 May application is split between targets

Table 3.

Lubbock Co.	Grower:	Consultant:	Variety:	Plant date:	Seed rate:	Acres:	Irrigation:
Lubbock, TX	**Bob Melcher**	**Brant Baugh**	**FM 9180 B2RF**	**20 May 2010**	**3.5 per ft**	**90**	**Drip**
Cost of seed = $62.97/A ($35.74/A Tech fees)							
Date	**Product**	**Rate (amt/A)**	**Application Method**	**Target**	**Product ($/A)**	**Application ($/A)**	**Total ($/A)**
26 June	Mepiquat Chloride	4 oz	Ground, broadcast	PGR	3.00	3.50	6.50
28 July	Mepiquat Chloride	4 oz	Ground, broadcast	PGR	3.00	1.75*	4.75
28 July	Glyphosate	2 qt	Ground, broadcast	Weeds	4.10	1.75*	5.85
9 September	Glyphosate	1.5 qt	Ground, broadcast	Weeds	3.75	3.50	7.25
16 October	Ethaphon + Ginstar	1 qt + 7 oz	Ground, broadcast	Harvest Aid	14.60	3.50	18.10
20 October	Parazone	32 oz	Ground, broadcast	Harvest Aid	7.60	3.50	11.10
Insecticide Totals			**0 trips**		**0.00**	**0.00**	**0.00**
Herbicide Totals			**1.5 trips**		**7.85**	**5.25**	**13.10**
PGR Totals			**1.5 trips**		**6.00**	**5.25**	**11.25**
Harvest Aid Totals			**2 trips**		**22.20**	**7.00**	**29.20**
Grand Totals			**5 trips**		**36.05**	**17.50**	**53.55**
% Damaged bolls			**0% worm, 0.3% bug**				
% Weed control			**97%**				
Yield (lint-lbs/A)			**1,560**				
Loan value ($/lb)			**0.5750**				

*Cost of the 28 June application is split between targets

Table 4.

Lubbock Co.	**Grower:**	**Consultant:**	**Variety:**	**Plant date:**	**Seed rate:**	**Acres:**	**Irrigation:**
Lubbock, TX	**Casey Jones**	**Brant Baugh**	**PHY 375 WRF**	**13 May 2010**	**3.5 per ft**	**90**	**Drip**
Cost of seed = $62.50/A ($36.15/A Tech fees)							
Date	**Product**	**Rate (amt/A)**	**Application Method**	**Target**	**Product ($/A)**	**Application ($/A)**	**Total ($/A)**
16 June	Glyphosate	1.5 qt	Ground, broadcast	Weeds	3.75	1.75*	5.50
16 June	Mepiquat Chloride	4 oz	Ground, broadcast	PGR	3.00	1.75*	4.75
30 June	Mepiquat Chloride	4 oz	Ground, broadcast	PGR	3.00	3.50	6.50
21 July	Glyphosate	1.5 qt	Ground, broadcast	Weeds	3.75	1.75*	5.50
21 July	Mepiquat Chloride	4 oz	Ground, broadcast	PGR	3.00	1.75*	4.75
3 August	Endigo	4.5 oz	Ground, broadcast	Lygus	12.00	3.50	15.50
16 October	Ethaphon + Aim	1 qt + 1 oz	Ground, broadcast	Harvest Aid	9.60	3.50	13.10
20 October	Gramoxone Inteon	32 oz	Ground, broadcast	Harvest Aid	8.40	3.50	11.90
20 October	Parazone	32 oz	Ground, broadcast	Harvest Aid	7.60	3.50	11.10
Insecticide Totals			**1 trip**		**12.00**	**3.50**	**15.50**
Herbicide Totals			**1.5 trips**		**7.50**	**5.25**	**12.75**
PGR Totals			**2.5 trips**		**9.00**	**7.00**	**16.00**
Harvest Aid Totals			**2 trips**		**18.00**	**7.00**	**25.00**
Grand Totals			**7 trips**		**46.50**	**22.75**	**69.25**
% Damaged bolls			**1% worm, 0.3% bug**				
% Weed control			**98%**				
Yield (lint-lbs/A)			**1,080**				
Loan value ($/lb)			**0.5581**				

*Cost of the 16 June and 21 July applications are split between targets

Boll Damage Survey of Bt and Non-Bt Cotton Varieties in the South Plains Region of Texas 2007-10

Cooperators: Texas AgriLife Extension Service

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South Plains

Summary:

Late-season boll damage surveys were conducted in 2007, 2008 and 2009 to evaluate the amount of Lepidoptera induced damage in Bt cotton varieties relative to non-Bt cotton varieties. Additional, data was collected on the number of insecticide applications required for these varieties to manage lepiopterous pests, and the number of bolls damaged by sucking pests in 2009. Boll damage was light in 2007; however, more damaged bolls where found in the non-Bt fields (3.11%) than in the Bollgard (0.52%) and Bollgard II (0.25%) fields, but did not differ from the Widestrike fields (1.29%). Very few insecticide applications were made targeting bollworm in any of the 2007 survey fields and there were no significant differences among variety types. None of the Bt cotton fields were treated for bollworms, whereas 9% on the non-Bt field received a single insecticide application. Late season bollworm damage in 2008 was similar to 2007. All of the Bt cotton variety types had significantly fewer damaged bolls than the non-Bt varieties and none of the Bt varieties required insecticide applications for lepidopterous pests, but unlike 2007, more non-Bt cotton was treated for bollworm and/or beet armyworms in 2008 (41% of the fields received a single insecticide application). In 2009, none of the surveyed fields were treated for lepidopterous pests. Worm damaged bolls were 2.83, 0.13 and 0.40% in non-Bt, Bollgard II and Widestrike varieties respectively. There were no differences among the variety types in sucking bug damaged which averaged 1.96% across all varieties. In 2010, 3.08% of bolls in the non-Bt fields were damaged, and 0.45 insecticide

applications were required per field on average. Damage did not exceed 0.27% in Bt cotton, and no Bt cotton field required treatment for lepidoterous pests. There were no differences among variety types regarding Lygus or stinkbug damaged bolls, which slight over 1% per field.

Objective:

The objective of this study was to compare the qualitative value of Bollgard II, Widestrike and Bollgard insect control traits in grower fields relative to each other and to non-Bt cotton varieties.

Materials and Methods:

In 2007, 2008, 2009 and 2010, boll damage surveys were conducted to quantify bollworm damage in late season Bt and non-Bt cotton varieties. Although the source of the damage is not certain, most of it is suspected to have come from cotton bollworms although beet armyworms were present in some fields in 2008, and fall armyworms were present in 2009 and 2010. Two of the non-Bt were treated for a mixed population of bollworms and beet armyworms in Bailey County in 2008, and non-Bt field in Gaines County in 2009 and 2010 contained about 20% fall armyworms and 80% bollworms. Fall armyworms were also present in Bailey County and Hale County experienced isolated beet armyworms problems. Additionally, cotton square borers were common throughout the southwestern and western areas of the South Plains in 2010. The survey was conducted late season because Bt levels in mature/senescent cotton tends to deteriorate relative to rapidly growing plants. Thus, late season would represent the time period when Bt levels would be less intensely expressed and damage would be more likely to occur.

Grower fields of non-Bt, Bollgard, Bollgard II and Widestrike cotton were sampled throughout the South Plains region of Texas (Table 1). Samples were taken after the last possible insecticide applications and before approximately 20% of the boll were open. Three distinct areas were sampled within each field, and 100 consecutive harvestable bolls were sampled from each location. Each field by variety type served as a replicate. Bolls were considered damaged if the carpal was breached through to the lint. The insecticide history in regard to insecticides targeting bollworms was recorded. In addition to bollworm damage, external Lygus and/or stinkbug damage to bolls was sampled for in most fields in 2009 and within 14 fields in 2010.

All data were analyzed using PROC MIXED and the means were separated using an F protected LSD ($P \leq 0.10$).

Results and Discussion:

In 2007, damage was very light across all of the field types. However, more damaged bolls where found in the non-Bt fields (3.11%) than in the Bollgard (0.52%) and Bollgard II (0.25%) fields, but did not differ from the Widestrike fields (1.29%) (Table 2). Damage in the Widestrike fields did not differ from the Bollgard and Bollgard II fields. The fact that Widestrike did not differ from the non-Bt fields does not appear to indicate a lack of efficacy, but probably indicates a lack of area wide bollworm pressure. Very few insecticide applications were made targeting bollworm in any of the 2007 survey fields and there were no significant differences among variety types. None of the Bt cotton fields were treated for bollworms, whereas 9% on the non-Bt field received a single insecticide application.

Late season bollworm damage in 2008 was similar to 2007. All of the Bt cotton variety types had significantly fewer damaged bolls than the non-Bt varieties (Table 3). There were no differences in boll damage among the Bt types. Similar to 2007, none of the Bt varieties required insecticide applications for bollworms, but unlike 2007, more non-Bt cotton was treated for bollworms and/or beet armyworms in 2008 (41% of the fields received a single insecticide application).

Bollworm populations were exceptionally light during 2009 with the exception of Gaines County. Both Bollgard II and Widestrike varieties suffered very low damage to boll feeding lepidopterous pest in 2009 and had significantly fewer damaged bolls than the non-Bt varieties (no Bollgard fields were sampled in 2009) (Table 4). There were no differences in damaged bolls between the Bt types, and there were no differences among any of the varietal types in sucking bug damage. None of the fields sampled in the 2009 survey were treated for lepipoterous pests. Much of the South Plains had significant acreage of late-planted grain sorghum and corn, and these crops tended to act as trap crops, essentially preferentially attracting bollworms and fall armyworms away for the cotton.

In 2010, bollworm populations were moderate to high in portions of Gaines, Terry, Hockley, and Lubbock counties, and occurred late in the season in areas north of Lubbock. Dawson County reported no damage from bollworms or armyworms. Boll damage in 2010 was greatest in the non-Bt varieties, and the Bollgard II and Widestrike varieties did not differ from one another (Table 5). As in previous years, damage was numerically higher in the Widestrike varieties than the Bollgard II, suggesting a slight trend in lesser efficacy. However, no Bt cotton field, Widestrike or Bollgard II, ever required treatment for ledipoterous pests, indicating that both Bt technologies provide excellent control. The non-Bt varieties required 0.45 insecticide applications per field for lepidopterous pests.

Based on these data, Bt cotton appears to continue to be highly effective in preventing boll damage by lepidopterous pests in the South Plains region of Texas.

Acknowledgments:

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Table 1. Number of fields sampled by county and Bt trait in 2007-10.

County	Non-Bt	Bollgard	Bollgard II	Widestrike
Year 2007				
Bailey	0	3	1	0
Castro	4	0	3	0
Dawson	1	3	2	4
Floyd	3	0	4	0
Gaines	0	0	0	1
Hale	7	0	6	3
Hockley	3	2	2	2
Lubbock	1	5	2	1
Parmer	2	1	0	1
Terry	1	0	3	4
TOTAL	22	14	23	16
Year 2008				
Bailey	5	0	5	0
Castro	6	0	6	1
Dawson	0	0	0	2
Gaines	4	0	3	10
Hale	3	0	2	1
Hockley	5	5	5	3
Lubbock	6	0	5	0
TOTAL	29	5	26	17
Year 2009				
Bailey	1	0	1	0
Castro	1	0	2	1
Crosby	1	0	1	0
Dawson	0	0	1	1
Gaines	2	0	2	2
Hale	1	0	1	0
Hockley	1	0	1	0
Swisher	1	0	1	0
TOTAL	8	0	10	4
Year 2010				
Bailey	2	0	2	2
Crosby	1	0	2	0
Dawson	3	0	3	3
Floyd	1	0	0	0
Gaines	2	0	2	2
Hale	3	0	3	1
Hockley	3	0	3	4
Lubbock	3	0	3	2
TOTAL	20	0	20	16

Table 2. Percentage of damaged bolls and insecticide applications for non-Bt and various Bt technology varieties grown in the South Plains of Texas, 2007.

Variety type	n[a]	% damaged bolls[b]	Mean no. sprays per site[c]
Non-Bt	22	3.11 a	0.09 a
Bollgard	14	0.52 b	0.00 a
Bollgard II	23	0.25 b	0.00 a
WideStrike	14	1.29 ab	0.00 a

Means in a column followed by the same letter are not significantly different based on an F protected Mixed Procedure LSD ($P \leq 0.10$).
[a]Number of fields sampled.
[b]Percentage of damaged bolls from three locations in each field, 100 bolls sampled per locations, 300 bolls per field.
[c]Mean number of insecticide applications targeting lepidopterous pests per site.

Table 3. Percentage of damaged bolls and insecticide applications for non-Bt and various Bt technology varieties grown in the South Plains of Texas, 2008.

Variety type	n[a]	% damaged bolls[b]	Mean no. sprays per site[c]
Non-Bt	29	3.16 a	0.41 a
Bollgard	5	0.53 b	0.00 b
Bollgard II	26	0.04 b	0.00 b
WideStrike	17	0.18 b	0.00 b

Means in a column followed by the same letter are not significantly different based on an F protected Mixed Procedure LSD ($P \leq 0.10$).
[a]Number of fields sampled.
[b]Percentage of damaged bolls from three locations in each field, 100 bolls sampled per locations, 300 bolls per field.
[c]Mean number of insecticide applications targeting lepidopterous pests per site.

Table 4. Percentage of damaged bolls and insecticide applications for non-Bt and various Bt technology varieties grown on the South Plains of Texas, 2009.

Variety type	n[a]	% worm damaged bolls[b]	% sucking bug damaged bolls[b]	Mean no. sprays per site[c]
Non-Bt	8	2.83 a	3.83 a	0.00 a
Bollgard II	10	0.13 b	2.06 a	0.00 a
WideStrike	4	0.40 b	0.00 a	0.00 a

Means in a column followed by the same letter are not significantly different based on an F protected Mixed Procedure LSD ($P \leq 0.10$).
[a]Number of fields sampled.
[b]Percentage of worm or sucking bug damaged bolls from three locations in each field, 100 bolls sampled per locations, 300 bolls per field.
[c]Mean number of insecticide applications targeting lepidopterous pests per site.

Table 5. Percentage of damaged bolls and insecticide applications for non-Bt and various Bt technology varieties grown on the South Plains of Texas, 2010.

Variety type	n[a]	% worm damaged bolls[b]	% sucking bug damaged bolls[b]	Mean no. sprays per site[c]
Non-Bt	20	3.08 a	1.87 a	0.45 a
Bollgard II	20	0.15 b	1.00 a	0.00 b
WideStrike	16	0.27 b	0.58 a	0.00 b

Means in a column followed by the same letter are not significantly different based on an F protected Mixed Procedure LSD ($P \leq 0.10$).
[a]Number of fields sampled.
[b]Percentage of worm or sucking bug damaged bolls from three locations in each field, 100 bolls sampled per locations, 300 bolls per field; only 14 fields sampled for bug damage.
[c]Mean number of insecticide applications targeting lepidopterous pests per site.

Controlling Mixed Populations of Bollworm and Fall Armyworm in Non-Bt Cotton

Cooperators: Glen Shook, Grower

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Gaines County

Summary:

Non-Bt cotton comprises approximately 50% of the cotton acreage planted in the Texas High Plains, and damage caused by bollworms and fall armyworms often results in significant yield loss. When fall armyworms are present, they usually occur concurrently with bollworms. Bollworms are typically controlled using pyrethroid insecticides while fall armyworms are better controlled with alternative chemistries. In this study, several pyrethroids (Karate, Holster and a high and low rate of Mustang Max) were evaluated for their efficacy towards a mixed population of bollworms and fall armyworms. Additionally, an alternative chemistry, Belt, was tested at its low rate and mixed with the low rate of Mustang Max. At 7 DAT, all of the treatments had fewer medium and large bollworms than the untreated with the exception of Belt alone. There were no differences among the other treatments. Generally, Belt is thought to be relatively more efficacious towards fall armyworms than bollworms. As expected, at its lowest labeled rate, Belt did not provide effective bollworm control; especially in growthy cotton where many of the small larvae were feeding under bloom tags. Against fall armyworms, the only treatment that differed from the untreated was the tank mix of Mustang Max + Belt. Pyrethoids are generally considered weak against fall armyworms. Belt is known to have good activity towards fall armyworms. However, Belt at the lower rate (2.0 fl-oz/acre) failed to achieve adequate control. It is not certain if increasing the rate of Belt would alleviate this problem, but much of the difficulty in control may be related to the need for Belt to be consumed to maximize activity. Although Belt is translaminar, larvae moving from fruit to fruit are less likely to encounter toxicant than if it were a contact poison. Although Belt alone appeared to be ineffective, it did not differ in yield from the best performing treatment. Yield was negatively correlated with the total worm population. Based on this regression, approximately 9,000 larvae per acre resulted in a 10% yield reduction. The ratio of small larvae to medium and large larvae was

approximately 7:3. Considering an action threshold of 10,000 small or 5,000 medium and large larvae per acre threshold, 9,000 total larvae per acre is close to the estimated threshold of 8,500 larvae based on the 7:3 ratio we encountered.

Objective:

Objectives of this study were as follows: 1. Determine the efficacy of several commonly used pyrethroids for control of bollworms and fall armyworms in cotton, 2. Determine if the low labeled rate of Belt (2 fl-oz/acre) is effective in controlling bollworms and fall armyworms, 3. Determine if tank mixing a lower rate of Belt (2 fl-oz/acre) with a pyrethroid provides cost effective control.

Materials and Methods:

This test was conducted on a commercial farm located in Gaines Co., south of Loop, TX. The cotton variety ‘Dyna-Grow 2400RF’ was grown on 40-inch rows and irrigated using a pivot irrigation system. Plots were 4-rows wide × 60-feet long. Plots were arranged in a randomized complete block design with 4 replicates. The insecticide treatments and rates are outlined in Table 1. Treatments were applied on 17 August 2010.

Bollworm and fall armyworm populations were estimated by counting the number of worms on 10 whole plants per plot.

Larvae were separated by species, and size was estimated by length: small larvae (<1/4 inch), medium larvae (1/4 to 5/8 inch) and large larvae (>5/8 inch). Small larvae were not separated by species because they could not be distinguished from one another in the field.

The test was harvested on 5 November 2010, using a 28-inch hand basket stripper. Six samples were harvested per plot and pooled. All samples were weighed, ginned and classed.

All data were analyzed using ARM and the means were separated using an F protected LSD ($P < 0.05$).

Results and Discussion:

On 17 August, prior to insecticide application, the population of medium and large worms averaged 11,440 and 2,280 bollworms and fall armyworms per acre, respectively (estimated plant population = 40,000 per acre) (Figures 1A & 1B). This is well above the action threshold of 5,000 worms per acre. Although smaller worms could not be speciated, the population of small worms across both species was estimated to be 25,440 worms per acre (Figure 1C). The action threshold for small larvae is 10,000 worms per acre.

Using speciation of medium sized worms in the untreated plots at 7 DAT, the number of small bollworms and fall armyworms were estimated before treatment. The worm population at this test site was estimated to be ~70% bollworms. By size, bollworms comprised 52%, 85% and 73% of the small, medium and large sized larvae respectively (Figure 2). Total larvae across both species and all sizes averaged 38,840 worms per acre (Figure 1D). During pretreatment counts, it was noted that many of the small worms were feeding under bloom tags. Additionally, the cotton in this test was growthy (~46 inches in height); thus obtaining adequate insecticide coverage was likely to be difficult.

At 7 DAT, all of the treatments had fewer medium and large bollworms than the untreated with the exception of Belt at the lower rate (2 fl-oz/acre) (Figure 3A). There were no differences among the other treatments. Generally, Belt is thought to be relatively more efficacious towards fall armyworms than bollworms. As expected, at its lowest labeled rate, Belt did not provide effective bollworm control; especially in growthy cotton where many of the small larvae were feeding under bloom tags.

Against fall armyworms, the only treatment that differed from the untreated was the tank mix of Mustang Max + Belt (Figure 3B). Pyrethoids are generally considered weak against fall armyworms. Belt is known to have good activity towards fall armyworms. However, Belt at the lower rate (2.0 fl-oz/acre) failed to achieve adequate control. It is not certain if increasing the rate of Belt (3 fl-oz/acre) would alleviate this problem, but much of the difficulty in control may be related to the need for Belt to be consumed to maximize activity. Although Belt is translaminar, larvae moving from fruit to fruit are less likely to encounter toxicant than if it were a contact poison.

When evaluating activity across both species, because the population was predominately bollworms, the high rates of the pyrethroids and the low rate of Mustang Max + Belt all reduced the population significantly lower than the untreated (Figure 3C).

There were no significant differences in yield among the high rates of the pyrethroids, Belt alone or the tank mix of the low rate of Mustang Max + the low rate of Belt (Figure 3D).

Although Belt alone (2.0 fl-oz/acre) appeared to be ineffective, it did not differ in yield from the best performing treatment. The reason for this is not certain; it could be an aberration in the data, or Belt may be providing undetectable control. Similar results were observed in a test conducted in 2008.

Yield was negatively correlated with the total worm population (Figure 4). Based on this regression, approximately 9,000 larvae per acre resulted in a 10% yield reduction. The ratio of small larvae to medium and large larvae was approximately 7:3. Considering an action threshold of 10,000 small or 5,000 medium and large larvae per acre threshold, 9,000 total larvae per acre is close to the estimated threshold of 8,500 larvae based on the 7:3 ratio we encountered.

Acknowledgments:

This project was funded in part by Bayer CropScience and the Plains Cotton Improvement Program.

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Table 1. Insecticide treatments and rates.

Treatment[a]	Active Ingredient	Rate (product/ac)
1) Untreated	--	--
2) Mustang Max 0.83EC	Zeta-cypermethrin	3.6 fl-oz
3) Mustang Max 0.83EC	Zeta-cypermethrin	2.6 oz
4) Karate 1EC	Lambda-cyhalothrin	5.12 fl-oz
5) Holster 2.5EC	Cypermethrin	5.0 fl-oz
6) Belt 480SC	Flubendiamide	2.0 fl-oz
6) Mustang Max 0.83EC + Belt 480SC	Zeta-cypermethrin +Flubendiamide	2.6 fl-oz + 2.0 fl-oz

[a]*All treatments included Dyne-Amic non-ionic surfactant at 0.25% v/v.*

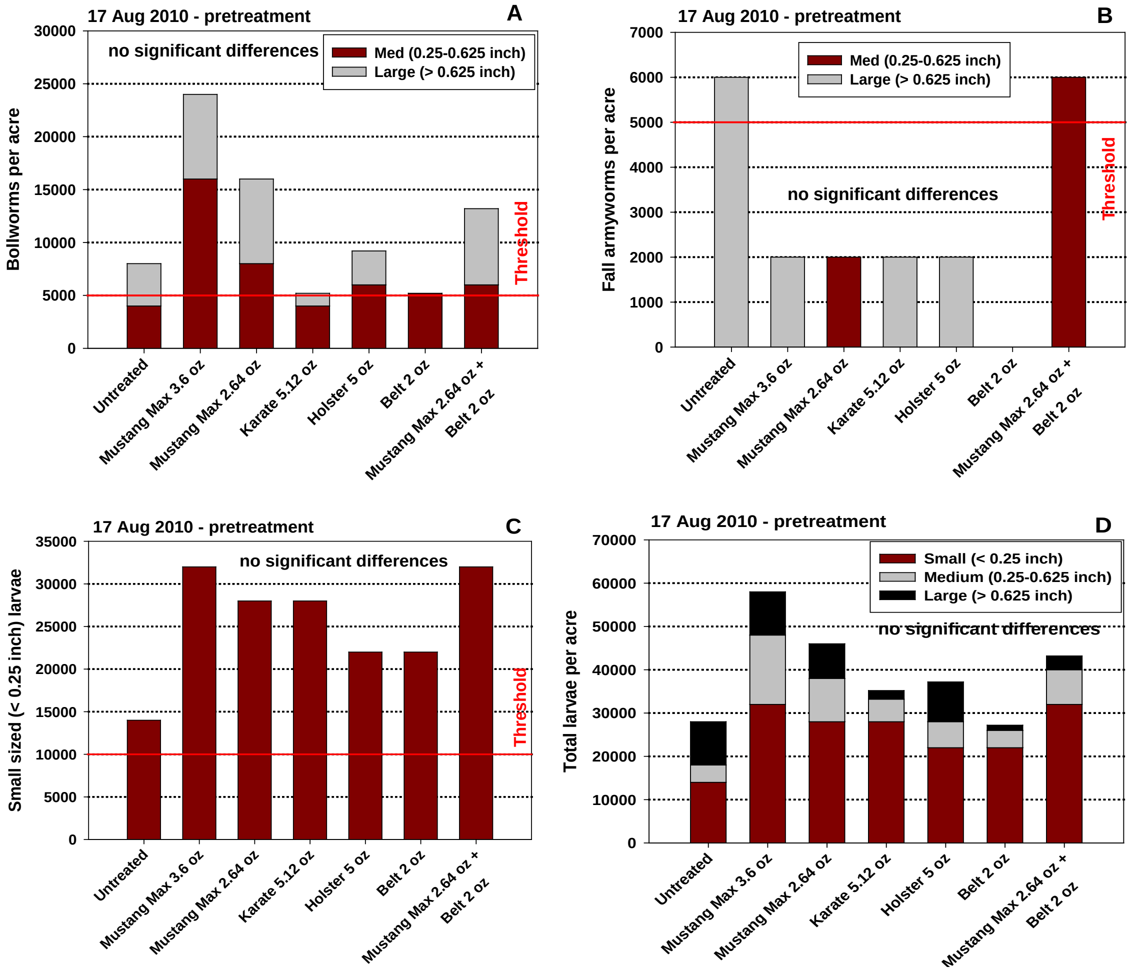

Figure 1. Number of medium and large bollworm larvae per acre before application (A), medium and large fall armyworms (B), total small larvae (C), and total larvae by size (D); no significant differences were detected among any of the treatments for any parameter based on an F protected (LSD, $P \geq 0.05$).

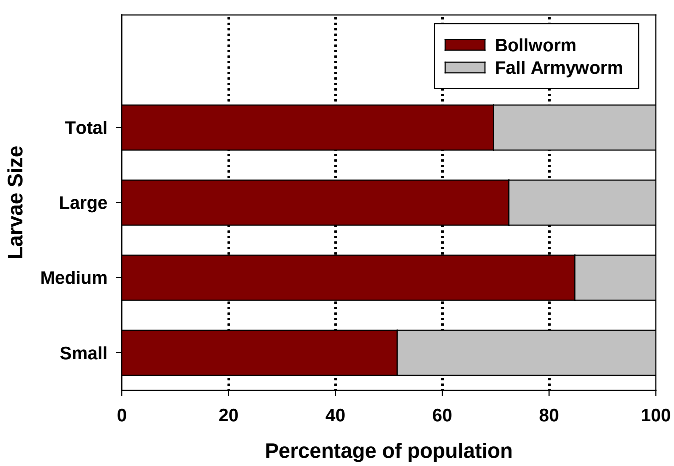

Figure 2. Percentages of bollworms and fall armyworms by size on 17 August, prior to treatment.

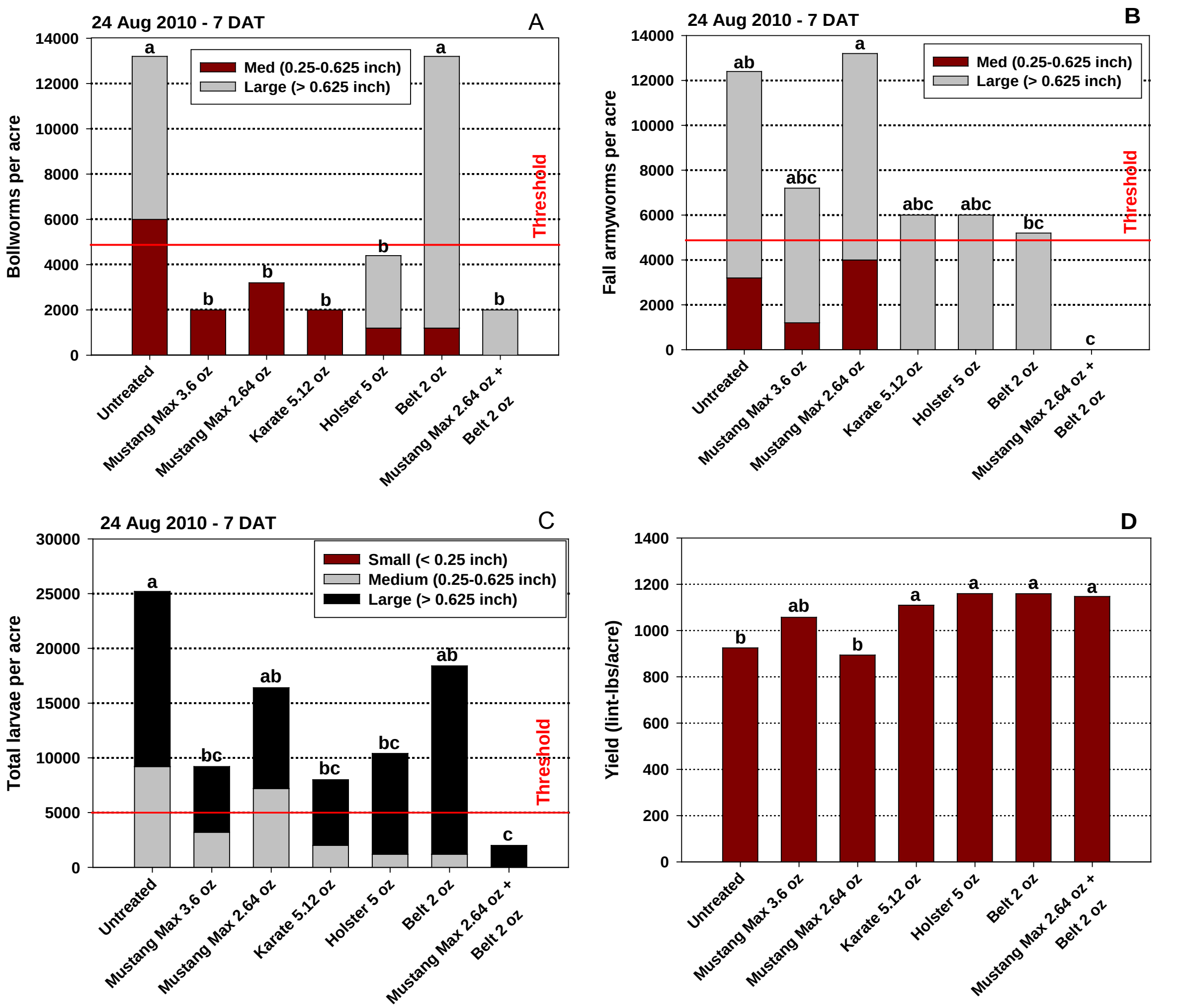

Figure 3. Number of medium and large bollworm larvae per acre 7 days after treatment (A), medium and large fall armyworms (B), total larvae (C), and yield (D); Columns within a chart capped by the same letter are not significantly different based on an F protected (LSD, *P* > 0.05).

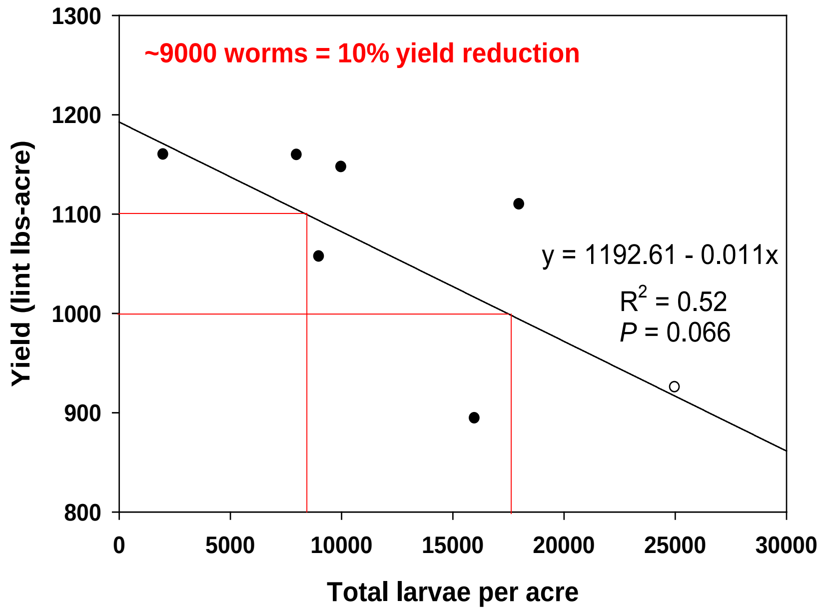

Figure 4. Linear relationship between all sizes of bollworms and fall armyworms and yield.