FOREWORD

This document contains reports of applied research/demonstration projects conducted by Texas AgriLife Extension Service dealing with management of arthropod pests and production practices. Objectives of the studies were to find cost effective ways to manage pests and to improve production. Experiments were conducted with commercial agricultural producers in cooperation with county Extension agents, county row crop committees, agricultural consultants, and agribusiness companies. Coastal Bend farm cooperators are acknowledged for providing land, equipment, labor, time, ideas, and other assistance in support of these projects.

Trade names of commercial products used in this report are included only for better understanding and clarity. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Texas A&M University System is implied. Results from one experiment may not represent conclusive evidence that the same response would occur where conditions vary.

A few reports contain calculations of added return over treatment costs based on numerical differences in yield. It must be kept in mind that the returns attributed to treatment are not absolute, i.e. the yield differences may have been the result of other variables not associated with the treatment. The reader should always consider the statistical analysis and data from multiple tests over space and time in making judgments concerning economic returns.

This report and others are available for previous years at the following web site http://agfacts.tamu.edu/~rparker. If you have comments or questions about the reports contained herein, contact:

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RESPONSE OF CORN TO CHINCH BUG CONTROL WITH VARIOUS RATES OF CRUISER AND PONCHO SEED TREATMENTS

Rancho Grande Farms, Wharton County and Lawrence Hinze Farm, Lavaca County, 2011

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SUMMARY: The two tests were conducted to evaluate three rates of Poncho and Cruiser seed treatments for control of chinch bug on corn grown in irrigated (Wharton County) and dryland (Lavaca County) production systems. At both locations insecticides at all evaluated rates significantly reduced chinch bug numbers compared to those in the nontreated corn on all evaluation dates. Numerically, often with statistically significant differences, the higher rates were the most effective; furthermore, Poncho plots, at least numerically, contained fewer chinch bugs than did the Cruiser treatments.

At the Wharton County location (Test 1) all treatments except Cruiser at 0.5 mg ai/seed produced significantly greater yield than the nontreated corn. In the Lavaca County dryland location (Test 2) yields were very low due to drought conditions. At the Lavaca County location the higher rates of both Poncho and Cruiser treatments produced more than twice the corn yield compared to the non-insecticide treated corn; all insecticide seed treatments produced significantly more corn than the nontreated.

There was a trend in rate-for-rate comparisons for Poncho treated corn to produce more yield than the Cruiser treatments, and when yields were averaged across rates for insecticides, Poncho treated corn had higher yields. When comparing dollar returns for the various treatments, Poncho treated corn, at least numerically, had the higher return, but in Test 1 there was not a statistical difference in yield and in Test 2 there was not a statistical difference in yield when comparing similar seed treatment rates. Aflatoxin accumulation averaged 9.4 ppb and 46.2 ppb in the irrigated and dryland tests, respectively. There were no statistical differences in aflatoxin accumulation in either one of the field studies.

OBJECTIVES: The corn seed treatments were evaluated for effectiveness in controlling chinch bugs and to evaluate dollar returns.

MATERIALS/METHODS: BH 8881 RR corn seed (95% germination with 116-118 relative days to maturity), with no insecticide treatment, was obtained from BH Genetics on which to apply Poncho and Cruiser. Treatments were applied at 0.25, 0.50, and 1.25 mg ai/seed by placing a water solution of the insecticide on the seed in a small concrete mixer and agitating the seed for 2-3 minutes to obtain coverage. Tests were planted in a randomized complete block experimental design with 4 replications of the treatments.

Agriculture Research Manager (ARM revision 6.1.13) software was used to conduct analysis of variance, and means were separated by LSD at the 0.05 probability level.

Test 1 (Rancho Grande Farms, Irrigated Study, Wharton County) – A total of 52 seed were placed into packages for planting in 6-row by 30-foot plots with a John Deere 7100 planter equipped with cone seeding devices to deliver 22,651 kernels/acre on rows with 40-inch centers. The test was planted March 3, 2011, next to FM 961 about 3 miles north of Highway 59 in Wharton County. Cotton had been planted on the site the preceding season. Data were obtained from the center 2 rows of plots. Fertilizer consisted of 137-28-0-0.55 Zn. Herbicide consisted of grower applied Bicep II Magnum 5.5L (3.6 pt/acre as a 19-inch band) before planting and we applied Dual II Magnum (0.65 pints/acre) + Roundup Weather Max (22 oz/acre) after planting. The soil temperature at planting was 61°F, and soil moisture content was excellent for planting. The clay soil (42% sand, 18% silt, 40% clay) with a 6.9 pH contained 2.21% organic matter. Irrigation water was applied in-furrow as needed.

Treatments were assessed by (1) counting the number of corn plants on 1/1000 acre on each of the center 2 rows in plots on 3/18, (2) counting the number of chinch bugs on and around 20 plants/plot on 3/29 [26 DAP = days after planting] and on 4/7 [35 DAP], (3) visual damage rating of corn plants [1 = no damage up to 5 = severe lodging, dying plants, and uneven growth] on 4/7, and (4) harvesting the center two rows of plots with a research combine equipped with moisture and weight determination instruments on 7/12. Grain weights were expressed at a standard level of 15% moisture. Corn from each plot was obtained and ground with a Romar Mill (series 2a). Aflatoxin levels were then measured with a Vicam Series-4 Fluorometer Model V2 testing kit (Afla Test FGIS method).

Test 2 (Lawrence Hinze Farm, Dryland Study, Lavaca County) – The test was planted March 2, 2011 in 4-row plots ranging in length from 752 to 785 feet (harvested length) with a buster type planter (model IH 87) on 38-inch spaced rows. It was located one mile east of State Highway 95 along FM Road 1891 north of Shiner, Texas, and corn was grown under rain fed conditions. Corn has been planted on the site for many years, but the Mexican corn rootworm has not been present at the site. The planting rate was approximately 20,000 seed/acre and soil moisture was good. The sandy clay loam soil (48% sand, 18% silt, 34% clay) with 8.0 pH contained 1.99% organic matter.

Fertilizer consisted of 81-6-3-6 S-0.3 Zn. Herbicide broadcast at planting was Atrazine 4L (1.375 quarts/acre). On April 29 glyphosate (1.5 pints/acre) + 2,4-D (0.5 pints/acre) was applied for weed control.

Treatments were assessed by (1) counting the number of plants on 10-row feet on each of the center two rows in plots on 4/1, (2) counting chinch bugs on 20 plants/plot 3/25 [33 DAP] and 4/1 [40 DAP], (3) assigning a damage rating [see test above] to plots on 4/1 and 4/12 [40 and 51 DAP, respectively] with the average of both dates reported, (4) obtaining samples for aflatoxin accumulation at harvest [see above test for measurement method], and (5) harvesting plots with a 4-row corn header and weighing grain on a weigh wagon on 7/8. Grain moisture and bushel weights were determined for each plot, and yields were converted to a 15% moisture weight standard.

RESULTS/DISCUSSION: Test 1 – There were no differences in plant populations (Table 1). Chinch bug damage ratings were significantly higher in the non-insecticide treated corn 35 DAP.

Cruiser at the low rate had a higher damage rating than other seed treatments. Likewise, chinch bug numbers were higher in nontreated plots at 26 and 35 DAP. At 26 DAP, comparison of rate-for-rate revealed much greater infestation in Cruiser treated compared to Poncho treated corn at the 0.25 mg ai/seed rate. Differences were not observed at the 0.5 mg ai/seed rate. However, significantly more chinch bugs were present in Cruiser treated corn at the 1.25 mg ai/seed rate. By 35 DAP differences in chinch bug numbers were even greater with significantly more in the Cruiser treatment at the 0.25 and 0.5 mg ai/seed rates, but there were no differences in the two seed treatments at the 1.25 mg ai/seed rate. Season average chinch bug numbers (26 and 35 DAP combined) followed the same general pattern.

Table 2 shows aflatoxin accumulation, bushel weight, grain moisture at harvest, yield and dollar return data. Aflatoxin accumulation was low with no significant differences among treatments. Bushel weights and grain moisture at harvest were not affected by treatments. Significantly greater yield was found in insecticide treated corn compared to the nontreated corn except for the Cruiser 0.5 mg ai/seed rate. Although there was a trend for more yield in the Poncho treatments compared to the Cruiser treatments, the differences were generally 2 bushels/acre except for the 0.5 mg ai/seed rate where the numerical advantage for Poncho was 9.3 bushels/acre (not statistically significant). Substantial dollar returns were observed with all insecticide seed treatments. The Poncho treatments averaged $94.48 return more than the nontreated corn whereas the Cruiser treatments averaged $77.09 more than the nontreated corn. The difference in returns for the Poncho and Cruiser cannot be considered absolute since there were no statistical differences in the yield data among the insecticides and rates evaluated. Treatment costs considered in the analysis included harvesting/hauling the extra yield above the nontreated corn and cost for the insecticide.

Test 2 – Plant stands were relatively low in all treatments (Table 3). Plant damage ratings were not statistically different, but on a numerical basis the highest damage rating was observed in the nontreated corn. At 33 and 40 DAP all insecticide treatments had fewer chinch bugs than nontreated corn. When season averages were evaluated, only the high Poncho rate separated from the low rate of Cruiser tested. Otherwise, there were no significant differences among the insecticide treatments. Very high chinch bug numbers were found in nontreated corn.

There were no differences in bushel weight or grain moisture readings at harvest (Table 4). There were, however, significant differences in the yield data. Corn yields in nontreated plots averaged near half that produced in two of the Poncho rates and one of the Cruiser rates. There was a consistent numerical increase in yield for each insecticide as the rates applied increased. Aflatoxin accumulation was higher in corn at this test location compared with the first location, but levels were not excessive nor were statistical differences observed.

The Poncho treatments averaged $53.04 more in return than the nontreated corn whereas the Cruiser treatments averaged $40.55 more than the nontreated corn. However, in rate-for-rate comparison, there were no statistical differences in yield data between Poncho and Cruiser. The treatment costs considered were the same as considered for test 1 above.

CONCLUSIONS FROM TESTS 1 &2: High chinch bug numbers resulted in severe damage to non-insecticide treated corn. Chinch bug numbers were significantly reduced by both Poncho and Cruiser at all three rates tested. Numerically, in all rate-for-rate comparisons on all inspection dates, Poncho treated corn contained fewer chinch bugs. Furthermore, the same numerical trend was observed in the yield data. However, in Test 1 there were no statistical differences among the insecticide treatments, and in Test 2 there were no statistical differences between Poncho and Cruiser when equal seed treatment rates were compared. Substantial dollar returns were obtained by using the insecticide seed treatments. Poncho at the high rate (1.25 mg ai/acre) except for Test 1 had numerically the most dollar return. In both tests averaging the three treatment rates for Poncho compared with Cruiser, Poncho had the greater numerical dollar return. Aflatoxin accumulation differences among treatments were not excessive nor were differences among treatments observed.

ACKNOWLEDGMENTS: Special thanks are extended to Wayne Waters and to Ellen and Lawrence Hinze for providing the test sites and other activities in connection with conduct of the field studies. Special acknowledgment is give Brian Bacek, Syngenta Crop Protection, and to David Little, BH Genetics, for their assistance in corn harvest. BH Genetics is thanked for obtaining non-insecticide treated corn seed for use in both tests.

Table 1. Plant stand, chinch bug number and plant damage rating on corn treated with Poncho and Cruiser insecticides applied to seed, Rancho Grande Farms, Wharton County, TX, 2011.

Seed treatment	Rate mg ai/seed	Plants 1000's/acre	Damage Rating 35 DAP[2/]	Chinch bugs/100 plants		
				26 DAP[3/]	35 DAP	Average
Poncho 5FS	0.25	21.8[a]	1.8[c]	32.5[d]	11.3[d]	21.9[cd]
	0.50	21.1[a]	1.7[c]	43.8[cd]	5.0[d]	24.4[cd]
	1.25	20.4[a]	1.6[c]	22.5[d]	8.8[d]	15.6[d]
Cruiser 5FS	0.25	21.6[a]	3.2[b]	126.3[b]	118.8[b]	122.5[b]
	0.50	19.8[a]	2.2[c]	63.8[cd]	52.5[c]	58.1[c]
	1.25	22.3[a]	1.5[c]	78.8[c]	12.5[d]	45.6[cd]
Nontreated		21.5[a]	4.6[a]	298.8[a]	247.5[a]	273.1[a]
LSD (P = 0.05)		NS[1/]	0.74	45.92	38.90	37.71
P > F		.4915	.0001	.0001	.0001	.0001

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]NS = Not Significant
[2/]Damage rating: 1 = no damage up to 5 = severe lodging, dying plants, and uneven plant growth. Ratings were made 35 DAP.
[3/]DAP = Days After Planting

Table 2. Production factors and aflatoxin accumulation in corn treated with Poncho and Cruiser insecticide applied to the seed, Rancho Grande Farms, Wharton County, TX 2011.

Seed treatment	Rate mg ai/seed	Aflatoxin ppb	Bushel weight	% grain moisture	Yield bu/acre[2/]	$ return over nontreated[3/]
Poncho 5FS	0.25	11.8[a]	56.3[a]	10.6[a]	94.4[a]	91.15
	0.50	9.3[a]	56.3[a]	10.8[a]	96.8[a]	104.41
	1.25	5.0[a]	56.1[a]	11.0[a]	95.0[a]	87.88
Cruiser 5FS	0.25	7.3[a]	55.9[a]	10.8[a]	92.3[a]	77.82
	0.50	10.5[a]	56.0[a]	10.7[a]	87.5[ab]	45.36
	1.25	19.4[a]	56.3[a]	10.7[a]	93.3[a]	77.09
Nontreated		2.8[a]	55.9[a]	10.5[a]	79.6[b]	-
LSD (P = 0.05)		NS[1/]	NS	NS	10.33	
P > F		.6372	.7177	.3093	.0384	

Means in a column followed by the same letter are not significantly different by ANOVA.

[1/] NS = Not Significant

[2/] Yield at 15% moisture

[3/] Corn valve was $6.75/bu. Costs included harvesting/hauling ($0.40/bu); chemical cost based on seeding rate was $2.83/acre (0.25 mg ai/seed), $4.81/acre (0.50 mg ai/seed) and $9.91/acre (1.25 mg ai/seed). Returns were calculated without regard to statistically similar yields.

Table 3. Plant stand, chinch bug number and plant damage rating on corn treated with Poncho and Cruiser insecticides applied to the seed, Lawrence Hinze Farm, Lavaca County, TX, 2011.

Seed treatment	Rate mg ai/seed	Plants 1000's/acre	Damage rating[2/]	Chinch bugs/100 plants		
				33 DAP[3/]	40 DAP	Average
Poncho 5FS	0.25	13.8[a]	2.1[a]	18.8[b]	33.8[b]	26.3[bc]
	0.50	12.7[a]	2.0[a]	21.3[b]	20.0[b]	20.6[bc]
	1.25	12.4[a]	2.0[a]	10.0[b]	25.0[b]	17.5[c]
Cruiser 5FS	0.25	14.8[a]	2.5[a]	25.0[b]	56.3[b]	40.6[b]
	0.50	13.8[a]	2.3[a]	32.5[b]	50.0[b]	41.3[b]
	1.25	11.7[a]	2.4[a]	18.8[b]	41.3[b]	30.0[bc]
Nontreated		13.8[a]	2.9[a]	128.8[a]	195.0[a]	161.9[a]
LSD (P = 0.05)		NS[1/]	NS	23.51	44.8	21.02
P > F		.2500	.1627	.0001	.0001	.0001

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]NS = Not Significant
[2/]Damage rating: 1 = no damage up to 5 = severe lodging, dying plants, and uneven plant growth. Ratings are an average of observations 40 and 51 DAP.
[3/]DAP = Days After Planting

Table 4. Production factors and aflatoxin accumulation in corn treated with Poncho and Cruiser insecticides applied to the seed, Lawrence Hinze Farm, Lavaca County, TX 2011.

Seed treatment	Rate mg ai/seed	Aflatoxin ppb	Bushel weight	% grain moisture	Yield bu/acre[2/]	$ return over nontreated[3/]
Poncho 5FS	0.25	23.1[a]	53.9[a]	11.2[a]	17.0[bcd]	42.59
	0.50	48.5[a]	54.3[a]	11.6[a]	19.1[abc]	54.17
	1.25	45.0[a]	54.0[a]	12.3[a]	21.1[a]	62.37
Cruiser 5FS	0.25	61.5[a]	53.9[a]	10.8[a]	13.9[d]	22.90
	0.50	57.3[a]	53.9[a]	11.3[a]	16.7[cd]	38.93
	1.25	53.0[a]	54.1[a]	11.4[a]	20.7[ab]	59.83
Nontreated		35.3[a]	53.5[a]	10.5[a]	9.9[e]	-
LSD (P = 0.05)		NS[1/]	NS	NS	3.87	
P > F		.7870	.7359	.2749	.0001	

Means in a column followed by the same letter are not significantly different by ANOVA.

[1/] NS = Not Significant

[2/] Yield at 15% moisture

[3/] Corn valve was $6.75/bu. Costs included harvesting/hauling ($0.40/bu); chemical cost based on seeding rate was $2.50/acre (0.25 mg ai/seed), $4.25/acre (0.50 mg ai/seed) and $8.75/acre (1.25 mg ai/seed). Returns were calculated without regard to statistically similar yields.

IMPACT OF CORN HYBRID GENETIC TRAITS ON CORN EARWORM (TEST 1)

Texas AgriLife Research and Extension Center, Nueces County, 2011

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SUMMARY: Corn earworm larvae were significantly lower in number at the brown silk stage in the VT3 Pro hybrids. In the other hybrids earworm numbers averaged more than 1/ear. Ear damage was especially low in DKC 68-05 VT3 Pro hybrid compared to all other hybrids including the other VT3 Pro hybrid (DKC 67-21). No statistical differences were found in plant stands, grain moisture or yield. However, all three non-Bt hybrids had numerically lower yields ranging from 4.9-17.4 bushels/acre. The VT3 Pro hybrids sustained less corn earworm damage, but this did not result in a statistical advantage in yield. Aflatoxin levels ranged from 20.1 to 251.8 ppb without showing statistically significant differences.

OBJECTIVES: Hybrids were evaluated to measure levels of protection from corn earworm and other caterpillar pests, to determine if protection from aflatoxin accumulation could be achieved through better caterpillar control, and to evaluate the fit of the hybrids under Texas Gulf Coast growing conditions (increased value for growers).

MATERIALS/METHODS: Corn hybrids were planted February 25, 2011 at the Texas AgriLife Research and Extension Center Meaney Annex in Nueces County. A 4-row John Deere model 6100 planter equipped with cone seeders delivered seed to 8-row by 35 foot plots with row spacing of 38 inches. The seeding rate was 20,634/acre. Treatments were arranged in a randomized complete block with 4 replications. Corn was grown under dryland conditions with good moisture at planting followed by very little in-season rainfall.

Hybrids containing VT3 Pro had two genes (Cry1A.105+Cry2Ab2 pyramid of toxins) for caterpillar control. One of the Pioneer hybrids (33F87 HX1) contained one gene toxin (Cry1F) for caterpillar control. The corresponding hybrids to the Bt-gene hybrids were near isolines (similar genetics).

Herbicide applied on the planting date included Atrazine 4L (1.0 quart/acre) + Dual II Magnum (1.3 pints/acre). Fertilizer consisted of 80-20-0-5S-2Zn.

Treatments were assessed by (1) Counting the number of corn plants on 13.75 feet on each of the center two rows in plots on 4/11; (2) examining 10 ears/plot at the brown silk stage on 5/9 for corn earworm and fall armyworm larvae and sizing larvae into small [visible to 0.25 inch], medium [>0.25 to 0.50 inch] and large [> 0.50 inch]; (3) selecting 10 ears/plot on 6/15 to measure kernel damage, centimeters distance from tips with damage, square centimeters damage on ears, and number of ears with evidence of caterpillar feeding; and (4) harvesting 13.75 feet of row from both of the center two rows in plots on 6/27. Ear samples were threshed on a research laboratory machine; corn weights were converted to that at 15% moisture. Corn samples were measured for aflatoxin accumulation using a Vicam Series-4 Fluorometer Model V2 testing kit (Afla Test FGIS method).

Agriculture Research Manager (ARM revision 6.1.13) software was used to conduct analysis of variance, and means were separated by LSD.

RESULTS/DISCUSSION: Corn earworm larvae, divided into size categories, were significantly fewer in number and tended to have more classified in the small category in the VT3 Pro hybrids evaluated at the brown silk stage compared with numbers found in the non-Bt hybrids (Table 1). Note especially the differences or lack thereof in the paired isolines. Likewise, numerically more small corn earworms were observed in the Pioneer HX1 (single Bt gene) hybrid than medium or large sizes. Total numbers of corn earworm larvae were significantly fewer in the two VT3 Pro hybrids. Nearly equal numbers of corn earworms (all sizes) were found in the non-Bt hybrids and the Pioneer HX1 hybrid; in these hybrids corn earworm numbers averaged more than 1/ear. Significantly fewer ears were infested in the two VT3 Pro hybrids tested.

Numbers of kernels damaged, length of ear damage down the ear from the tip, square centimeters of ear damage, percentage of ears with tip damage, and aflatoxin accumulation in harvested corn is provided in Table 2. Numbers of kernels damaged and centimeters of ear tip damage by corn earworm was significantly lower in only one of the VT3 Pro hybrids (DKC 68-05) compared with all other hybrids evaluated. The same hybrid also exhibited fewer square centimeters of ear damage and had the lowest percentage of the ears with tip damage (evidence of infestation). Aflatoxin accumulation differences were not observed, but numerical differences were great ranging from 20.1 to 251.8 ppb. There seemed to be a trend for the isolines DKC 67-22 RR (non-Bt) and DKC 67-21 RR VT3 Pro to have higher aflatoxin associated with the genetics, but again, it could not be demonstrated statistically. Based on the fact that aflatoxin accumulation was not different where lower corn earworm damage was observed indicates that this insect damage was not related to aflatoxin levels, at least in this field study.

No differences were found in plant stands, grain moisture at harvest or yield, but differences were measured in numbers of harvested ears and bushel weight (Table 3). Reasons for fewer numbers of harvested ears (while at the same time showing no differences in plant stands) cannot be explained. However, the increased bushel weight readings in two entries may relate to the fact that they were near isogenic hybrids (DKC 67-21 and DKC 67-22). Although no differences were measured in the yield data, all 3 non-Bt hybrids numerically had lower yield (ranged from 4.9-17.4 bushels less) than the corresponding near isogenic hybrid. Yields were highly variable within hybrids possibly related to inadequate soil moisture during the maturing process.

ACKNOWLEDGMENTS: Atila Deak, Monsanto Company, is thanked for his support of the field study. Rudy Alaniz and Clint Livingston, Demonstration Assistants, are thanked for their work in conducting the study.

Table 1. Corn earworm and percentage of infested ears in corn hybrids at brown silk stage, Texas AgriLife Research and Extension Center, Nueces County, TX, 2011.

Hybrid	Number corn earworm /10 ears				% CEW[1/] infested ears at brown silk
	small	medium	large	total	
DKC 68-04 RR (non-Bt)	3.3[bc]	5.5[a]	4.8[a]	13.5[a]	90.0[a]
DKC 68-05 VT3 Pro	4.0[bc]	0.0[b]	0.0[b]	4.0[b]	35.0[b]
DKC 67-22 RR (non-Bt)	2.8[bc]	3.3[a]	5.3[a]	11.3[a]	85.0[a]
DKC 67-21 RR VT3 Pro	1.8[c]	0.0[b]	0.3[b]	2.0[b]	27.5[b]
Pioneer 33F85 RR (non-Bt)	5.8[ab]	5.5[a]	1.8[ab]	13.0[a]	87.5[a]
Pioneer 33F87 HX1	8.3[a]	3.5[a]	1.0[b]	12.8[a]	87.5[a]
LSD (P = 0.05)	3.38	2.68	3.54	6.64	25.05
P > F	.0114	.0008	.0204	.0054	.0001

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]CEW = Corn earwormTable

Table 2. Corn earworm damage to ears and aflatoxin accumulation in corn hybrids, Texas AgriLife Research and Extension Center, Nueces County, TX, 2011.

Hybrid	# da. kernels/ear	Max da. cm/ear tip	Ear da. sq cm/ear	% ears with tip da.	Aflatoxin ppb
DKC 68-04 RR (non-Bt)	13.8[a]	3.2[a]	3.9[ab]	100[a]	20.1[a]
DKC 68-05 VT3 Pro	5.0[b]	1.0[b]	1.0[c]	65.0[b]	53.0[a]
DKC 67-22 RR (non-Bt)	14.8[a]	3.6[a]	4.9[a]	92.5[a]	197.5[a]
DKC 67-21 RR VT3 Pro	11.3[a]	2.8[a]	3.2[b]	87.5[a]	251.8[a]
Pioneer 33F85 RR (non-Bt)	10.9[a]	3.4[a]	3.5[b]	95.0[a]	40.7[a]
Pioneer 33F87 HX1	12.4[a]	2.9[a]	3.4[b]	100.0[a]	85.3[a]
LSD (P = 0.05)	5.09	1.02	1.40	15.48	NS
P > F	.0145	.0012	.0011	.0020	.2315

Means in a column followed by the same letter are not significantly different by ANOVA.

Table 3. Plant stand and production factors in corn hybrids evaluated for caterpillar control, Texas AgriLife Research and Extension Center, Nueces County, TX, 2011.

Hybrid	Plants 1000's/acre	Ears harvested 1000's/acre	Bushel weight	Moisture %	Yield bu/acre[2/]
DKC 68-04 RR (non-Bt)	20.5[a]	19.5[ab]	52.9[d]	15.7[a]	64.3[a]
DKC 68-05 VT3 Pro	20.8[a]	20.4[a]	53.5[d]	15.1[a]	69.2[a]
DKC 67-22 RR (non-Bt)	20.6[a]	19.4[ab]	57.5[a]	16.6[a]	59.3[a]
DKC 67-21 RR VT3 Pro	20.6[a]	18.1[bc]	57.5[a]	16.1[a]	72.4[a]
Pioneer 33F85 RR (non-Bt)	18.6[a]	16.8[c]	56.4[b]	16.3[a]	53.5[a]
Pioneer 33F87 HX1	20.1[a]	18.9[ab]	55.5[c]	15.5[a]	70.9[a]
LSD (P = 0.05)	NS[1/]	1.98	0.87	NS	NS
P > F	.5839	.0222	.0001	.4555	.1712

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]NS = Not Significant
[2/]Yield at 15% moisture

IMPACT OF CORN HYBRID GENETIC TRAITS ON CORN EARWORM (TEST 2)

M Plus Land Company, Colorado County, 2011

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SUMMARY: The corn earworm infestation in ears was low, but the two VT3 Pro (2-gene Bt) hybrids and Pioneer 33F87 HX1 hybrid had fewer larvae in ears than the other tested hybrids. Except for the Pioneer HX1 (1-gene Bt) hybrid, larval numbers in the VT3 Pro hybrid were statistically lower compared to their numbers in the other hybrids tested. Generally less damage to ears was observed in the VT3 Pro hybrids, but it was not always significantly different from the Pioneer Bt hybrid.

The test was conducted under very dry conditions which resulted in poor corn production. Bushel weight and grain moisture differences were found. Statistical differences did not occur in the yield data, but numerically within the hybrid pairs, the highest yield favored the non-Bt hybrid in all cases. No differences were found in aflatoxin accumulation.

OBJECTIVES: Corn hybrids were evaluated to determine the level of caterpillar control obtained in 2-gene and 1-gene genetically engineered entries compared to non-Bt hybrids, and to measure yield and aflatoxin accumulation.

MATERIALS/METHODS: The corn test was planted on March 3, 2011 on the M Plus Land Company Farm next to County Road 190 just north of FM 2614. A John Deere model 7100 2-row planter seeded 23,844 kernels/acre through cone seed dispensers. Plots were 8 rows wide by 30-feet long, and treatments were replicated 4 times in a randomized complete block design. Atrazine 4L (1.0 quart/acre) + Dual II Magnum (1.3 pints/acre) + Roundup WM (22.0 ounces/acre) herbicides were applied just after planting. Soil moisture was excellent at planting , but season rainfall was very limited (drought conditions).

Corn hybrids containing VT3 Pro had two genes (pyramid of toxins) for caterpillar control. One of the Pioneer hybrids (33F87 HX1) contained one gene toxin for caterpillar control. The corresponding hybrids to the Bt-gene hybrids were near isolines (similar characteristics).

Treatments were assessed by (1) counting the number of plants on 13.75 feet of row on both center two rows in plots on 3/18; (2) examining 20 ears/plot on 5/19 just as silks were starting to turn brown for the presence of corn earworm and assigning the larvae to size categories of small [visible to 0.25 inch], medium [0.25 to 0.5 inch], and large [> 0.5 inch]; (3) selecting 20 ears/plot on 6/28 to evaluate number of kernels damaged, centimeters down from the ear tip exhibiting damage, and square centimeters damage; and (4) harvesting 10-row feet on each of the center two rows in plots for yield. Harvested ear corn was threshed on a research laboratory machine; corn weights were converted to the standard at 15% moisture. Corn samples were measured for aflatoxin accumulation with a Vicam Series-4 Fluorometer model V2 testing kit (Afla Test FGIS method).

Agriculture Research Manager (ARM revision 6.1.13) software was used to conduct analysis of variance, and means were separated by LSD.

RESULTS/DISCUSSION: Corn earworm larvae on ears at the brown silk stage were relatively low in number compared with numbers found in similar tests conducted over the past two seasons (Table 1). Although statistical differences were not always found when larvae were separated by size (small and large larvae) the trends followed what would be expected; that is, lower numbers of corn earworm in the two VT3 Pro hybrids (2 Bt-genes) and even in the HX1 hybrid (1 Bt-gene). However, total corn earworm numbers did show the statistical differences expected. Likewise, the Bt hybrids had lower percentage damaged ears at the brown silk stage. However, the non-Bt hybrid 33F85 did not have statistically higher level of infested ears compared to the Bt hybrids.

As the grain began to dry, additional ears were examined for amount of corn earworm damage (Table 2). Significantly less damaged kernels, centimeters of corn earworm feeding down the ear, square centimeters of damage, and percentage of ears exhibiting damage was measured in the VT3 Pro hybrids compared with the non-Bt hybrids. The Pioneer 33F87 HX1 hybrid corn did not differ statistically for these parameters in several cases. Surprisingly low aflatoxin levels (considering the severe drought stress) were measured, and no statistical differences were found among treatments.

Plant stand, yield and grain characteristics are given in Table 3. Plant stand differences were not observed, but there were differences in bushel weight and grain moisture data. DKC 67-22 (non-Bt) had significantly higher bushel weight than all other tested hybrids. Numerically, the similar hybrid (DKC 67-21 RR VT3 Pro) was next in line in bushel weight. Yields were very low due to the extreme dry conditions under which the corn was grown. No differences were detected in yield; however, it was interesting to note that the non-Bt isolines of the tested pairs in all cases had the higher yield (5.8, 8.3, and 4.7 bushels/acre, respectively).

ACKNOWLEDGMENTS: Atila Deak, Monsanto Company, is thanked for his support of the field study. Rudy Alaniz and Clint Livingston, Demonstration Assistants, are thanked for their support.

Table 1. Corn earworm and percentage of infested ears in corn hybrids at brown silk stage, M Plus Land Company, Colorado County, TX.

Hybrid	Number corn earworm /20 ears small	medium	large	total	% CEW[2/] damaged ears at brown silk
DKC 68-04 RR (non-Bt)	1.3[a]	4.3[a]	0.8[a]	6.3[ab]	30.0[a]
DKC 68-05 VT3 Pro	0.5[a]	0.0[b]	0.0[a]	0.5[c]	2.5[c]
DKC 67-22 RR (non-Bt)	4.5[a]	1.5[b]	0.5[a]	6.5[a]	27.5[ab]
DKC 67-21 RR VT3 Pro	0.3[a]	0.0[b]	0.0[a]	0.3[c]	1.3[c]
Pioneer 33F85 RR (non-Bt)	1.8[a]	0.3[b]	0.0[a]	2.0[bc]	12.5[bc]
Pioneer 33F87 HX1	0.5[a]	0.0[b]	0.0[a]	0.5[c]	3.8[c]
LSD (P = 0.05)	NS[1/]	2.57	NS	4.47	16.47
P > F	.0531	.0172	.1039	.0179	.0042

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]NS = Not Significant
[2/]CEW = Corn earworm

Table 2. Corn earworm damage to ears and aflatoxin accumulation in corn hybrids, M Plus Land Company, Colorado County, TX.

Cultivar	# da. kernels/ear	Max da. cm/ear tip	Ear da. sq cm/ear	% ears with tip da., 6/28	Aflatoxin ppb
DKC 68-04 RR (non-Bt)	4.2[a]	1.4[a]	1.7[a]	50.0[a]	11.5[a]
DKC 68-05 VT3 Pro	0.6[b]	0.2[c]	0.1[b]	7.5[c]	16.0[a]
DKC 67-22 RR (non-Bt)	4.0[a]	1.5[a]	1.9[a]	47.5[a]	38.2[a]
DKC 67-21 RR VT3 Pro	0.5[b]	0.4[bc]	0.3[b]	17.5[bc]	6.8[a]
Pioneer 33F85 RR (non-Bt)	4.9[a]	1.7[a]	1.7[a]	52.5[a]	2.4[a]
Pioneer 33F87 HX1	3.2[ab]	0.8[b]	0.8[b]	27.5[b]	3.7[a]
LSD (P = 0.05)	2.94	0.49	0.76	19.57	NS[1/]
P > F	.0200	.0001	.0002	.0005	.5885

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]NS = Not Significant

Table 3. Plant density and grain production parameters for various corn hybrids, M Plus Land Company, Colorado County, TX, 2011.

Cultivar	Plants 1000's/acre	Bushel weight	Moisture %	Yield bu/acre[2/]
DKC 68-04 RR (non-Bt)	21.3[a]	46.8[d]	12.3[d]	43.2[a]
DKC 68-05 VT3 Pro	22.6[a]	48.0[cd]	12.7[cd]	37.4[a]
DKC 67-22 RR (non-Bt)	22.1[a]	53.9[a]	12.9[bc]	39.7[a]
DKC 67-21 RR VT3 Pro	22.4[a]	50.6[b]	13.1[ab]	31.4[a]
Pioneer 33F85 RR (non-Bt)	20.9[a]	50.1[bc]	13.4[a]	39.1[a]
Pioneer 33F87 HX1	22.1[a]	49.6[bc]	13.2[ab]	34.4[a]
LSD (P = 0.05)	NS[1/]	2.60	0.40	NS
P > F	.5610	.0007	.0003	.2310

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]NS = Not Significant
[2/]Yield at 15% moisture

EFFECT OF FOLIAR INSECTICIDE AND FUNGICIDE ON NON-BT CORN

Albert Andel Farm, Jackson County, 2011

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Edna and Corpus Christi, Texas

SUMMARY: No reduction was found in corn earworm numbers or damage in Belt or Belt + Headline treatments, nor was there any effect on yield. Corn earworm numbers were relatively low in the study. No differences were found in aflatoxin levels. Furthermore, we have demonstrated yield increase in only 2 of 7 field studies over the years by the use of foliar insecticide applied to field corn at early silking stage. We have not found a significant yield increase with Headline used alone, although in 2010 Baythroid + Headline treatment did produce significantly more corn. In that same study, however, Baythroid used alone produced the same yield (0.5 bushel difference). Our conclusion from this testing program is that economic return over time by use of either insecticide or fungicide in field corn is highly unlikely.

OBJECTIVES: The test was conducted (1) to determine the impact of Belt insecticide on corn earworm and other caterpillar pests, (2) to measure yield response and aflatoxin accumulation as a result of insect control, and (3) to evaluate the response of corn to Headline fungicide.

MATERIALS/METHODS: Pioneer 33F85 RR (non-Bt) hybrid corn grown on the Albert Andel Farm on County Road 108 in Jackson County was used for the test. Individual plots were 40 rows wide and rows were spaced on 38-inch centers with plot lengths varying from 580 to 1030 feet. Treatments were arranged in a randomized complete block design with 3 replications of the treatments. Belt 4SC (4.0 ounces/acre) and Headline 2.09EC (6.0 ounces/acre) were applied by air on 5/4 during early silk stage. Total spray volume for the treatments was 5 gpa, and NIS was added at 1% vv.

Treatments were assessed by (1) examining 20 corn ears in each plot on 5/16 at the brown silk stage 12 DAT (days after treatment) for corn earworm larvae and damage; (2) dividing corn earworm larvae into size category as small [visible to 0.25 inch], medium [> 0.25 to 0.50 inch], and large [> 0.50 inch]; (3) assigning a dry down rating to plots [1 = green leaves to 5 = complete brown leaves] on 3 dates; (4) harvesting 8 rows near the center of plots on 7/6 with a commercial John Deere 9610 combine equipped with a Greenstar 2600 GPS and yield monitor; and (5) using a Vicam Series-4 Fluorometer Model V2 testing kit [Afla Test FGIS method] to measure aflatoxin levels in harvested corn samples. Grain bushel weights and moisture levels were determined. Grain weights were corrected to the 15% moisture standard.

Agriculture Research Manager (ARM revision 6.1.13) software was used to conduct analysis of variance, and means were separated by LSD.

RESULTS/DISCUSSION: The corn earworm infestation was relatively low compared to what is generally observed. No differences were found in their numbers or damage to ears 12 days after treatment (DAT) nor were there any data trends to even indicate the slightest treatment effect (Table 1).

It has been reported that the fungicide Headline helps to maintain green plant pigment for an extended period. Plant dry down ratings on 3 dates did not show statistical differences (Table 2), but there may have been a very slight trend based on slightly greener ratings in the Headline treatment evaluated on 6/1 and 6/8. By the time of the last rating on 6/16 no evidence remained of enhanced green plant color nor did there seem to be any trend in the average of the three rating dates.

Aflatoxin accumulation in harvested corn and production parameters are provided in Table 3. Aflatoxin levels in the treatments ranged from 19.1 to 50.0 ppb with no statistical differences or trends observed. Significant differences were not observed in bushel weight, grain moisture at harvest, or in the yield data. Over the years we have only in occasional tests been able to demonstrate yield increase with insecticide applied to field corn. Only in one test (see 2010) did a significant yield increase occur with the use of Headline + Baythroid compared with nontreated corn. However, in that same test Baythroid alone produced just as much corn as the Headline + Baythroid treatment.

ACKNOWLEDGMENTS: Special acknowledgment is extended to Don Wright, Coastal Flying Service, for applying the chemicals to these tests over the past several years. Coastal Flying Service has shown special interest in this work and has had to ferry fairly long distances to make these applications. Albert Andel is thanked for his interest in conducting the study by providing the corn field and harvesting samples to determine yield. Gary Schwarzlose, Bayer CropScience, is thanked for providing the Belt insecticide, and Brian Vercellino, BASF Corporation, is thanked for providing the Headline fungicide.

Table 1. Corn earworm numbers in corn following insecticide and fungicide treatment, Albert Andel Farm, Jackson County, TX, 2011.

Treatment[1/] (rate)	Number corn earworm /20 ears				CEW[3/] da. % ears
	small	medium	large	total	
Belt 4SC (3.0 oz/acre)	0.7[a]	1.3[a]	1.3[a]	3.3[a]	21.7[a]
Belt 4SC+Headline 2.09 EC (3.0 + 6.0 oz/acre)	0.0[a]	1.3[a]	1.7[a]	3.0[a]	18.3[a]
Headline 2.09 SC (6.0 oz/acre)	0.0[a]	0.7[a]	1.7[a]	2.3[a]	30.0[a]
Nontreated	1.0[a]	2.0[a]	2.0[a]	5.0[a]	23.3[a]
LSD (P = 0.05)	NS[2/]	NS	NS	NS	NS
P > F	.5609	.7677	.9050	.5002	.7971

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]Treatments were applied 5/4 when corn was in the early to mid-green silk stage. Corn earworm counts were made12 days after treatment (5/16).
[2/]NS = Not Significant
[3/]CEW = Corn earworm

Table 2. Plant dry down ratings in corn treated with insecticide and fungicide, Albert Andel Farm, Jackson County, TX, 2011.

Treatment[1/] (rate)	Dry down ratings[3/]			
	6/1	6/8	6/16	Average
Belt 4SC (3.0 oz/acre)	2.8[a]	3.5[a]	4.3[a]	3.6[a]
Belt 4SC+Headline 2.09 EC (3.0 + 6.0 oz/acre)	2.2[a]	3.3[a]	4.2[a]	3.2[a]
Headline 2.09 SC (6.0 oz/acre)	1.8 [a]	3.0[a]	4.2[a]	3.0[a]
Nontreated	2.3[a]	3.2[a]	4.0[a]	3.2[a]
LSD (P = 0.05)	NS[2/]	NS	NS	NS
P > F	.5883	.2442	.5720	.5393

Means in a column followed by the same letter are not significantly different by ANOVA.

[1/]Treatments were applied 5/4 when corn was in the early to mid-green silk stage. Corn earworm counts were made12 days after treatment (5/16).

[2/]NS = Not Significant

[3/]Ratings range from 1 = green leaves to 5 = completely brown leaves on plants.

Table 3. Aflatoxin accumulation and production factors in corn treated with insecticide and fungicide, Albert Andel Farm, Jackson County, TX, 2011.

Treatment[1/] (rate)	Aflatoxin ppb	Bushel weight	Moisture %	Yield bu/acre[3/]
Belt 4SC (3.0 oz/acre)	42.3[a]	58.6[a]	12.5[a]	79.5[a]
Belt 4SC+Headline 2.09 EC (3.0 + 6.0 oz/acre)	50.0[a]	58.6[a]	12.4[a]	72.9[a]
Headline 2.09 SC (6.0 oz/acre)	43.3[a]	58.7[a]	13.3[a]	85.4[a]
Nontreated	19.1[a]	58.1[a]	12.4[a]	82.3[a]
LSD (P = 0.05)	NS[2/]	NS	NS	NS
P > F	.7267	.2968	.4882	.4628

Means in a column followed by the same letter are not significantly different by ANOVA.

[1/]Treatments were applied 5/4 when corn was in the early to mid-green silk stage. Corn earworm counts were made12 days after treatment (5/16).

[2/]NS = Not Significant

[3/]Yield at 15% moisture corn

CORN EARWORM CONTROL WITH SYNGENTA AGRISURE VIPTERA CORN HYBRIDS WITH VARIOUS REFUGE SEED BLENDS

Alan Stasney Farm, Fort Bend County, 2011

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SUMMARY: Significant reduction in corn earworm and damage was observed in the pyramid gene Bt corn hybrids evaluated which included the blends with non-Bt hybrid seed (95/5 and 90/10 Bt to non-Bt). There were plant stand and grain moisture differences in the test which could not be explained. Statistical differences in aflatoxin accumulation were not found, but numerically the non-Bt and single gene Bt corn had much higher aflatoxin levels. No statistically significant differences were observed in the yield data. Yields were very low in all treatments due to late planting and hot conditions; therefore, yields are not reported herein.

OBJECTIVES: The field study was conducted to compare various corn hybrids with and without pyramid genes for caterpillar control, to determine the impact of non-Bt/Bt hybrid blends of seed, to measure aflatoxin accumulation, and to evaluate effect on yield.

MATERIALS/METHODS: The field study was planted March 29, 2011 on the Alan Stasney Farm near Kendleton, Texas with a two-row John Deere model 7100 planter equipped with cone seed dispensers. Plots were 4 rows by 22 feet and treatments were arranged in a randomized complete block design with 6 replications. Four border rows and 22-foot end plots were planted around the test. A 10-foot fallow area was maintained around the test perimeter and corn was not grown within 660 feet of the site in order to comply with USDA APHIS regulations.

The test was conducted under USDA APHIS regulatory guidelines for experimental genetically modified organisms. Isolation from other corn and monitoring of the test site was maintained. Planting, harvest and shredder equipment was cleaned following planting, harvest and plant destruction operations. Monthly inspection of the site will be maintained until the anniversary plant destruction date of August 2, 2012.

Treatments were assessed by (1) periodically monitoring the site for insect activity and unusual plant growth throughout the season; (2) counting the number of corn plants on all 4 rows in plots on 5/5; (3) examining 10 ears/plot at the brown silk stage on 6/15 for corn earworm and fall armyworm and sizing the larvae into small [visible to 0.25 inch], medium [> 0.25 to 0.50 inch] and large [> 0.50 inch]; (4) examining another 10 corn ears on 6/29 for damaged kernels, maximum centimeters damage from ear tips down the ears, total square centimeters of damage on ears, and percentages of ears exhibiting corn earworm damage; and (5) harvesting the center two rows in plots on 8/2 with a research combine equipped with moisture and weight determination instruments. Grain weights were corrected to 15% moisture level. Corn from each plot was ground with a Romar Mill (series 2A). Aflatoxin levels were then measured using a Vicam Series-4 Fluorometer Model V2 testing kit (Afla Test FGIS method).

Agriculture Research Manager (ARM revision 6.1.13) software was used to conduct analysis of variance, and means were separated by LSD at the 0.05 probability level.

RESULTS/DISCUSSION: Ears in the non-Bt and Bt11 corn hybrid plots at the brown silk stage contained about the same number of corn earworm larvae (average of all sizes), and their numbers were significantly greater in these hybrids than found in the other hybrids tested (Table 1). Small larvae were found in significantly greater number in the single gene hybrid (Bt11); similar data have been observed in single gene Bt hybrids in the past. It probably indicates that the gene has an adverse effect on corn earworm larval development, i.e. development is slower on the Bt hybrid resulting in higher numbers of small larvae because these larvae had not yet reached the cannibalistic stage as they had in the non-Bt corn. A significantly higher percentage of ears infested at brown silk were observed in the non-Bt and Bt11 corn hybrids. These high infestation rates led to significantly higher counts of larvae per ear and feeding damage per ear in the non-Bt and Bt11 hybrids than in the pyramid-gene stacked hybrids.

Ears were examined about the time they began to dry for effects of corn earworm on kernels (Table 2). Kernel damage was much greater in the non-Bt hybrid and the Bt11 hybrid compared with the pyramid-gene Bt hybrids, and there was a numerical increase in the number of damaged kernels when non-Bt hybrid seed was included with the pyramid-gene Bt hybrid at both the 95/5 and 90/10 mixture. Centimeters damage from the ear tip, square centimeters of ear damage, and percentage of ears exhibiting damage showed that the pyramid-gene hybrids with or without the non-Bt blended seed contained about the same low levels of ear tip damage.

Plant stand (not shown) and aflatoxin accumulation (Table 2) were measured. Lower plant stands in the non-Bt and Bt11 hybrid could not be explained but may have been due to seed quality variation associated with seed produced via hand-crossing. There was no evidence of caterpillar damage to seedling or larger plants that may have reduced plant stand. Statistical differences were not observed in aflatoxin accumulation, but the non-Bt and Bt11 hybrids numerically had the highest aflatoxin levels. Due to the very hot conditions and delay in harvest, grain moisture was very low. Corn yields were very low in all plots due to late planting and hot conditions even with irrigation (data not shown).

ACKNOWLEDGMENTS: Thanks are extended to Alan Stasney for his support of crop research activities. Brad Minton, Brian Bacak, and Trevor Jones, Syngenta Crop Protection are acknowledged for their help with field activities. Syngenta Seeds is thanked for providing a grant for this work.

Table 1. Number of corn earworm and percentage infested ears in non-Bt, Bt, and Bt + non-Bt seed blended corn hybrids at brown silk stage, Alan Stasney Farm, Fort Bend County, TX, 2011.

Hybrid[1/]	Number corn earworm/10 ears				% CEW[3/] infested ears at brown silk
	small	medium	large	total	
Non-Bt	4.8[b]	6.2[a]	5.2[a]	16.2[a]	68.3[a]
Bt11	8.2[a]	5.0[a]	2.8[b]	16.0[a]	73.3[a]
Bt11 + MIR162	0.7[c]	0.2[b]	0.0[c]	0.8[b]	8.3[b]
Bt11 + MIR162 + TC1507	0.2[c]	0.0[b]	0.0[c]	0.2[b]	3.3[b]
Bt11 + MIR162 + TC1507 (95/5)[2/]	0.8[c]	0.0[b]	0.3[c]	1.2[b]	10.0[b]
Bt11 + MIR162 + TC1507 (90/10)[2/]	0.5[c]	1.0[b]	0.3[c]	1.8[b]	15.0[b]
LSD (P = 0.05)	2.84	3.35	2.05	4.74	23.07
P > F	.0001	.0010	.0001	.0001	.0001

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]All hybrids contain the glyphosate gene (GA21 or GA2)
[2/]Refers to the percentage seed blend of Bt genes with Non-Bt
[3/]CEW = Corn earworm

Table 2. Corn earworm damage to ears in non-Bt, Bt, and Bt + non-Bt seed blended corn hybrids, Alan Stasney Farm, Fort Bend County, TX, 2011.

Hybrid[1/]	# da. kernels/ear	Max. da. cm/ear tip	Ear da. sq cm/ear	% ears with tip da.	Aflatoxin ppb
Non-Bt	33.9[a]	7.3[a]	14.1[a]	100.0[a]	117.4[a]
Bt11	21.6[b]	5.6[b]	10.0[b]	98.3[a]	257.0[a]
Bt11 + MIR162	1.0[c]	0.6[c]	0.4[c]	21.7[b]	97.5[a]
Bt11 + MIR162 + TC1507	0.9[c]	0.6[c]	0.4[c]	30.0[b]	41.1[a]
Bt11 + MIR162 + TC1507 (95/5)[2/]	3.1[c]	0.8[c]	1.0[c]	21.7[b]	77.7[a]
Bt11 + MIR162 + TC1507 (90/10)[2/]	3.0[c]	1.1[c]	1.4[c]	31.7[b]	75.8[a]
LSD (P = 0.05)	4.54	0.69	2.07	10.84	NS[5/]
P > F	.0001	.0001	.0001	.0001	.4280

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]All hybrids contain the glyphosate gene (GA21 or GA2)
[2/]Refers to the percentage seed blend of Bt genes with Non-Bt
[3/]NS = Not Significant

EVALUATION OF SYSTEMIC SEED AND PLANTER BOX APPLIED INSECTICIDES ON SORGHUM FOR CONTOL OF EARLY SEASON INSECTS AND IMPACT ON YIELD

Texas AgriLife Research and Extension Center, Nueces County, 2011

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SUMMARY: Insect pest numbers were low at the test site; therefore, the corn leaf aphid which was present served as an indicator for treatment effectiveness. The highest number of corn leaf aphid was observed in the Cruiser (low rate), Latitude, and nontreated sorghum. The Latitude treatment contained the highest levels of corn leaf aphid, and the Poncho and Cruiser (high rate) treatments contained several fold fewer corn leaf aphids which were statistically lower in number. However, in none of the treatments were corn leaf aphid numbers statistically different from what was found in the nontreated sorghum. Although not reported in the data, numerically greater numbers of weak seedling plants were found in the nontreated plots. It was not determined if an insect caused this damage. There were no statistical differences in the yield data, but there appeared to be a fairly strong trend for higher yield in the Poncho and Cruiser (both rates) treated sorghum compared to the nontreated sorghum.

OBJECTIVES: The field study was conducted to compare marketed systemic insecticide seed treatments on sorghum with special emphasis on a low and high rate of Cruiser.

MATERIALS/METHODS: Sorghum hybrid DKS 53-67 seed was treated by mixing the insecticide and seed in a small concrete mixer for approximately 3 minutes. Seed was then packaged and planted on March 1, 2011 on the Meaney Annex of the Texas AgriLife Research and Extension Center at Corpus Christi with a 4-row model 6100 John Deere planter equipped with cone seed dispensers. The planting rate was 61,902 seed/acre. Cotton had been grown on the site in 2010. Individual plots were 4 rows by 35 feet with a 5-foot alley between each of the 4 replications. The test design was a randomized complete block and rows were on 38-inch centers.

Soil at the site was a sandy clay (50% sand, 14% silt, 36% clay) with a pH of 8.0 and 1.49% organic matter. Herbicide consisted of Atrazine 4L (1.0 quart/acre) + Dual II Magnum (1.3 pints/acre) applied just after planting. The few weeds that did appear were removed from plots by hand. Fertilizer applied was 80-20-0-5S-2Zn.

Treatments were assessed by (1) counting the number of plants and weak plants on 10-row feet in each of the center rows of plots on 3/26, (2) estimating the number of corn leaf aphids/whorl by examination of 5 plants/plot on 4/22, and (4) harvesting 13.75 feet row in each plot on 6/29 and counting the number of harvested heads. Harvested sorghum heads were threshed on a research machine, grain bushel weight was determined, and grain moisture was measured. Grain weight was corrected to 14% moisture.

Agriculture Research Manager (ARM revision 6.1.13) software was used to conduct analysis of variance, and means were separated by LSD.

RESULTS/DISCUSSION: No differences were detected in number of emerged plants (Table 1). Early season insect pests such as yellow sugarcane aphid, greenbug, chinch bug, southern corn rootworm, and white grub were in such low numbers that formal counts in all plots were not taken. Although numbers are not reported herein, on a numerical basis more weak plants were observed in the non-insecticide treated sorghum plots when plant stand counts were made. Significantly fewer heads were harvested from the Cruiser (low rate), Latitude, and nontreated treatments. It is not known if insect pests were responsible for the lower number of harvested heads, but it is known that these same treatments contained the highest levels of corn leaf aphid. It is not thought that corn leaf aphids caused the head differences, only that this insect could be an indicator of treatment effectiveness on insects in general. It is also not known why the Cruiser (high rate) treatment had statistically lower grain moisture at harvest. Although there were no statistical differences in the yield data, numerically, the Poncho and Cruiser treatments averaged 502 lb/acre more than the nontreated sorghum; furthermore, the range in this yield difference was 402 to 614 lb/acre. The trend for this yield difference seems fairly strong, but it cannot be linked to a specific insect pest.

ACKNOWLEDGMENTS: Monsanto Company is thanked for providing non-insecticide treated sorghum seed for the study. Rudy Alaniz and Clint Livingston, Demonstration Assistants, are thanked for carrying out all aspects of the study from treating seed, preparing the land, planting, harvesting and processing harvested grain samples.

Table 1. Effect of insecticide seed and planter box treatments on sorghum, Texas AgriLife Research and Extension Center, Nueces County, TX, 2011.

Treatment (rate)	1000's/acre plants	1000's/acre harvested heads/plot	CLA[3/] /whorl	Grain Moisture %	Yield[4/] lb/acre
Poncho 5FS (5.3 oz/cwt seed)	57.4[a]	63.8[a]	10.3[b]	16.1[a]	4387[a]
Cruiser 5FS (5.1 oz/cwt seed)	52.3[a]	58.3[b]	32.5[ab]	16.1[a]	4474[a]
Cruiser 5FS (7.6 oz/cwt seed)	55.4[a]	66.0[a]	10.8[b]	15.4[b]	4599[a]
Latitude[1/] (5.0 oz/cwt seed)	58.3[a]	54.3[b]	53.8[a]	16.1[a]	4185[a]
Nontreated	54.2[a]	54.0[b]	30.0[ab]	15.7[ab]	3985[a]
LSD (P = 0.10)	NS[2/]	7.87	25.39	0.39	NS
P > F	.8623	.0593	.0526	.0275	.4373

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]A planter box treatment
[2/]NS = Not Significant
[3/]CLA = Corn Leaf Aphid
[4/]Yield at 14% moisture

COMPARISON OF NEW INSECTICIDES AND RATES FOR CONTROL OF HEADWORMS AND RICE STINK BUG ON SORGHUM

David Mayo Farm, Nueces County, 2011
Roy D. Parker and Jeffrey R. Stapper
Extension Entomologist and County Extension Agent, respectively

Corpus Christi and Robstown, Texas

SUMMARY: All insecticides and rates tested provided effective control of headworms (nearly all corn earworm with a few fall armyworm). A higher level of control was not detected with increasing Prevathon rates. Rice stink bug numbers were not significantly reduced, but there was a fairly strong trend for fewer in any plots treated with pyrethroid insecticide (especially Baythroid). Yield was not enhanced by reduction in headworm numbers, which may have resulted from a rapid decline in their numbers possibly due to attack by natural enemies before they reached the last larval instar.

OBJECTIVES: The study was conducted to evaluate new insecticides for headworm control on sorghum and to measure their effects on secondary insect pests such as rice stink bug.

MATERIALS/METHODS: The test insecticides were applied to Pioneer 83G19 hybrid sorghum planted March 9, 2011 on County Road 30 about 0.75 miles west of the intersection with FM 892 on the David Mayo Farm. Some of the seed was already in soft dough when the insecticides were applied. Treatments were applied to 4 rows of 40 foot plots, and 3 nontreated rows were maintained on the side of each plot to prevent drift to evaluated rows. Treatments were arranged in a randomized complete block design with 4 replications of each treatment. Plots to which treatments were applied in each replication were established down the field rows so that each treatment in each replication was on the same set of rows. This arrangement was also used to limit the width of the test to allow the grower an easier way to skip over the test when applying treatment to the remainder of the field.

Insecticides were applied on 6/1 with a Spider Trac sprayer calibrated to deliver 5.1 gpa total volume through 4X hollow cone nozzles at 40 psi and at a speed of 4.2 mph.

Treatments were assessed by (1) shaking 10 heads exhibiting headworm damage into a 2.5 gallon bucket to count corn earworm, fall armyworm and rice stink bug on 5/31 [pretreatment], 6/3 [2 DAT], and 6/5 [4 DAT] from a different row section on each field visit; and (2) harvesting 13.75 feet row from one of the center rows in plots on 6/30. Sorghum samples were threshed on a laboratory machine, grain moisture and bushel weights were obtained for each plot, and grain yields were converted to 14% moisture.

Agriculture Research Manager (ARM revision 6.1.13) software was used to conduct analysis of variance and means were separated by LSD.

RESULTS/DISCUSSION: All tested insecticides and rates provided control of headworms in late milk and early soft dough sorghum at 2 and 4 days after treatment (DAT) compared with numbers found in the nontreated sorghum (Table 1). There were no statistical differences in headworm numbers among the insecticides nor was there a numerical response observed with increasing rates of Prevathon. By 4 DAT headworm numbers had begun to decline in the nontreated sorghum. Post-treatment averages did not reveal any insights other than the fact that all insecticides reduced headworm numbers.

These insecticides did not significantly reduce rice stink bug numbers, but there appeared to be a trend in the pyrethroid insecticide treated sorghum (Asana and Baythroid) for fewer rice stink bugs (Table 2). In fact, following treatment no rice stink bugs were found in any treatment containing Baythroid. Overall, rice stink bug numbers were not sufficiently high enough to obtain meaningful data.

Headworm numbers were near the established economic treatment threshold level, but no differences were detected in the yield level among the treatments (Table 3). There were also no differences in grain moisture or bushel weight. The headworm population was not sustained long enough to cause the amount of damage expected even at the relatively low populations encountered. Similar results were observed in a 2010 field experiment indicating that more focused studies need to be undertaken to find out why the headworms reach a certain size and then begin to slowly decline before entering the pupal stage.

ACKNOWLEDGMENTS: David Mayo is thanked for providing the field site for the study. Rudy Alaniz and Clint Livingston, Demonstration Assistants, provided support by applying treatments, harvesting the sorghum, and processing samples. DuPont and Bayer companies are thanked for providing insecticides and grant support for the test.

Table 1. Effectiveness of insecticides on headworms on sorghum heads, David Mayo Farm, Nueces County, TX, 2011.

Treatment (rate)	Headworms /10 heads[2/]			
	Pretreat	2 DAT[3/]	4 DAT	Post-treat. average
Prevathon 0.43SC (9.8 oz/acre)	2.3[a]	0.8[b]	0.3[b]	0.5[b]
Prevathon 0.43SC (13.3 oz/acre)	2.0[a]	1.3[b]	0.0[b]	0.6[b]
Prevathon 0.43SC (19.9 oz/acre)	3.0[a]	1.3[b]	0.3[b]	0.8[b]
Prevathon 0.43SC + Asana XL 0.66EC (9.8 oz/acre + 5.82 oz/acre)	2.5[a]	0.0[b]	0.0[b]	0.0[b]
Belt 4SC (3.0 oz/acre)	2.8[a]	0.5[b]	0.8[b]	0.6[b]
Baythroid XL 1EC (2.8 oz/acre)	4.5[a]	0.8[b]	0.0[b]	0.4[b]
Belt 4SC + Baythroid XL 1EC (2.0 oz/acre + 1.3 oz/acre)	4.0[a]	0.0[b]	0.5[b]	0.3[b]
Nontreated	3.5[a]	3.5[a]	2.8[a]	3.1[a]
LSD (P = 0.05)	NS[1/]	1.44	0.84	0.87
P > F	.7958	.0015	.0001	.0001

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]NS = Not Significant
[2/]96% headworms were corn earworm
[3/]DAT = Days After Treatment

Table 2. Effectiveness of insecticides on rice stink bug on sorghum heads, David Mayo Farm, Nueces County, TX, 2011.

Treatment (rate)	Rice stink bugs/10 heads			
	Pretreat	2 DAT[2/]	4 DAT	Post-treat. average
Prevathon 0.43SC (9.8 oz/acre)	0.3[a]	1.0[a]	0.5[a]	0.8[a]
Prevathon 0.43SC (13.3 oz/acre)	1.0[a]	1.8[a]	2.5[a]	2.1[a]
Prevathon 0.43SC (19.9 oz/acre)	1.5[a]	0.8[a]	0.8[a]	0.8[a]
Prevathon 0.43SC + Asana XL 0.66EC (9.8 oz/acre + 5.82 oz/acre)	0.5[a]	0.0[a]	0.5[a]	0.3[a]
Belt 4SC (3.0 oz/acre)	0.8[a]	1.0[a]	2.3[a]	1.6[a]
Baythroid XL 1EC (2.8 oz/acre)	0.3[a]	0.0[a]	0.0[a]	0.0[a]
Belt 4SC + Baythroid XL 1EC (2.0 oz/acre + 1.3 oz/acre)	4.0[a]	0.0[a]	0.0[a]	0.0[a]
Nontreated	2.5[a]	1.5[a]	4.5[a]	3.0[a]
LSD (P = 0.05)	NS[1/]	NS	NS	NS
P > F	.3453	.2305	.0835	.0891

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]NS = Not Significant
[2/]DAT = Days After Treatment

Table 3. Sorghum grain moisture, bushel weight and yield from plots treated with various insecticides, David Mayo Farm, Nueces County, TX, 2011.

Treatment (rate)	Grain moisture %	Bushel weight lb	Yield[2/] lb/acre
Prevathon 0.43SC (9.8 oz/acre)	9.7[a]	55.0[a]	3784[a]
Prevathon 0.43SC (13.3 oz/acre)	9.7[a]	55.1[a]	4071[a]
Prevathon 0.43SC (19.9 oz/acre)	9.7[a]	55.0[a]	4029[a]
Prevathon 0.43SC + Asana XL 0.66EC (9.8 oz/acre + 5.82 oz/acre)	9.7[a]	55.3[a]	4409[a]
Belt 4SC (3.0 oz/acre)	9.5[a]	54.8[a]	3847[a]
Baythroid XL 1EC (2.8 oz/acre)	9.4[a]	54.8[a]	4052[a]
Belt 4SC + Baythroid XL 1EC (2.0 oz/acre + 1.3 oz/acre)	9.4[a]	55.1[a]	3910[a]
Nontreated	9.6[a]	55.3[a]	4131[a]
LSD (P = 0.05)	NS[1/]	NS	NS
P > F	.2869	.9645	.1899

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]NS = Not Significant
[2/]Yield at 14% moisture sorghum.

HEADWORM AND RICE STINK BUG CONTROL ON SORGHUM HEADS WITH SELECTED INSECTICIDES

David Mayo Farm, Nueces County, 2011

Roy D. Parker and Jeffrey R. Stapper
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Corpus Christi and Robstown, Texas

SUMMARY: Declare, Lannate, Cobalt Advanced, Stallion, and Mustang Max effectively reduced headworms in sorghum, but as expected, Dimethoate was the least effective tested insecticide on headworms. All products tested reduced rice stink bug, but their numbers overall were low at the test site. No yield effects were observed in the relatively low headworm infestation.

OBJECTIVES: The insecticide evaluation was conducted on sorghum to measure the impact of products on headworms and rice stink bug and to determine if there was any effect of the treatments on production factors.

MATERIALS/METHODS: Treatments were applied to Pioneer 83G19 hybrid sorghum planted March 9, 2011 on County Road 30 about 0.75 miles west of the intersection with FM 892 on the David Mayo Farm. Some of the seed was already in soft dough when insecticides were applied. Treatments were applied to 4 rows of 40-foot plots, and 3 nontreated rows were maintained on the side of each plot to prevent drift to evaluated rows. Treatments were arranged in a randomized complete block design with 4 replications of each treatment. Plots to which treatments were applied in each replication were established down the field rows so that each treatment in each replication was on the same set of rows. This arrangement was also used to limit the width of the test to allow the grower an easier way to skip over the test when applying treatment to the remainder of the field.

Insecticides were applied on 6/1 with a Spider Trac sprayer calibrated to deliver 5.1 gpa total volume through 4X hollow cone nozzles at 40 psi and at a speed of 4.2 mph.

Treatments were assessed by (1) shaking 10 heads exhibiting headworm damage into a 2.5 gallon bucket to count corn earworm, fall armyworm and rice stink bug on 5/31 [pretreatment], 6/3 [2 DAT], and 6/5 [4 DAT] from a different row section on each field visit on the outside treated rows; and (2) harvesting 13.75 feet row from one of the center rows in plots on 6/30. Sorghum samples were threshed on a laboratory machine, grain moisture and bushel weights were obtained for each plot, and grain yields were converted to 14% moisture.

Agriculture Research Manager (ARM revision 6.1.13) software was used to conduct analysis of variance and means were separated by LSD.

RESULTS/DISCUSSION: All but one insecticide tested provided effective control of headworms (96% corn earworm) by 2 DAT (Table 1). Dimethoate was ineffective, as expected, in providing significant headworm control. Declare (gamma-cyhalothrin), Lannate (methomyl), Cobalt (chlorpyrifos + gamma-cyhalothrin), Stallion (zeta-cypermethrin+chlorpyrifos), and Mustang Max (zeta-cypermethrin) all provided excellent control of the headworms.

Rice stink bugs were reduced significantly by all insecticides even though several have been found not to provide the level of control needed in commercial sorghum fields (Table 2). The low number of rice stink bugs encountered at the test site probably did not create enough pressure to show the insecticide weakness. Dimethoate in previous studies has provided a high degree of rice stink bug control.

No differences were observed in grain moisture, bushel weight, or yield in any of the treatments (Table 3). Rapid crop maturity, decline in headworm numbers as they were about to reach the last instar, and a relatively low level infestation likely contributed to the lack of yield response with the insecticide treatments.

ACKNOWLEDGMENTS: David Mayo is thanked for providing the field site for the study. Rudy Alaniz and Clint Livingston, Demonstration Assistants, provided support by applying treatments, harvesting sorghum, and processing samples. Cheminova, FMC Corporation, and Dow AgroSciences companies are thanked for providing insecticides and grant support for the test.

Table 1. Effect of insecticides on headworm numbers on sorghum heads, David Mayo Farm, Nueces County, TX, 2011.

Treatment (rate)	Headworms /10 heads[2/] Pretreat	2 DAT[3/]	4 DAT	Post-treat. average
Declare 1.25SC (1.54 oz/acre)	3.0[a]	0.0[c]	0.0[d]	0.0[c]
Dimethoate 4E (8.0 oz/acre)	5.0[a]	1.5[b]	2.0[ab]	1.8[b]
Declare + Dimethoate (1.54 oz/acre + 8.0 oz/acre)	3.0[a]	0.0[c]	0.0[d]	0.0[c]
Lannate 2.4LV (24.0 oz/acre)	3.5[a]	0.0[c]	0.5[cd]	0.3[c]
Cobalt Advanced 2.628EW (13.0 oz/acre)	2.8[a]	0.0[c]	1.3[bc]	0.6[c]
Stallion 3EC (11.7 oz/acre)	1.8[a]	0.3[c]	0.0[d]	0.1[c]
Mustang Max 0.8EC (4.0 oz/acre)	3.3[a]	0.0[c]	0.0[d]	0.0[c]
Nontreated	3.5[a]	3.5[a]	2.8[a]	3.1[a]
LSD (P = 0.05)	NS[1/]	0.97	0.84	0.77
P > F	.6019	.0001	.0001	.0001

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]NS = Not Significant
[2/]96% headworms were corn earworm
[3/]DAT = Days After Treatment

Table 2. Effect of insecticides on rice stink bug on sorghum heads, David Mayo Farm, Nueces County, TX, 2011.

Treatment (rate)	Rice stink bugs/10 heads			
	Pretreat	2 DAT[2/]	4 DAT	Post-treat. average
Declare 1.25SC (1.54 oz/acre)	0.8[a]	0.0[b]	0.5[b]	0.3[b]
Dimethoate 4E (8.0 oz/acre)	0.3[a]	0.3[b]	0.3[b]	0.3[b]
Declare + Dimethoate (1.54 oz/acre + 8.0 oz/acre)	0.0[a]	0.0[b]	0.5[b]	0.3[b]
Lannate 2.4LV (24.0 oz/acre)	0.3[a]	0.0[b]	0.0[b]	0.0[b]
Cobalt Advanced 2.628EW (13.0 oz/acre)	0.5[a]	0.5[b]	0.3[b]	0.4[b]
Stallion 3EC (11.7 oz/acre)	0.5[a]	0.3[b]	0.5[b]	0.4[b]
Mustang Max 0.8EC (4.0 oz/acre)	2.5[a]	0.0[b]	0.0[b]	0.0[b]
Nontreated	0.8[a]	1.5[a]	4.5[a]	3.0[a]
LSD (P = 0.05)	NS[1/]	0.67	2.11	1.25
P > F	.6609	.0017	.0039	.0010

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]NS = Not Significant
[2/]DAT = Days After Treatment

Table 3. Effect of insecticides on production factors on sorghum, David Mayo Farm, Nueces County, TX, 2011.

Treatment[1/] (rate)	Grain moisture %	Bushel weight lb	Yield[2/] lb/acre
Declare 1.25SC (1.54 oz/acre)	9.6[a]	55.0[a]	4166[a]
Dimethoate 4E (8.0 oz/acre)	9.8[a]	54.9[a]	4272[a]
Declare + Dimethoate (1.54 oz/acre + 8.0 oz/acre)	9.8[a]	55.0[a]	4156[a]
Lannate 2.4LV (24.0 oz/acre)	9.6[a]	54.5[a]	3983[a]
Cobalt Advanced 2.628EW (13.0 oz/acre)	9.8[a]	55.8[a]	4134[a]
Stallion 3EC (11.7 oz/acre)	9.6[a]	55.5[a]	4143[a]
Mustang Max 0.8EC (4.0 oz/acre)	9.6[a]	55.3[a]	3994[a]
Nontreated	9.6[a]	55.3[a]	4131[a]
LSD (P = 0.05)	NS[1/]	NS	NS
P > F	.8071	.5665	.8568

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]NS = Not Significant
[2/]Yield at 14% moisture sorghum

EVALUATION OF INSECTICIDES APPLIED TO STORED SORGHUM FOR PROTECTION AGAINST PEST INSECTS AND THEIR AFFECT ON GRAIN CHARACTERISTICS

Preliminary Report

Texas AgriLife Research and Extension Center, Nueces County, 2011

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SUMMARY: Insect pest numbers were greater in the nontreated sorghum even by 9 DAT, and they continued to increase in dramatic fashion exceeding 100/quart sample during the 3rd storage month. Only one insecticide treatment had failed by the 3rd month, and that was Actellic (alone) where lesser grain borer numbers exceeded the count in the nontreated sorghum. Storcide II, Storcide II + Diacon II, Contain, and Contain + Diacon II treatments were noteworthy in keeping pest numbers relatively low. Actellic + Diacon II, although not statistically different, appeared to have somewhat more rice weevil numbers compared to the other treatments. Counts over the next few months should provide a wealth of information with regard to the effectiveness of the materials being tested.

OBJECTIVE: The experiment was established to measure the impact of insecticides on pest insects in stored grain sorghum with special emphasis on the performance of Contain (spinosad).

MATERIALS/METHODS: Sorghum harvested in 2011 and held at the Bee County Cooperative, Tynan, Texas for about 2 months before it was treated with test insecticides for stored grain insects. The grain was measured in 50 lb increments and treated on August 30, 2011 in a concrete mixer by applying equivalent to 5 gallons of spray volume/60,000 lb. Four 50 lb samples of each treatment were placed in 30 gallon drums for a total of 200 lb/drum. Each drum was weighed to determine exact starting weight of the sorghum, and bushel weight was determined. Each treatment was replicated 4 times and later arranged in randomized complete block experimental design on the floor of the shop building at the Texas AgriLife Research and Extension Center at Corpus Christi. Drums were covered with 0.5-inch hardware cloth to keep out birds, rodents and other unwanted animals. Initial samples were taken 9 days after treatment. Immediately following sampling (before actual counts were made in the samples) 10 live specimens each of rusty grain beetle, red flour beetle, rice weevil, and lesser grain borer were added to each drum. Insects from surrounding natural infestations from inside and outside the building had access to the experimental grain.

Treatments were assessed monthly by (1) measuring grain temperature with a 12-inch thermometer pushed into the center of the grain mass approximately 11.0 inches, (2) using a grain probe at 5 locations in each drum to obtain quart samples of grain for insect counts and moisture determination, and (3) separating insects from the grain using a Seedburo Equipment Company sieve [8/64-inch triangle holes]. Insects were then counted under a Circline magnifier lamp.

Agriculture Research Manager (ARM revision 6.1.13) software was used to conduct analysis of variance and means were separated by LSD (least significant difference).

RESULTS/DISCUSSION: Grain moisture remained relatively stable during the first two full storage months of October and November with no differences among the treatments, but by the December inspection (month 3) statistical differences were observed (Table 1). However, these differences could not be explained biologically nor were they of practical significance.
Grain temperature was significantly higher in the non-insecticide treatment by the second storage month. By the third storage month both the nontreated and Actellic (alone) treated grain had significantly higher temperature which was the result of high insect numbers in these two treatments.

Insect counts taken 9 DAT showed significantly more red flour beetles in the nontreated grain, and their numbers remained significantly higher through the first 3 storage months (Table 2). Rusty grain beetle numbers reflected that found for red flour beetle except by the third storage month (December) higher numbers were found in the Actellic (alone) treatment compared with the remaining insecticides.

Rice weevil numbers were significantly higher in the nontreated sorghum by 9 DAT, and the differences continued through the 3rd month counts (Table 3). Their numbers increased from 0.8/sample 9 DAT to 66.5/quart by the December sample (3rd month). Lesser grain borer populations increased following the first inspection, and by October significantly more were found in the nontreated sorghum. Lesser grain borer numbers continued to increase in the Actellic (alone) treatment until they exceeded statistically the number found in the non-insecticide treated sorghum. The higher number of lesser grain borer in the Actellic (alone) treatment compared to the number found in the nontreated sorghum was not unexpected based on data obtained from previous stored corn tests. This insecticide simply has little effect on the lesser grain borer. Furthermore, since elimination of the other insect species is achieved there is no competition, which may account for the elevated numbers in this treatment for this particular species. Note that where Actellic + Diacon II was used no lesser grain borers were found in any of inspection month to this point.

Table 4 contains data for the total number of stored grain insects for the various treatments including two species not reported in table form (Indian meal moth and sawtoothed grain beetle). By December (3rd storage month) very high numbers of pest insects exceeding treatment threshold were found not only in nontreated grain but also where the Actellic was used alone. Loss to insects has not yet been observed in grain weight, but it seems there is a trend already present in that the greatest weight change to date has occurred in the December inspection (3rd storage month) in the non-insecticide treated grain.

ACKNOWLEDGMENTS: Thanks are extended to Bayer CropScience for providing insecticides and monetary support of the project. Rudy Alaniz and Clint Livingston, Demonstration Assistants, are acknowledged for their help in establishing, maintaining, and collecting data from the study.

Table 1. Moisture and temperature of stored sorghum during the first 3 months following treatment with protectants, Texas AgriLife Research and Extension Center, Nueces County, TX 2011.

		Storage month number and calendar month post-treatment							
		temperature (°F)				moisture (%)			
Treatment	Rate oz/60,0000 lb	0[1/] Sep	1 Oct	2 Nov	3 Dec	0 Sep	1 Oct	2 Nov	3 Dec
Storcide II	11.6	86.8[a]	82.3[a]	76.8[c]	69.3[b]	13.6[a]	13.9[a]	13.3[a]	13.6[a]
Storcide II+Diacon II	11.6+3.5	86.5[a]	82.5[a]	77.0[bc]	69.0[b]	13.6[a]	13.8[a]	13.4[a]	13.3[c]
Contain	9.8	79.5[a]	82.5[a]	76.5[c]	69.0[\b]	13.5[a]	13.9[a]	13.3[a]	13.4[abc]
Contain+Actellic	9.8+6.15	86.8[a]	82.5[a]	77.0[bc]	68.8[b]	13.5[a]	13.8[a]	13.3[a]	13.5[ab]
Actellic	12.3	86.8[a]	82.5[a]	78.0[b]	70.0[a]	13.6[a]	13.9[a]	13.1[a]	13.3[c]
Actellic+Diacon II	9.2+3.5	87.0[a]	82.8[a]	77.5[bc]	69.3[b]	13.4[a]	13.8[a]	13.1[a]	13.5[abc]
Nontreated		87.0[a]	83.3[a]	79.3[a]	70.0[a]	13.5[a]	13.8[a]	13.1[a]	13.3[bc]
LSD (P = 0.05)		NS[2/]	NS	1.20	0.69	NS	NS	NS	0.18
P > F		.4841	.1922	.0023	.0056	.5531	.9533	.1246	.0369

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]Counts made 9 days after treatment (9/8).
[2/]NS=Not Significant

Table 2. Rusty grain beetle and red flour beetle in stored sorghum during the first 3 months following treatment with protectants, Texas AgriLife Research and Extension Center, Nueces County, TX 2011.

		Storage month number and calendar month post-treatment							
		rusty grain beetles/qt				red flour beetles/qt			
Treatment	Rate oz/60,000 lb	0[1/] Sep	1 Oct	2 Nov	3 Dec	0 Sep	1 Oct	2 Nov	3 Dec
Storcide II	11.6	0.0[a]	0.0[b]	0.0[b]	0.0[c]	0.0[b]	0.0[b]	0.0[b]	0.0[b]
Storcide II+Diacon II	11.6+3.5	0.0[a]	0.0[b]	0.0[b]	0.0[c]	0.0[b]	0.0[b]	0.0[b]	0.0[b]
Contain	9.8	0.5[a]	0.5[b]	1.3[b]	0.3[c]	0.0[b]	0.3[b]	0.3[b]	0.0[b]
Contain+Actellic	9.8+6.15	0.3[a]	0.0[b]	0.0[b]	0.0[c]	0.0[b]	0.0[b]	0.0[b]	0.0[b]
Actellic	12.3	0.0[a]	0.5[b]	3.3[b]	4.0[b]	0.0[b]	0.0[b]	0.0[b]	0.0[b]
Actellic+Diacon II	9.2+3.5	0.0[a]	0.0[b]	0.0[b]	0.0[c]	0.0[b]	0.0[b]	0.0[b]	0.0[b]
Nontreated		2.3[a]	15.5[a]	25.5[a]	21.8[a]	0.5[a]	3.5[a]	1.8[a]	5.8[a]
LSD (P = 0.05)		NS[2/]	1.95	10.55	2.47	0.32	1.41	0.60	1.74
P > F		.1854	.0001	.0006	.0001	.0327	.0003	.0001	.0001

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]Counts made 9 days after treatment (9/8).
[2/]NS=Not Significant

Table 3. Rice weevil and lesser grain borer in stored sorghum during the first 3 months following treatment with protectants, Texas AgriLife Research and Extension Center, Nueces County, TX 2011.

		Storage month number and calendar month post-treatment							
		rice weevil/qt				lesser grain borer/qt			
	Rate oz/60,000 lb	0[1/] Sep	1 Oct	2 Nov	3 Dec	0 Sep	1 Oct	2 Nov	3 Dec
Storcide II	11.6	0.0[b]	0.0[b]	0.0[b]	0.3[b]	0.0[a]	0.0[c]	1.3[c]	0.5[c]
Storcide II+Diacon II	11.6+3.5	0.0[b]	0.3[b]	0.0[b]	0.0[b]	0.3[a]	0.0[c]	0.0[c]	0.0[c]
Contain	9.8	0.0[b]	0.5[b]	0.3[b]	1.0[b]	0.0[a]	0.0[c]	0.0[c]	0.0[c]
Contain+Actellic	9.8+6.15	0.0[b]	0.8[b]	0.3[b]	0.0[b]	0.0[a]	0.0[c]	0.0[c]	0.0[c]
Actellic	12.3	0.0[b]	0.0[b]	0.0[b]	0.0[b]	0.0[a]	7.0[b]	12.8[a]	84.3[a]
Actellic+Diacon II	9.2+3.5	0.3[b]	1.0[b]	1.3[b]	3.3[b]	0.0[a]	0.0[c]	0.0[c]	0.0[c]
Nontreated		0.8[a]	8.3[a]	12.8[a]	66.5[a]	0.0[a]	13.5[a]	8.8[b]	17.8[b]
LSD (P = 0.05)		0.39	4.02	3.96	22.50	NS[2/]	2.54	3.07	10.23
P > F		.0045	.0041	.0001	.0001	.4552	.0001	.0001	.0001

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]Counts made 9 days after treatment (9/8).
[2/]NS=Not Significant

Table 4. Total pest insects and % change in grain weight in stored sorghum during the first 3 months following treatment with protectants, Texas AgriLife Research and Extension Center, Nueces County, TX 2011.

		Storage month number and calendar month post-treatment				
		total insects/qt.				
Treatment	Rate oz/60,0000 lb	0[1/] Sept	1 Oct	2 Nov	3 Dec	% loss in grain weight (12/2)
Storcide II	11.6	0.0^{b}	0.0^{c}	1.3^{c}	0.8^{b}	0.6^{a}
Storcide II+Diacon II	11.6+3.5	0.3^{b}	0.3^{c}	0.0^{c}	0.0^{b}	0.4^{a}
Contain	9.8	0.5^{b}	1.3^{bc}	1.8^{c}	1.3^{b}	0.5^{a}
Contain+Actellic	9.8+6.15	0.3^{b}	0.8^{bc}	0.3^{c}	0.0^{b}	0.7^{a}
Actellic	12.3	0.0^{b}	7.5^{b}	16.0^{b}	88.3^{a}	0.6^{a}
Actellic+Diacon II	9.2+3.5	0.3^{b}	1.0^{bc}	1.3^{c}	4.3^{b}	0.6^{a}
Nontreated		3.5^{a}	40.8^{a}	48.8^{a}	113.0^{a}	0.9^{a}
LSD (P = 0.05)		2.23	6.88	13.75	29.34	NS
P > F		.0425	.0001	0.0001	.0001	.3204

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]Counts made 9 days after treatment (9/8).
[2/]NS=Not Significant

COMPARISON OF SELECTED INSECTICIDES FOR CONTROL OF THE COTTON FLEAHOPPER IN COTTON

Bill and Randy Wright Farm, Nueces County, 2011

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SUMMARY: Centric, Carbine, Belay, and Intruder significantly reduced fleahopper number through 14 days after treatment (DAT). Centric and Belay were especially effective in reducing nymphs. Carbine treated plots tended to have more fleahoppers than other treatments at 8 and 14 DAT. Since the treatments were applied late in the development of the cotton plant no differences were observed in lint production.

OBJECTIVES: The field study on cotton was conducted to measure the impact of the insecticides on the cotton fleahopper.

MATERIALS/METHODS: The test was conducted on the Bill and Randy Wright Farm on County Road 44 about 0.5 miles west of FM 1694 in Nueces County. The cotton variety was FiberMax 832. Treatments were applied late in the fruiting stage with the cotton at 5 nodes above white flower (NAWF) on May 26, 2011. The test was arranged in a randomized complete block design with 4 replications of each treatment. Plots were 4 rows by 40 feet with 8 buffer rows between treatments.

Treatments were applied with a Spider Trac sprayer calibrated to deliver 5.1 gpa total volume through 4X hollow cone nozzles at 40 psi and at a speed of 4.2 mph. All treatments included a non-ionic surfactant (0.25% v/v).

Treatments were assessed by (1) counting fleahoppers on 20 plant terminals/plot before treatments were applied on May 26 followed by counts 2, 4, 8, and 14 days after treatment [DAT], and (2) harvesting the third row of each plot with an International Harvester model 120A spindle picker. Seed cotton was weighed and lint production was based on 37% of the seed cotton weight.

Agriculture Research Manager (ARM revision 6.1.13) software was used to conduct analysis of variance, and means were separated by LSD at the 0.05 probability level.

RESULTS/DISCUSSION: The experiment was conducted on cotton that was beyond the growth stage for which fleahopper control would be expected to have any impact on lint production; the cotton was at 5 nodes above white flower (NAWF) on May 26 when pretreatment counts were made, but the location provided opportunity to evaluate the impact of chemicals on fleahopper numbers.

Fleahopper nymphs were abundant when treatments were applied on May 26 (Table 1). All fleahopper nymph counts at 2, 4, 8, and 14 days after treatment (DAT) were significantly lower in the insecticide treatments regardless of chemical or rate used. Statistical differences were not observed among any of the insecticide treatments evaluated. However, nymphs were not detected in the Belay treated cotton at either rate evaluated on any post-treatment evaluation. Only at 14 DAT were any nymphs detected in the Centric treatment.

Adult fleahoppers generally increased in number following treatment in non-insecticide treated cotton (Table 2). Centric, Belay (both rates), and Intruder were more effective than either rate of Carbine. Fleahopper adults increased in Carbine treated cotton at 8 DAT. When nymph and adult fleahopper counts were combined (Table 3), all insecticides tested provided significant control when compared with the nontreated cotton.

No differences were observed in lint production (Table 3). Cotton was already at 5 NAWF when the test was established; it was well beyond the treatment period for cotton fleahopper. Cotton is most susceptible to damage from first square to one week into bloom. These results demonstrate that nothing can be gained by treating for cotton fleahopper beyond the established growth stage for which treatments are currently recommended. It also demonstrates the effectiveness of insecticides in controlling cotton fleahopper. However, since the test was conducted at a late stage of cotton plant development little migration of fleahoppers into the cotton seemed to occur. It will be useful to conduct additional tests when treatments can be made for fleahopper control when the plants are more vulnerable to damage.

ACKNOWDEDGMENTS: Thanks are extended to Bill and Randy Wright for providing the field location for conduct of the study and their interest in such work. Rudy Alaniz and Clint Livingston, Demonstration Assistants, are thanked for applying treatments, and for harvest and ginning of cotton samples.

Table 1. Evaluation of insecticides for fleahopper control applied to blooming cotton under dry soil conditions, Bill and Randy Wright Farm, Nueces County, TX, 2011.

Treatment (rate)	Fleahopper **nymphs** per 100 plants					
	Pretreat	2 DAT	4 DAT	8 DAT	14 DAT	Post-treat. avg.
Centric 40WG (1.25 oz/acre)	20.0[a]	0.0[b]	0.0[b]	0.0[b]	2.5[b]	0.6[b]
Carbine 50WG (1.7 oz/acre)	31.3[a]	3.8[b]	1.3[b]	5.0[b]	3.8[b]	3.4[b]
Carbine 50WG (1.25 oz/acre)	26.3[a]	3.8[b]	3.8[b]	7.5[b]	2.5[b]	4.4[b]
Belay 2.13 SC (4.0 oz/acre)	26.3[a]	0.0[b]	0.0[b]	0.0[b]	0.0[b]	0.0[b]
Belay 2.13 SC (3.0 oz/acre)	22.5[a]	0.0[b]	0.0[b]	0.0[b]	0.0[b]	0.0[b]
Intruder 70WP (1.0 oz/acre)	30.0[a]	1.3[b]	2.5[b]	2.5[b]	2.5[b]	2.2[b]
Nontreated	23.8[a]	63.8[a]	67.5[a]	46.3[a]	38.8[a]	54.1[a]
LSD (P=0.05)	NS[1/]	12.34	11.28	8.44	14.67	9.25
P > F	.7150	.0001	.0001	.0001	.0003	.0001

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/] NS = Not Significant

Table 2. Evaluation of insecticides for fleahopper control applied to blooming cotton under dry soil conditions, Bill and Randy Wright Farm, Nueces County, TX, 2011.

Treatment (rate)	Fleahopper **adults** per 100 plants					
	Pretreat	2 DAT	4 DAT	8 DAT	14 DAT	Post-treat. avg.
Centric 40WG (1.25 oz/acre)	3.8[a]	2.5[b]	1.3[b]	6.3[cd]	7.5[c]	4.4[c]
Carbine 50WG (1.7 oz/acre)	5.0[a]	0.0[b]	1.3[b]	18.8[bc]	21.3[ab]	10.3[b]
Carbine 50WG (1.25 oz/acre)	3.8[a]	0.0[b]	5.0[ab]	28.8[b]	13.8[bc]	11.9[b]
Belay 2.13 SC (4.0 oz/acre)	7.5[a]	0.0[b]	1.3[b]	1.3[d]	2.5[c]	1.3[c]
Belay 2.13 SC (3.0 oz/acre)	3.8[a]	0.0[b]	2.5[b]	5.0[cd]	3.8[c]	2.8[c]
Intruder 70WP (1.0 oz/acre)	7.5[a]	2.5[b]	2.5[b]	10.0[cd]	10.0[bc]	6.3[bc]
Nontreated	11.3[a]	10.0[a]	10.0[a]	57.5[a]	26.3[a]	25.9[a]
LSD (P=0.05)	NS[1/]	4.68	5.50	14.81	11.93	5.64
P > F	.2955	.0024	.0327	.0001	.0039	.0001

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/] NS = Not Significant

Table 3. Evaluation of insecticides for fleahopper control applied to blooming cotton under dry soil conditions, Bill and Randy Wright Farm, Nueces County, TX, 2011.

Treatment[1/] (rate)	Fleahopper **nymphs** and **adults** per 100 plants						Lint yield
	Pretreat	2 DAT	4 DAT	8 DAT	14 DAT	Post-treat avg.	lb/acre
Centric 40WG (1.25 oz/acre)	23.8[a]	2.5[b]	1.3[b]	6.3[cd]	10.0[bc]	5.0[bcd]	745[a]
Carbine 50WG (1.7 oz/acre)	36.3[a]	3.8[b]	2.5[b]	23.8[bc]	25.0[b]	13.8[bc]	703[a]
Carbine 50WG (1.25 oz/acre)	30.0[a]	3.8[b]	8.8[b]	36.3[b]	16.3[bc]	16.3[b]	675[a]
Belay 2.13 SC (4.0 oz/acre)	33.8[a]	0.0[b]	1.3[b]	1.3[d]	2.5[c]	1.3[d]	715[a]
Belay 2.13 SC (3.0 oz/acre)	26.3[a]	0.0[b]	2.5[b]	5.0[cd]	3.8[c]	2.8[cd]	726[a]
Intruder 70WP (1.0 oz/acre)	37.5[a]	3.8[b]	5.0[b]	12.5[cd]	7.5[bc]	7.2[bcd]	688[a]
Nontreated	35.0[a]	73.8[a]	77.5[a]	103.8[a]	65.0[a]	80.0[a]	714[a]
LSD (P = 0.05)	NS[1/]	15.33	12.87	19.41	19.39	11.63	NS
P > F	.7495	.0001	.0001	.0001	.0001	.0001	.9110

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]NS = Not Significant

EVALUATION OF INSECTICIDES FOR CONTROL OF COTTON FLEAHOPPER

Texas AgriLife Research and Extension Center, Nueces County, 2011

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SUMMARY: Fleahopper numbers remained relatively low throughout the test period although they did approach the treatment threshold on two inspection dates. Centric, Couraze (2.0 oz/acre), and CMT 4586 provided the highest level of fleahopper control, but the control level was not always statistically better than Fastac. Fastac generally did not perform as well as the other insecticides and was no better than the nontreated for the post-treatment average of total fleahoppers. CMT 4586 seemed to stand out as far as high level of aphid control even in this test where aphid numbers were low. Statistical differences were not measured in lint production, but all insecticide treated cotton produced more lint pounds than the nontreated cotton. Similar yield trends in previous testing years where statistical differences could not be shown have occurred in the insecticide-treated cotton.

OBJECTIVES: The experiment was conducted to compare the effect of insecticides on cotton fleahopper and to measure impact on lint production.

MATERIALS/METHODS: DPL 1044 B2RF variety cotton was planted at a rate of 55 thousand seed/acre on March 14, 2011 at the Meaney Annex of the Texas AgriLife Research and Extension Center, Corpus Christi, Texas with a 4-row John Deere model 6100 planter. Treatments were arranged in a randomized complete block design with 4 replications in 8-row by 35 foot plots with rows spaced on 38-inch centers.

Fleahopper treatments were applied to the center 4 rows in plots with a Spider Trac sprayer calibrated to deliver 5.3 gpa total volume through 4X hollow cone nozzles at 50 psi traveling at 4.0 mph. Insecticide treatments were initiated during the second week of squaring on 4/27, and treatments were applied again on 5/11. The CMT 4586 insecticide was applied with MSO at 0.25% v/v and UAN 28% at 2.5% v/v. There were 8 rows of buffer cotton between the treatments.

Treatments were assessed by (1) counting the fleahopper nymphs and adults on 20 plants/plot on 4/27 [pretreatment counts], 5/3 [5 DAT-1], 5/7 [9 DAT-1], 5/14 [3 DAT-2], 5/17 [6 DAT-2], and 5/20 [9 DAT-2]; (2) estimating the number of aphids/leaf on 5 dates; and (3) harvesting the center two rows in each plot on 7/15 with a 2-row John Deere 9900 spindle picker. Seed cotton samples were weighed, a sample was obtained for lint turnout, and it was ginned on a 10-saw Eagle laboratory machine.

Agriculture Research Manager (ARM revision 6.1.13) software was used to conduct analysis of variance (ANOVA). Means were separated by least significant difference (LSD).

RESULTS/DISCUSSION: No cotton fleahopper nymphs were found in pretreatment counts, and they remained relatively low throughout the majority of the test period (Table 1). No statistically significant differences were observed in nymph numbers on individual inspection dates, but there were statistical differences in the post-treatment average of the five inspection dates. Centric, Couraze (2.0 oz/acre), and CMT 4586 treated cotton were the only insecticide treatments that contained significantly fewer nymphs compared with the nontreated cotton in the post-treatment average.

The adult fleahopper infestation was relatively low throughout the test period, and little increase in their numbers occurred in nontreated cotton over duration of the test (Table 2). Significant differences were observed at 3 and 9 days after the first treatment, but no statistical differences were observed in counts 3, 6, and 9 DAT-2. At 5 DAT-1 all insecticide treated cotton had significantly fewer fleahopper adults than observed in the nontreated cotton. Post-treatment average fleahopper adult numbers were significantly higher in the nontreated cotton compared with treatments other than Fastac.

When fleahopper counts (nymphs and adults) were combined, significant differences were found among treatments on two inspection dates (Table 3). At 9 DAT-1 all treatments except Fastac (2.0 oz/acre) had significantly fewer fleahoppers than observed in the nontreated cotton. At 9 DAT-2 all insecticides except for both rates of Fastac had fewer total fleahoppers when compared with the nontreated cotton. The post-treatment averages followed a similar pattern. Both rates of Fastac failed to maintain fleahopper numbers at numbers significantly different from the nontreated cotton.

Although aphid numbers remained relatively low, counts were made on five dates (Table 4). Surprisingly, statistical differences were observed on two inspection dates, and in the average counts for the five inspections. Centric, Couraze (2.0 oz/acre), and CMT 4586 treated cotton was noteworthy in having the fewest aphids for the season average. The other treatments containing Couraze did not differ statistically in aphid numbers from these better treatments.

Even though fleahopper numbers did not exceed the established threshold, they approached the threshold on two dates. A statistical difference was not found in the yield data, but numerically all insecticide treated cotton had higher lint production. The increased yield ranged from 26 to 94 lb/acre with an average of 58 lb/acre.

ACKNOWLEDGMENTS: Syngenta, Cheminova, BASF, and Bayer companies are thanked for supporting the study. Rudy Alaniz and Clint Livingston, Demonstration Assistants, are thanked for all aspects of crop production, harvest, and ginning.

Table 1. Comparison of foliar insecticides on cotton for fleahopper control, Texas AgriLife Research and Extension Center, Nueces County, TX, 2011.

Treatment (rate)	Fleahopper **nymphs** per 100 plants						
	Pretreat	5 DAT-1	9 DAT-1	3 DAT-2	6 DAT-2	9 DAT-2	Post-treat. avg.
Centric 40WG (1.25 oz/acre)	0.0^{a}	0.0^{a}	0.0^{a}	0.0^{a}	0.0^{a}	0.0^{a}	0.0^{c}
Couraze 4F (1.5 oz/acre)	0.0^{a}	0.0^{a}	2.5^{a}	0.0^{a}	2.5^{a}	2.5^{a}	1.5^{bc}
Couraze 4F (2.0 oz/acre)	0.0^{a}	0.0^{a}	0.0^{a}	0.0^{a}	1.3^{a}	0.0^{a}	0.3^{c}
Couraze + Dimethoate (1.25 oz/acre + 8.0 oz/acre)	0.0^{a}	1.3^{a}	0.0^{a}	0.0^{a}	1.3^{a}	5.0^{a}	1.5^{bc}
Fastac 0.83EC (2.0 oz/acre)	0.0^{a}	2.5^{a}	5.0^{a}	2.5^{a}	12.5^{a}	11.3^{a}	6.8^{a}
Fastac 0.83EC (8.0 oz/acre)	0.0^{a}	2.5^{a}	3.8^{a}	2.5^{a}	1.3^{a}	11.3^{a}	4.3^{ab}
CMT 4586 2SC (4.0 oz/acre)	0.0^{a}	1.3^{a}	0.0^{a}	0.0^{a}	0.0^{a}	0.0^{a}	0.3^{c}
Nontreated	0.0^{a}	1.3^{a}	3.8^{a}	2.5^{a}	3.8^{a}	11.3^{a}	4.5^{ab}
LSD (P = 0.05)	NS[1/]	NS	NS	NS	NS	NS	3.54
P > F	1.0000	.5002	.1142	.3047	.0934	.0928	.0044

Means in a column followed by the same letter are not significantly different by ANOVA.

[1/]NS = Not Significant.

Table 2. Comparison of foliar insecticides on cotton for fleahopper control, Texas AgriLife Research and Extension Center, Nueces County, TX, 2011.

Treatment (rate)	Fleahopper **adults** per 100 plants						
	Pretreat	5 DAT-1	9 DAT-1	3 DAT-2	6 DAT-2	9 DAT-2	Post-treat. avg.
Centric 40WG (1.25 oz/acre)	3.8^{a}	0.0^{b}	2.5^{bc}	5.0^{a}	1.3^{a}	2.5^{a}	2.3^{bcd}
Couraze 4F (1.5 oz/acre)	2.5^{a}	1.3^{b}	1.3^{c}	1.3^{a}	1.3^{a}	1.3^{a}	1.3^{cd}
Couraze 4F (2.0 oz/acre)	3.8^{a}	0.0^{b}	2.5^{bc}	2.5^{a}	2.5^{a}	0.0^{a}	1.5^{cd}
Couraze + Dimethoate (1.25 oz/acre + 8.0 oz/acre)	2.5^{a}	0.0^{b}	1.3^{c}	0.0^{a}	0.0^{a}	2.5^{a}	0.8^{d}
Fastac 0.83EC (2.0 oz/acre)	5.0^{a}	1.3^{b}	6.3^{ab}	6.3^{a}	2.5^{a}	1.3^{a}	3.5^{ab}
Fastac 0.83EC (4.0 oz/acre)	6.3^{a}	1.3^{b}	0.0^{c}	3.8^{a}	7.5^{a}	2.5^{a}	3.0^{abc}
CMT 4586 2SC (8.0 oz/acre)	5.0^{a}	0.0^{b}	1.3^{c}	1.3^{a}	0.0^{a}	0.0^{a}	0.5^{d}
Nontreated	2.5^{a}	6.3^{a}	7.5^{a}	2.5^{a}	5.0^{a}	2.5^{a}	4.8^{a}
LSD (P = 0.05)	NS[1/]	3.31	4.36	NS	NS	NS	1.87
P > F	.8918	.0116	.0180	.2276	.1178	.5926	.0012

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]NS = Not Significant.

Table 3. Comparison of foliar insecticides on cotton for fleahopper control, Texas AgriLife Research and Extension Center, Nueces County, TX, 2011.

Treatment (rate)	Fleahopper **nymphs** and **adults** per 100 plants						
	Pretreat	5 DAT-1	9 DAT-1	3 DAT-2	6 DAT-2	9 DAT-2	Post-treat. avg.
Centric 40WG (1.25 oz/acre)	3.8^{a}	0.0^{a}	2.5^{b}	5.0^{a}	1.3^{a}	2.5^{bc}	2.3^{c}
Couraze 4F (1.5 oz/acre)	2.5^{a}	1.3^{a}	3.8^{b}	1.3^{a}	3.8^{a}	3.8^{abc}	2.8^{bc}
Couraze 4F (2.0 oz/acre)	3.8^{a}	0.0^{a}	2.5^{b}	2.5^{a}	3.8^{a}	0.0^{c}	1.8^{c}
Couraze + Dimethoate (1.25 oz/acre + 8.0 oz/acre)	2.5^{a}	1.3^{a}	1.3^{b}	0.0^{a}	1.3^{a}	7.5^{abc}	2.3^{c}
Fastac 0.83EC (2.0 oz/acre)	5.0^{a}	3.8^{a}	11.3^{a}	8.8^{a}	15.0^{a}	12.5^{ab}	10.3^{a}
Fastac 0.83EC (4.0 oz/acre)	6.3^{a}	3.8^{a}	3.8^{b}	6.3^{a}	8.8^{a}	13.8^{a}	7.3^{ab}
CMT 4586 2SC (8.0 oz/acre)	5.0^{a}	1.3^{a}	1.3^{b}	1.3^{a}	0.0^{a}	0.0^{c}	0.8^{c}
Nontreated	2.5^{a}	7.5^{a}	11.3^{a}	5.0^{a}	8.8^{a}	13.8^{a}	9.3^{a}
LSD (P = 0.05)	NS[1/]	NS	6.88	NS	NS	11.14	4.65
P > F	.8918	.0599	.0190	.1779	.0664	.0498	.0010

Means in a column followed by the same letter are not significantly different by ANOVA.

[1/]NS = Not Significant.

Table 4. Effects of insecticides applied for cotton fleahopper on aphid numbers and lint production, Texas AgriLife Research and Extension Center, Nueces Counrty, TX, 2011.

Treatment (rate)	Aphids per leaf						Lind yield lb/acre
	5 DAT-1	9 DAT-1	3 DAT-2	6 DAT-2	9 DAT-2	Average	
Centric 40WG (1.25 oz/acre)	7.3[a]	4.3[c]	0.3[b]	0.2[a]	0.0[a]	2.4[c]	737[a]
Couraze 4F (1.5 oz/acre)	4.5[a]	11.0[bc]	0.4[b]	0.0[a]	0.3[a]	3.2[bc]	735[a]
Couraze 4F (2.0 oz/acre)	2.8[a]	7.3[bc]	0.0[b]	0.3[a]	0.0[a]	2.0[c]	755[a]
Couraze + Dimethoate (1.25 oz/acre + 8.0 oz/acre)	5.0[a]	12.8[bc]	0.5[b]	0.3[a]	0.0[a]	3.7[bc]	767[a]
Fastac 0.83EC (2.0 oz/acre)	17.5[a]	19.5[ab]	3.0[a]	1.8[a]	0.0[a]	8.4[ab]	720[a]
Fastac 0.83EC (4.0 oz/acre)	21.0[a]	26.5[a]	0.5[b]	2.3[a]	0.3[a]	10.1[a]	699[a]
CMT 4586 2SC (8.0 oz/acre)	2.0[a]	3.0[c]	0.0[b]	0.0[a]	0.0[a]	1.0[c]	704[a]
Nontreated	28.0[a]	20.0[ab]	2.5[a]	1.0[a]	0.0[a]	10.3[a]	673[a]
LSD (P = 0.05)	NS[1/]	12.83	1.48	NS	NS	5.71	NS
P > F	.0643	.0098	.0012	.0756	.4586	.0076	.5318

Means in a column followed by the same letter are not significantly different by ANOVA.

[1/]NS = Not Significant

EVALUATION OF TRANSFORM (SULFOXAFLOR) FOR CONTROL OF COTTON FLEAHOPPER

Kevin McKamey Farm, Calhoun County and Texas AgriLife Research and Extension Center, Nueces County, 2011

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SUMMARY: Both studies were conducted on cotton that was beyond the growth stage where any impact would be expected from the cotton fleahopper on lint production; consequently no yield effects were found. However, fleahopper numbers were in enough abundance to measure effects of Transform and the Centric standard on the population. Transform (all 3 rates) and Centric provided significant fleahopper control of both nymphs and adults for the duration of the studies. In the Calhoun County study it appeared that numerically, the low rate of Transform may not have been as effective as the two higher rates, but in the Nueces County study this trend did not occur. Transform performed equal to Centric which was used for a standard comparison insecticide in the study.

It should be noted that the late stage of cotton growth and slow rate of plant growth due to the drought conditions may have affected the results. Under more favorable growing conditions of rapid plant growth early in the season, dilution effects due to increased vegetation possibly could affect control results. Cotton growth had almost ceased at both study locations when treatments were applied.

OBJECTIVES: The two field studies were conducted to compare the effects of different rates of Transform on the cotton fleahopper with Centric included as a standard treatment. Although effect of cotton fleahopper on lint production was an initial objective, their numbers were not high enough to conduct the tests when cotton was at the critical growth stage to sustain fleahopper damage that would result in lint loss.

MATERIALS/METHODS: Tests were conducted on the Kevin McKamey Farm in Calhoun County and at the Texas AgriLife Research and Extension Center, Meaney Annex in Nueces County. Cotton at both locations was not treated for fleahopper until the growth stage was somewhat beyond that expected to sustain damage from the insect. Tests were arranged in a randomized complete block design with 4 replications of treatments (Centric, Transform at 3 rates and nontreated).

Agriculture Research Manager (ARM revision 6.1.13) software was used to conduct analysis of variance (ANOVA), and means were separated by LSD at the 0.05 probability level.

Calhoun County Test – Treatments were applied to cotton grown on 30-inch centers in plots of 8 rows by 40 feet. Insecticide treatments were applied on 5/12 (first bloom growth stage) and

5/17. A Spider Trac sprayer calibrated to deliver 5.8 gpa through TXVS-04 nozzles while traveling at 3.5 mph was used to apply insecticides. A CO2 pressurized cylinder was used to power the spray boom.

Treatment were assessed by (1) counting the number of fleahopper nymphs and adults on 10 plants/plot just before the first treatment was applied on 5/12 and on 20 plants/plot thereafter [5/16, 5/20, 5/24, and 5/27], (2) estimating the number of aphids/leaf by examining 5 fully expanded leaves in plots 3, 7, and 10 DAT-2, and (3) harvesting the 5th row of each plot with a 1-row 120A model IH picker on 7/22. Seed cotton was weighed and a standard lint percentage of 37/% was used to calculate lint yield. (In another fleahopper test seed cotton was ginned to determine lint percentage with resulting percentages being very close with no effects on the lint yield data.)

Nueces County Test – Cotton variety STV 5458 was planted at the Texas AgriLife Research and Extension Center in Nueces County on March 22, 2011 with a 4-row model 6100 John Deere planter. Plots were 8 rows by 36 feet with 4 rows of each plot treated with insecticide. Insecticide was applied on 6/7 with a Spider Trac sprayer calibrated to deliver 5.1 gpa total volume through 4X hollow cone nozzles (2/row) at 40 psi and at a speed of 4.2 mph.

Treatments were assessed by (1) counting the number of fleahopper nymphs and adults on 20 plants/plot on 6/6 [pretreatment], 6/9 [2 days after treatment or 2 DAT], 6/12 [5 DAT], and 6/17 [10 DAT]; and (2) harvesting the two center rows in each plot with a 9900 John Deere 2-row spindle picker. Seed cotton was weighed and a standard 37% lint percentage was used to calculate lint yield.

RESULTS/DISCUSSION: Treatments were applied to cotton at both locations at a growth stage well beyond that expected to result in any impact on production. However, fleahopper numbers were high enough to provide good evaluation of the effects of the insecticides on the insect.

Calhoun County Test – Fleahopper nymphs were in much greater abundance than adults in pretreatment counts (Tables 1 and 2). By 4 days after treatment 1 (4 DAT-1) both nymphs and adults had been significantly reduced by all insecticide treatments, but adult numbers were still well above the normal treatment threshold. There were indications of substantial migration of additional adult fleahoppers into the study area. Consequently, a second treatment was applied the day following the first post-treatment counts. At 3 days after the second treatment (3 DAT-2) fleahopper nymphs and adults had been reduced to near zero in all treatments (Tables 1, 2, and 3). Their numbers remained at a low level in all insecticide treated cotton through the duration of the test (10 DAT-2). There were no statistical differences among the insecticides or rates of Transform applied. However, numerically, more fleahoppers were counted in cotton where the low rate of Transform had been applied compared to the two higher rates.

Additional studies with treatments applied at the early squaring growth stage when fleahoppers are increasing in cotton that is vulnerable to yield loss will be needed to determine the best rates to use on the insect. Transform provided a level of control in this study equal to the standard Centric rate used in the area by cotton growers. Even though aphid numbers were low, fewer aphids were found in Transform treated cotton compared with what was found in Centric treated or the nontreated cotton (Table 4). In fact no aphids were detected in any of the Transform treated cotton. The low number present in the cotton test may have been one reason that not a single aphid was discovered in the Transform treatments.

There was no impact on lint production (Table 4). Substantial yield effects would normally be expected had the insecticides been applied to early squaring cotton with this infestation level.

Nueces County Test – Fleahopper nymphs were reduced to very low numbers by all insecticide treatments by 2 DAT (Table 5). They had increased somewhat by 10 DAT; cotton by that time had reached complete cutout due to very dry conditions. Transform performed equal to Centric which was used as a standard for comparison. Unlike the results in the Calhoun County test, there did not seem to be a rate response with Transform. In fact, numerically, the low rate of Transform had fewer nymphs than the two higher rates. Results from adult fleahopper counts were similar to what was found for nymphs (Table 6). It should be noted that results might be different if the cotton had been growing rapidly with new growth, but the severe drought resulted in very little additional plant growth for the duration of the test. Total fleahoppers (nymphs + adults) reflected what was found for their numbers reported individually (Table 7).

Just as in the Calhoun County test, no differences were found in lint production (Table 7), nor was any impact expected.

ACKNOWLEDGMENTS: Dow AgroSciences is thanked for their support of the studies, and Syngenta Crop Protection is thanked for providing the Centric. Kevin McKamey is thanked for providing the test site in Calhoun County. Rudy Alaniz and Clint Livingston, Demonstration Assistants, are acknowledged for assistance with treatments, cotton harvest, and ginning of the cotton samples.

Table 1. Evaluation of Transform (sulfoxaflor) for control of cotton fleahopper, Kevin McKamey Farm, Calhoun County, TX, 2011.

Treatment (rate)	Fleahopper **nymphs** per 100 plants					
	Pretreat	4 DAT-1	3 DAT-2	7 DAT-2	10 DAT-2	Post-treat. avg.
Centric 40WG (1.25 oz/acre)	67.5[a]	3.8[b]	0.0[b]	0.0[b]	0.0[b]	0.9[b]
Transform 50WG (0.75 oz/acre)	80.0[a]	8.8[b]	1.3[b]	2.5[b]	0.0[b]	3.1[b]
Transform 50WG (1.00 oz/acre)	57.5[a]	1.3[b]	0.0[b]	1.3[b]	0.0[b]	0.6[b]
Transform 50WG (1.25 oz/acre)	57.5[a]	1.3[b]	0.0[b]	0.0[b]	0.0[b]	0.3[b]
Nontreated	47.5[a]	28.8[a]	18.8[a]	20.0[a]	16.3[a]	20.9[a]
LSD (P = 0.05)	NS[1/]	9.12	3.92	6.29	5.17	3.38
P > F	.3642	.0001	.0001	.0001	.0001	.0001

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]NS = Not Significant

Table 2. Evaluation of Transform (sulfoxaflor) for control of cotton fleahopper, Kevin McKamey Farm, Calhoun County, TX, 2011.

Treatment (rate)	Fleahopper **adults** per 100 plants					
	Pretreat	4 DAT-1	3 DAT-2	7 DAT-2	10 DAT-2	Post-treat. avg.
Centric 40WG (1.25 oz/acre)	25.0[a]	27.5[b]	0.0[b]	0.0[a]	0.0[b]	6.9[b]
Transform 50WG (0.75 oz/acre)	22.5[a]	31.3[b]	1.3[b]	0.0[a]	0.0[b]	8.1[b]
Transform 50WG (1.00 oz/acre)	20.0[a]	16.3[b]	0.0[b]	0.0[a]	0.0[b]	4.1[b]
Transform 50WG (1.25 oz/acre)	17.5[a]	18.8[b]	1.3[b]	0.0[a]	0.0[b]	5.0[b]
Nontreated	32.5[a]	57.5[a]	18.8[a]	1.3[a]	5.0[a]	20.6[a]
LSD (P = 0.05)	NS[1/]	18.57	9.67	NS	2.18	4.90
P > F	.2825	.0030	.0045	.4449	.0069	.0001

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]NS = Not Significant

Table 3. Evaluation of Transform (sulfoxaflor) for control of cotton fleahopper, Kevin McKamey Farm, Calhoun County, TX, 2011.

Treatment (rate)	Fleahopper **nymphs** and **adults** per 100 plants					
	Pretreat	4 DAT-1	3 DAT-2	7 DAT-2	10 DAT-2	Post-treat. avg.
Centric 40WG (1.25 oz/acre)	92.5[a]	31.3[b]	0.0[b]	0.0[b]	0.0[b]	7.8[b]
Transform 50WG (0.75 oz/acre)	102.5[a]	40.0[b]	2.5[b]	2.5[b]	0.0[b]	11.3[b]
Transform 50WG (1.00 oz/acre)	77.5[a]	17.5[b]	0.0[b]	1.3[b]	0.0[b]	4.7[b]
Transform 50WG (1.25 oz/acre)	75.0[a]	20.0[b]	1.3[b]	0.0[b]	0.0[b]	5.3[b]
Nontreated	80.0[a]	86.3[a]	37.5[a]	21.3[a]	21.3[a]	41.6[a]
LSD (P = 0.05)	NS[1/]	22.82	9.49	5.67	7.64	7.05
P > F	.3840	.0002	.0001	.0001	.0001	.0001

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]NS = Not Significant

Table 4. Influence of insecticide treatments on aphid numbers and lint production, Kevin McKamey Farm, Calhoun County, TX, 2011.

Treatment (rate)	Cotton aphids/leaf				Lint yield Lb/acre
	3 DAT-2[1/]	7 DAT-2	10 DAT-2	Average	
Centric 40WG (1.25 oz/acre)	0.5[a]	0.8[a]	0.8[a]	0.7[a]	546[a]
Transform 50WG (0.75 oz/acre)	0.0[a]	0.0[a]	0.0[a]	0.0[a]	551[a]
Transform 50WG (1.00 oz/acre)	0.0[a]	0.0[a]	0.0[a]	0.0[a]	539[a]
Transform 50WG (1.25 oz/acre)	0.0[a]	0.0[a]	0.0[a]	0.0[a]	517[a]
Nontreated	0.2[a]	1.5[a]	1.8[a]	1.1[a]	551[a]
LSD (P = 0.05)	NS[2/]	NS	NS	NS	NS
P > F	.0586	.2704	.1908	.1333	.8010

Means in a column followed by the same letter are not significantly different by ANOVA.

[1/]DAT = Days After Treatment

[2/]NS = Not Significant

Table 5. Effectiveness of insecticides on cotton for control of fleahopper, Texas AgriLife Research and Extension Center, Nueces County, TX, 2011.

Treatment[1/] (rate)	Fleahopper **nymphs** per 100 plants				
	Pretreat	2 DAT[3/]	5 DAT	10 DAT	Post-treat. avg.
Centric 40WG (1.25 oz/acre)	13.8[a]	0.0[b]	3.8[b]	7.5[b]	3.7[b]
Transform 50WG (0.75 oz/acre)	18.8[a]	1.3[b]	1.3[b]	6.3[b]	2.9[b]
Transform 50WG (1.00 oz/acre)	17.5[a]	1.3[b]	1.3[b]	13.8[b]	5.4[b]
Transform 50WG (1.25 oz/acre)	11.3[a]	0.0[b]	3.8[b]	10.0[b]	4.6[b]
Nontreated	15.0[a]	18.8[a]	30.0[a]	46.3[a]	31.7[a]
LSD (P = 0.05)	NS[2/]	11.27	10.00	25.81	12.08
P > F	.3361	.0138	.0002	.0276	.0009

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]Treatments were applied on 6/7
[2/]NS = Not Significant
[3/]DAT = Days After Treatment

Table 6. Effectiveness of insecticides on cotton for control of fleahopper, Texas AgriLife Research and Extension Center, Nueces County, TX, 2011.

Treatment[1/] (rate)	Fleahopper **adults** per 100 plants				
	Pretreat	2 DAT[3/]	5 DAT	10 DAT	Post-treat. avg.
Centric 40WG (1.25 oz/acre)	16.3[a]	3.8[b]	1.3[b]	3.8[a]	2.9[b]
Transform 50WG (0.75 oz/acre)	13.8[a]	0.0[b]	6.3[ab]	1.3[a]	2.5[b]
Transform 50WG (1.00 oz/acre)	11.3[a]	0.0[b]	1.3[b]	5.0[a]	2.1[b]
Transform 50WG (1.25 oz/acre)	15.0[a]	0.0[b]	2.5[b]	10.0[a]	4.2[b]
Nontreated	12.5[a]	12.5[a]	8.8[a]	11.3[a]	10.8[a]
LSD (P = 0.05)	NS[2/]	6.89	5.63	NS	2.76
P > F	.5539	.0074	.0454	.2544	.0001

Means in a column followed by the same letter are not significantly different by ANOVA.

[1/]Treatments were applied on 6/7

[2/]NS = Not Significant

[3/]DAT = Days After Treatment

Table 7. Effectiveness of insecticides on cotton fleahopper and subsequent lint production, Texas AgriLife Research and Extension Center, Nueces County, TX, 2011.

Treatment[1/] (rate)	Fleahopper **nymphs** and **adults** per 100 plants					Lint yield lb/acre
	Pretreat	2 DAT[3/]	5 DAT	10 DAT	Post-treat. avg.	
Centric 40WG (1.25 oz/acre)	30.0[a]	3.8[b]	5.0[b]	11.3[b]	6.7[b]	588
Transform 50WG (0.75 oz/acre)	32.5[a]	1.3[b]	7.5[b]	7.5[b]	5.4[b]	579
Transform 50WG (1.00 oz/acre)	28.8[a]	1.3[b]	2.5[b]	18.8[b]	7.5[b]	583
Transform 50WG (1.25 oz/acre)	26.3[a]	0.0[b]	6.3[b]	20.0[b]	8.8[b]	535
Nontreated	27.5[a]	31.3[a]	38.8[a]	57.5[a]	42.5[a]	602
LSD (P = 0.05)	NS[2/]	9.46	8.17	22.41	11.17	NS
P > F	.4615	.0001	.0001	.0028	.0001	.3802

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]Treatments were applied on 6/7
[2/]NS = Not Significant
[3/]DAT = Days After Treatment

IMPACT OF FLEAHOPPER CONTROL FROM TREATMENTS APPLIED IN SELECTED COTTON SQUARING WEEKS

Texas AgriLife Research and Extension Center, Nueces County, 2011

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SUMMARY: Fleahoppers were low compared with their numbers in previous tests during the first 5 fruiting weeks. The treatments did result in significantly fewer numbers in various treatments compared to the number found in nontreated cotton. Only on two dates did the cotton fleahoppers exceed 15 or more /100 plant terminals. The higher numbers were marginally above the treatment threshold for the insect. No differences were found in any of the plant mapping data obtained near the harvest date which measured boll placement and amount of boll production. Consequently, statistical differences were not observed in lint production, but there appeared to be a numerical positive yield response since all insecticide treatment timings, except one, had a higher yield level. Furthermore, the higher yields were in plots treated during the second week or in multiple weeks of squaring.

OBJECTIVES: The study was conducted to evaluate the effects of fleahopper control carried out at various weeks of squaring on insect numbers, fruiting characteristics of plants, and production.

MATERIALS/METHODS: The cotton variety DPL 1044 B2RF was planted on March 14, 2011 on 38-inch row-spacing with a 4-row John Deere model 6100 planter which delivered 55 thousand seed per acre at the Texas AgriLife Research and Extension Center Meaney Annex. Plots were 8 rows by 35 feet with insecticide applied to 4 rows in each plot. Treatments were arranged in a randomized complete block design with 4 replications. Centric 40WG (1.25 oz/acre) was applied during the second, third, and fourth weeks of squaring in all possible treatment week combinations. These treatments were made 4/26 (second squaring week), 5/3 (third squaring week), and 5/11 (fourth squaring week). Insecticide was applied with a Spider Trac sprayer calibrated to deliver 5.3 gpa total volume through 4X hollow cone nozzles (2/row) at 50 psi traveling at 4.0 mph.

Treatments were assessed by (1) counting the number of cotton fleahopper nymphs and adults on 20 plant terminals/plot on 4/19 [squaring week 1], 4/25 [squaring week 2], 4/28 [squaring week 2 or 2 days after treatment 1 = 2 DAT-1], 5/2 [squaring week 2 or 6 DAT-1], 5/6 [squaring week 3 or 3 DAT-2], 5/10 [squaring week 3 or 7 DAT-2], 5/14 [squaring week 4 or 3 DAT-3], 5/17 [squaring week 4 or 6 DAT-3], and 5/20 [squaring week 5 or 9 DAT-3]; (2) assigning a spider mite damage rating to cotton plots on 5/20 [squaring week 5 or 9 DAT-3]; (3) selecting 6 plants from non-harvest rows for plant mapping using PMAP software on 6/17 just after bolls began to open; and (4) harvesting of the center 2 rows in plots on 7/17 with a 2-row model 9900 John Deere spindle cotton picker. Seed cotton weights were determined and a 35% lint turnout was used to determine lint yield.

Since all insecticide treatment timings except one had a positive yield compared with the nontreated cotton (not statistically significant), dollar returns were calculated for the various treatments.

RESULTS/DISCUSSION: Cotton fleahopper counts were initiated in the test at the beginning of the first week of squaring (first squares visible) and continued through the 5th week of squaring (Tables 1, 2, and 3).

Fleahopper nymphs were not present until late in the second week of squaring, and their numbers remained relatively low throughout the testing period (Table 1). Insecticide treatments generally did not result in significant differences in the number of nymphs, possibly due to their low numbers this season. However, at 3, 6 and 9 DAT-3 in weeks 4 and 5, nymph numbers were either significantly higher or close to being significantly higher in the nontreated cotton. Post-treatment average nymph counts were not different among the various insecticide timings, but their numbers were significantly higher in the nontreated cotton.

Likewise, adult fleahopper numbers were relatively low throughout the testing period (Table 2). Statistical differences among the various treatments only occurred 6 DAT-1 in squaring week 2 and 3 DAT-2 in squaring week 3. The post-treatment counts generally reflected the number of treatments applied.

Even the data showing the combination of nymph and adult fleahopers (Table 3) indicated an overall lower number than generally observed in previous field studies and in area cotton in past years. Statistically fewer fleahoppers were finally found at 6 DAT-1 in plots that had been treated in week 2 of squaring, and even in this case, the numbers were not always lower than that found in plots that had not been treated by that date. This anomaly cannot be explained. Distinct effects of insecticide treatments were finally observed 3 DAT-2 in week 3 of squaring (squaring week 2 and 3 treatments had been applied by that time). Fleahopper numbers were significantly higher in cotton that had not been treated by that date (week 4 and nontreated cotton). By 6 DAT-3 in week 4 of squaring all insecticide treated cotton had significantly fewer fleahoppers than the nontreated cotton; similar results were measured for the post-treatment average counts.

Fleahopper numbers throughout the testing period never exceeded by much the established treatment threshold of 15/100 plants (Table 3). The threshold was not reached until the 3rd squaring week in the non-insecticide treated plots although counts did reach 12.5/100 plants the prior week. Under these conditions effects of insecticide for increasing lint production would not be expected.

Compared with tests conducted in past years, fleahopper populations at the critical squaring stage where most damage would be expected were relatively low even though they did exceed or nearly reach the threshold for treatment in the nontreated cotton on three dates. Possible reasons for the low numbers encountered include lack of wild host plants due to drought conditions and earlier fruiting of the cotton due to a dramatic increase in heat units compared to previous years.

In an attempt to measure fleahopper effects on cotton fruiting, plant mapping was conducted just as bolls began to open to determine plant growth characteristics, where bolls were set on the plant, and percentage of the fruiting sites with harvestable bolls (Tables 4, 5, and 6). No differences or even possible trends were found in internode length, plant height, number of fruiting branches, or number of main stem nodes (Table 4).

Although not statistically significant, there appeared to be a slight trend for more spider mite damage in cotton treated more than once, especially where treatments were applied in the second squaring week.

No differences were found in the number of bolls/plant, boll set on various branch groups, or % boll retention (Table 5). Furthermore, no differences were detected in number of bolls by fruiting position or % boll retention by fruiting position off the main stem (Table 6).

Fleahopper numbers were simply not high enough during the critical fruiting window to cause noticeable differences in cotton growth and fruiting. One indication of at least the possibility of some effect by cotton fleahopper can be seen in the yield data (Table 7). Although there were no statistical differences in the yield data, all insecticide treated cotton except the single treatment made in week 3 had higher yield. The positive yield increase for six of the treatment timings averaged 31 lb lint/acre. Furthermore, there seemed to be a trend for cotton treated in week 2 of squaring or on at least two dates, to have the higher yields. Even though it could not be shown statistically, dollar return data is listed for the numerical increases. It is understandable that most people would discount listing of the dollar returns as true based on the low fleahopper numbers encountered, lack of differences or even trends in plant growth, and certainly the fact that no differences could be documented in plant fruiting characteristics.

ACKNOWLEDGMENTS: Rudy Alaniz and Clint Livingston, Demonstration Assistants, are thanked for their help in conduct of the study. They dedicated many hours to land preparation, planting, cultivation, weed control, treating, plant mapping, harvesting, and processing the seed cotton. Syngenta Crop Protection is thanked for providing the Centric insecticide used in the study.

Table 1. Timing of fleahopper treatments on cotton with initiation of treatments during the second week of squaring, Texas AgriLife Research and Extension Center, Nueces County, TX, 2011.

	Fleahopper **nymphs** per 100 plants and squaring week									
Insecticide applied in squaring week[1/]	Pretreat[2/] week 1	Pretreat[3/] week 2	2 DAT-1[5/] week 2	6 DAT-1 week 2	3 DAT-2 week 3	7 DAT-2 week 3	3 DAT-3 week 4	6 DAT-3 week 4	9 DAT-3 week 5	Post-treat. avg.
2	0.0[a]	0.0[a]	0.0[a]	0.0[a]	0.0[b]	0.0[a]	0.0[a]	0.0[b]	5.0[a]	0.7[b]
3	0.0[a]	0.0[a]	0.0[a]	1.3[a]	5.0[a]	2.5[a]	0.0[a]	1.3[b]	5.0[a]	2.1[b]
4	0.0[a]	0.0[a]	0.0[a]	6.3[a]	5.0[a]	1.3[a]	0.0[a]	0.0[b]	2.5[a]	2.1[b]
2, 3	0.0[a]	0.0[a]	0.0[a]	1.3[a]	0.0[b]	1.3[a]	0.0[a]	0.0[b]	1.3[a]	0.5[b]
2, 3, 4	0.0[a]	0.0[a]	0.0[a]	3.8[a]	0.0[b]	0.0[a]	0.0[a]	0.0[b]	0.0[a]	0.5[b]
2, 4	0.0[a]	0.0[a]	0.0[a]	3.8[a]	0.0[b]	5.0[a]	0.0[a]	1.3[b]	3.8[a]	2.0[b]
3, 4	0.0[a]	0.0[a]	0.0[a]	3.8[a]	2.5[ab]	1.3[a]	0.0[a]	0.0[b]	2.5[a]	1.4[b]
Nontreated	0.0[a]	0.0[a]	0.0[a]	5.0[a]	6.3[a]	3.8[a]	3.8[a]	11.3[a]	11.3[a]	5.9[a]
LSD (P=0.05)	NS[4/]	NS	NS	NS	3.90	NS	NS	3.37	NS	1.66
P > F	1.000	1.000	1.000	.4893	.0050	.1514	.0525	.0001	.0715	.0001

Means in a column followed by the same letter are not significantly different by ANOVA.

[1/]Centric 40WG (1.25 oz/acre) was applied at indicated squaring week; treatment dates were 4/26, 5/3, and 5/11.

[2/]Beginning of the first squaring week, 7 true leaves, 4/19.

[3/]Beginning of the second squaring week, 4/25.

[4/] NS = Not Significant

[5/] DAT = Days After Treatment

Table 2. Timing of fleahopper treatments on cotton with initiation of treatments during the second week of squaring, Texas AgriLife Research and Extension Center, Nueces County, TX, 2011.

	Fleahopper **adults** per 100 plants and squaring week									
Insecticide applied in squaring week[1/]	Pretreat[2/] week 1	Pretreat[3/] week 2	2 DAT-1[5/] week 2	6 DAT-1 week 2	3 DAT-2 week 3	7 DAT-2 week 3	3 DAT-3 week 4	6 DAT-3 week 4	9 DAT-3 week 5	Post-treat. avg.
2	2.5[a]	3.8[a]	0.0[a]	0.0[c]	1.3[b]	2.5[a]	3.8[a]	3.8[a]	3.8[a]	2.1[c]
3	2.5[a]	3.8[a]	5.0[a]	1.3[c]	1.3[b]	1.3[a]	1.3[a]	5.0[a]	3.8[a]	2.7[bc]
4	1.3[a]	1.3[a]	3.8[a]	6.3[a]	10.0[a]	5.0[a]	3.8[a]	1.3[a]	0.0[a]	4.3[ab]
2, 3	3.8[a]	5.0[a]	1.3[a]	1.3[c]	1.3[b]	0.0[a]	2.5[a]	1.3[a]	0.0[a]	1.1[c]
2, 3, 4	1.3[a]	5.0[a]	1.3[a]	2.5[bc]	1.3[b]	1.3[a]	2.5[a]	0.0[a]	0.0[a]	1.2[c]
2, 4	1.3[a]	0.0[a]	2.5[a]	2.5[bc]	2.5[b]	3.8[a]	1.3[a]	3.8[a]	2.5[a]	2.7[bc]
3, 4	3.8[a]	3.8[a]	2.5[a]	5.0[ab]	2.5[b]	1.3[a]	1.3[a]	1.3[a]	0.0[a]	2.0[c]
Nontreated	0.0[a]	3.8[a]	5.0[a]	7.5[a]	8.8[a]	3.8[a]	5.0[a]	5.0[a]	5.0[a]	5.7[a]
LSD (P=0.05)	NS[4/]	NS	NS	3.64	4.37	NS	NS	NS	NS	1.89
P > F	1.000	.5427	.2023	.0029	.0006	.3348	.7411	.5501	.0741	.0006

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]Centric 40WG (1.25 oz/acre) was applied at indicated squaring week; treatment dates were 4/26, 5/3, and 5/11.
[2/]Beginning of the first squaring week, 7 true leaves, 4/19.
[3/]Beginning of the second squaring week, 4/25.
[4/] NS = Not Significant
[5/] DAT = Days After Treatment

Table 3. Timing of fleahopper treatments on cotton with initiation of treatments during the second week of squaring, Texas AgriLife Research and Extension Center, Nueces County, TX, 2011.

	Fleahopper **nymphs** and **adults** per 100 plants and squaring week									
Insecticide applied in squaring week[1/]	Pretreat[2/] week 1	Pretreat[3/] week 2	2 DAT-1[5/] week 2	6 DAT-1 week 2	3 DAT-2 week 3	7 DAT-2 week 3	3 DAT-3 week 4	6 DAT-3 week 4	9 DAT-3 week 5	Post-treat. avg.
2	2.5[a]	3.8[a]	0.0[a]	0.0[c]	1.3[b]	2.5[a]	3.8[a]	3.8[b]	8.8[ab]	2.9[cd]
3	2.5[a]	3.8[a]	5.0[a]	2.5[bc]	6.3[b]	3.8[a]	1.3[a]	6.3[b]	8.8[ab]	4.8[bc]
4	1.3[a]	1.3[a]	3.8[a]	12.5[a]	15.0[a]	6.3[a]	3.8[a]	1.3[b]	2.5[bc]	6.4[b]
2, 3	3.8[a]	5.0[a]	1.3[a]	2.5[bc]	1.3[b]	1.3[a]	2.5[a]	1.3[b]	1.3[bc]	1.6[d]
2, 3, 4	1.3[a]	5.0[a]	1.3[a]	6.3[abc]	1.3[b]	1.3[a]	2.5[a]	0.0[b]	0.0[c]	1.8[d]
2, 4	1.3[a]	0.0[a]	2.5[a]	6.3[abc]	2.5[b]	8.8[a]	1.3[a]	5.0[b]	6.3[bc]	4.6[bc]
3, 4	3.8[a]	3.8[a]	2.5[a]	8.8[ab]	5.0[b]	2.5[a]	1.3[a]	1.3[b]	2.5[bc]	3.4[cd]
Nontreated	0.0[a]	3.8[a]	5.0[a]	12.5[a]	15.0[a]	7.5[a]	8.8[a]	16.3[a]	16.3[a]	11.6[a]
LSD (P=0.05)	NS[4/]	NS	NS	8.05	5.29	NS	NS	7.53	8.09	2.82
P > F	.6175	.5427	.2023	.0280	.0001	.1434	.3876	.0047	.0078	.0001

Means in a column followed by the same letter are not significantly different by ANOVA.
[1/]Centric 40WG (1.25 oz/acre) was applied at indicated squaring week; treatment dates were 4/26, 5/3, and 5/11.
[2/]Beginning of the first squaring week, 7 true leaves, 4/19.
[3/]Beginning of the second squaring week, 4/25.
[4/] NS = Not Significant
[5/] DAT = Days After Treatment

Table 4. Influence of cotton fleahopper treatment timing on plant growth and spider mite damage, Texas AgriLife Research and Extension Center, Nueces County, TX, 2011.

	Inches		No. per plant		
Insecticide applied in squaring week[1/]	Internode length	Plant height	Fruit branches	Main stem nodes	Spider mite Damage rating[3/]
2	1.26[a]	22.5[a]	13.7[a]	17.9[a]	1.2[a]
3	1.25[a]	23.3[a]	14.0[a]	18.7[a]	1.1[a]
4	1.28[a]	22.8[a]	13.3[a]	17.8[a]	1.0[a]
2, 3	1.19[a]	21.9[a]	13.8[a]	18.4[a]	1.3[a]
2, 3, 4	1.27[a]	23.0[a]	13.7[a]	18.1[a]	1.5[a]
2, 4	1.26[a]	22.2[a]	13.2[a]	17.6[a]	1.4[a]
3, 4	1.23[a]	22.1[a]	13.5[a]	17.9[a]	1.0[a]
Nontreated	1.25[a]	23.1[a]	14.1[a]	18.5[a]	1.0[a]
LSD (P = 0.05)	NS[2/]	NS	NS	NS	NS
P > F	.9479	.9783	.7878	.4321	.2467

Means in a column followed by the same letter are not significantly different by ANOVA.

[1/]Centric 40WG was applied at 1.25 oz/acre for the indicated squaring week; treatment dates were 4/26, 5/3, and 5/11.

[2/]NS = Not Significant

[3/]Damage ratings: 1 = very few mites and little damage up to 5 = abundant mites and abundant leaf discoloration.

Table 5. Influence of cotton fleahopper treatment timing on boll production and retention by fruiting branch groups, Texas AgriLife Research and Extension Center, Nueces County, TX, 2011.

Insecticide applied in squaring week[1/]	Bolls/ plant	No. bolls by branch group			% boll retention	% boll retention by branch group		
		1-5	6-10	11-15		1-5	6-10	11-15
2	11.8[a]	6.0[a]	4.6[a]	1.1[a]	49.6[a]	51.2[a]	42.7[a]	46.8[a]
3	14.1[a]	6.8[a]	5.7[a]	1.6[a]	58.6[a]	55.6[a]	53.8[a]	57.6[a]
4	10.7[a]	5.8[a]	4.3[a]	0.6[a]	52.6[a]	54.5[a]	45.1[a]	56.5[a]
2, 3	13.5[a]	7.0[a]	5.4[a]	1.0[a]	56.6[a]	54.3[a]	47.5[a]	51.2[a]
2, 3, 4	11.6[a]	7.0[a]	3.7[a]	0.8[a]	45.7[a]	50.3[a]	35.6[a]	46.3[a]
2, 4	10.0[a]	5.7[a]	3.8[a]	0.5[a]	46.1[a]	50.7[a]	39.4[a]	49.0[a]
3, 4	11.7[a]	6.4[a]	4.5[a]	0.8[a]	55.8[a]	53.2[a]	45.9[a]	54.2[a]
Nontreated	12.1[a]	6.1[a]	4.5[a]	1.4[a]	48.6[a]	50.2[a]	46.7[a]	58.6[a]
LSD (P = 0.05)	NS[2/]	NS	NS	NS	NS	NS	NS	NS
P > F	.5844	.4076	.6600	.3663	.7110	.8898	.7002	.5559

Means in a column followed by the same letter are not significantly different by ANOVA.

[1/]Centric 40WG was applied at 1.25 oz/acre for the indicated squaring week; treatment dates were 5/4, 5/11, 5/17, and 5/25.

[2/] NS = Not Significant

Table 6. Influence of cotton fleahopper treatment timing on boll location and percentage retention by fruiting position off main stem, Texas AgriLife Research and Extension Center, Nueces County, TX, 2011.

	No. bolls by fruit position			% boll retention by fruit position		
Insecticide applied in squaring week[1/]	1	2	3	1	2	3
2	9.0[a]	2.5[a]	0.3[a]	74.4[a]	26.3[a]	5.5[a]
3	10.0[a]	3.5[a]	0.5[a]	81.9[a]	39.7[a]	14.0[a]
4	8.2[a]	1.9[a]	0.4[a]	73.0[a]	26.5[a]	12.4[a]
2, 3	8.8[a]	4.0[a]	0.6[a]	74.4[a]	41.8[a]	16.4[a]
2, 3, 4	8.5[a]	2.9[a]	0.2[a]	70.2[a]	31.0[a]	4.8[a]
2, 4	8.2[a]	1.7[a]	0.1[a]	71.7 [a]	19.3[a]	5.0[a]
3, 4	9.0[a]	2.5[a]	0.2[a]	77.6[a]	28.7[a]	8.6[a]
Nontreated	9.2[a]	2.4[a]	0.5[a]	77.5[a]	29.1[a]	17.4[a]
LSD (P = 0.05)	NS[2/]	NS	NS	NS	NS	NS
P > F	.5408	.3678	.3827	.6440	.4862	.4967

Means in a column followed by the same letter are not significantly different by ANOVA.

[1/]Centric 40WG was applied at 1.25 oz/acre for the indicated squaring week; treatment dates were 5/4, 5/11, 5/17, and 5/25.

[2/] NS = Not Significant

Table 7. Influence of cotton fleahopper treatment timing on lint production and economic return, Texas AgriLife Research and Extension Center, Nueces County, TX, 2011.

Insecticide applied in squaring week[1/]	Lb lint/acre Yield	Lb lint/acre Over nontreated[3/]	$ return over nontreated[4/]
2	803[a]	+40	+29.90
3	761[a]	-2	-11.76
4	777[a]	+14	+ 4.37
2, 3	792[a]	+29	+ 9.72
2, 3, 4	796[a]	+33	+ 4.27
2, 4	791[a]	+28	+ 8.74
3, 4	805[a]	+42	+22.48
Nontreated	763[a]		
LSD (P = 0.05)	NS[2/]		
P > F	.8482		

Means in a column followed by the same letter are not significantly different by ANOVA.

[1/]Centric 40WG was applied at 1.25 oz/acre for the indicated squaring week treatment; dates were 5/4, 5/11, 5/17, and 5/25.

[2/]NS = Not Significant

[3/]Note that there were no statistical differences in yield; therefore, it is not normal procedure to list dollar return information. It is presented only as a discussion point.

[4/]Cotton value based on $1.00/lb for lint and $0.12/lb for seed using a factor of 1.6 times lint weight. Costs include Centric 40WG ($6.38 for 1.25 oz/acre) and application ($3.00/acre). Harvesting/hauling/ginning cost for extra lint above nontreated cotton was set at $0.21/lb lint.

COMPARISON OF METHODS FOR SAMPLING PLANT BUGS ON COTTON IN SOUTH TEXAS (2010)

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SUMMARY: A total of 26 cotton fields were sampled by experienced and inexperienced samplers at 3 growth stages using 5 methods to compare the most efficient and accurate method for sampling plant bugs in cotton. Each of the 5 methods had its own distinct advantages and disadvantages as a sampling method (tool). Overall the beat bucket looks to be the most promising method to incorporate into sampling plant bugs in cotton in the future.

OBJECTIVES: Our objectives were to compare sampling methods across sucking bug species at relevant plant growth stages within a cotton pest sampling program where sucking bugs are the primary targets for insecticide control. Practically, we focused on two dominant plant bugs, the cotton fleahopper and verde plant bug (Note: previously called green plant bug or Creos), in assessing acceptability and performance of sampling strategies.

MATERIALS/METHODS: This sampling survey was done in 26 cotton field-site locations from Port Lavaca to Brownsville, Texas. The following four methods were compared to the traditional visual method used for cotton fleahopper sampling: beat bucket, KISS sampler, beat sheet, and sweep net (Table 1). Cotton was sampled at 3 growth stages: early squaring, early bloom, and peak/late bloom. The survey involved a total of 7 samplers, and also compared the 4 experienced samplers to the 3 inexperienced samplers.

At each field-site samplers would take 4 sub-samples of 10 plants or more using each of the five methods. Data was taken on the type and number of each species and also the time needed to complete the sub-sample. Data from each sub-sample was converted to a 10-plant equivalent. The predominate plant bug species sampled were cotton fleahopper, *Pseudatomoscelis seriatus,* and verde plant bug, *Creontiades signatus.* The data recorded for these two species was used for the comparison of the five methods tested. Data at each site combined the number of nymphs and adults.

Table 1. Description of sampling procedures for five methods used to sample for the plant bug and stink bug complex on cotton occurring in South Texas, 2010.

METHOD	EQUIPMENT	SAMPLING PROCEDURE
SWEEP NET	Standard 15 inch diameter field net made from thick white fabric, 35 inch wood handle	Vigorous 10 pendulum sweeps across the top of the canopy along one row, down to base of small plants and into 7 to 10 inches of top growth of large plants [a]

BEAT CLOTH	White cloth (36 in. x 36 in.) framed with wood dulls on two parallel sides	Placed on soil surface with one edge at the base on one row of cotton; 3 to 4 plants are folded over and beat onto the cloth [b]
BEAT BUCKET	White 5 gallon plastic bucket, 12 in. in diameter and 15 in. in depth	Held at a tilt toward the plants, plants are grasped at the stem and bent into the bucket. 2 to 3 plants are quickly shaken against the side of the inside of the bucket [b]
VISUAL	None	Examine entire plant during squaring and upper 8-10 inches afterward [b]
KISS	Leaf blower with 5 x 16 in. cloth net held 9 inches from blower by a wire frame	The blower and net are placed on opposite sides of plant row. Insects are blown from 10 feet of row [a]

[a] Counts adjusted to a 10 plant equivalent based on stand count.
[b] Continue to another section of row until 10 plants are sampled.

RESULTS & DISCUSSION:

Growth Stage, Methods, and Experience Comparison. In collections from 26 coastal and inland fields, over 99 % of the insects collected using all five sampling methods were cotton fleahopper during early season squaring and early bloom. In the same fields during peak to late bloom, 98 % or more of the insects collected were verde plant bug and cotton fleahopper for each method (Fig. 1).
Cotton fleahopper. The beat bucket and sweep net methods tended to account for most captures, especially during peak/late bloom cotton growth; whereas, the KISS and visual methods captured much fewer insects for all methods (Fig. 2A) (sampling method by plant growth stage interaction: P=0.06). For experienced samplers, significantly more bugs were captured with the beat bucket and sweep net than with the other methods (Fig. 2B). Inexperienced samplers detected fewer bugs, and their counts were uniformly low among the methods (Fig. 2B) (sampling method by experience level: P=0.009).
Verde plant bug. Averaging across experience, there were more than twice as many bugs captured with the beat bucket and sweep net than observed with the KISS and visual methods, and the beat cloth method captured an intermediate number of bugs (P = 0.0015, Fig. 3).
Time to sample. There was a significant time efficiency advantage during the early squaring stage for all 4 alternative methods over the visual method (Fig. 4A). When sampling during the early and late bloom stages beat cloth, beat bucket, and sweep net were more time efficient than both the KISS and visual methods (Fig.4A). The inexperienced sampler was least time efficient using the KISS method while the experienced sampler was least time efficient using the visual method (Fig. 4B). Also, when using the visual method, the experienced sampler took almost twice as long as the inexperienced sampler (Fig. 4B).

In Summary: The beat bucket was an efficient and effective alternative to the visual method for cotton fleahopper especially for the experienced sampler. It also performed well for the verde plant bug sampling. It is flexible and lends its use to other crops, especially grain sorghum. Future work is merited for the development of economic thresholds for its use in cotton.

The KISS sampler appears to have more value as an early season detection tool than a season-long sampling method, especially for private consultants. This tool is useful in quickly sampling a large number of plants when insect populations are very low. It may have use when first detecting the presence of insects early in the season, but the specialty equipment may not permit its use across the industry.

This study also validates the need and value of the well trained/experienced sampler to insure accuracy in the implementation of the sampling method, especially the visual method.

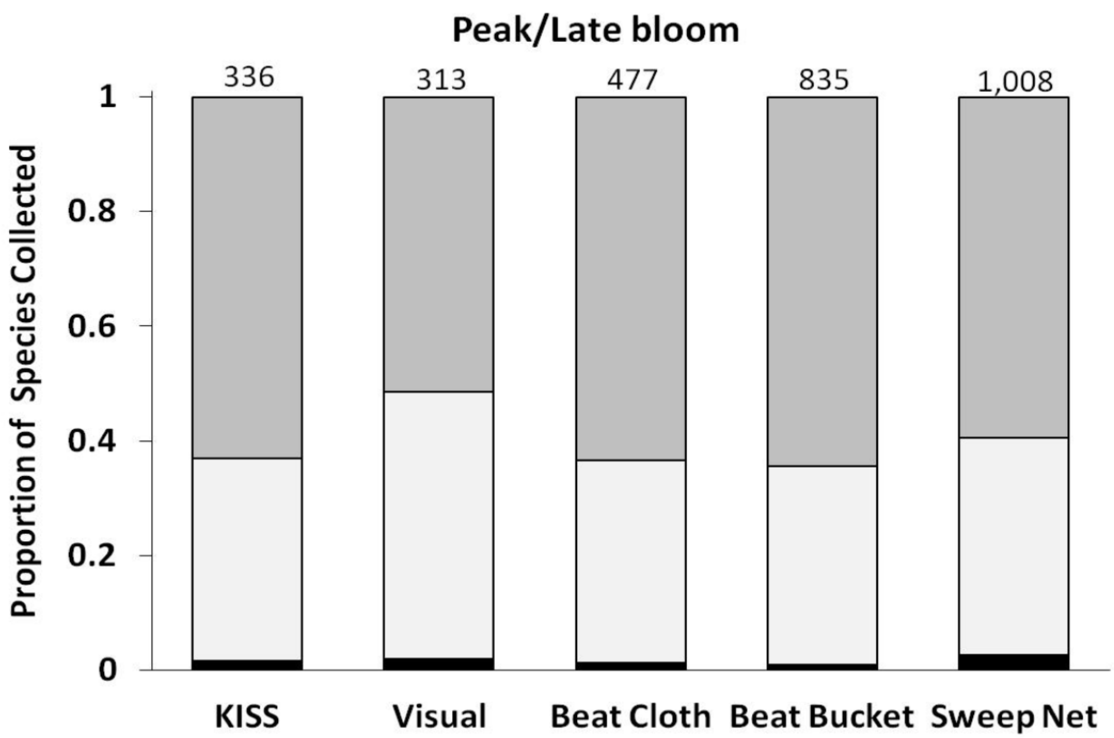


Fig. 1. The proportion of each species collected averaging data across all fields and samplers for the five sampling methods during peak through late bloom in 2010. Total collected is above each bar. Dark grey = Verde plant bug, Light grey = Cotton fleahopper, Black = Combined Lygus sp., Rice stink bug, and Green stink Bug.

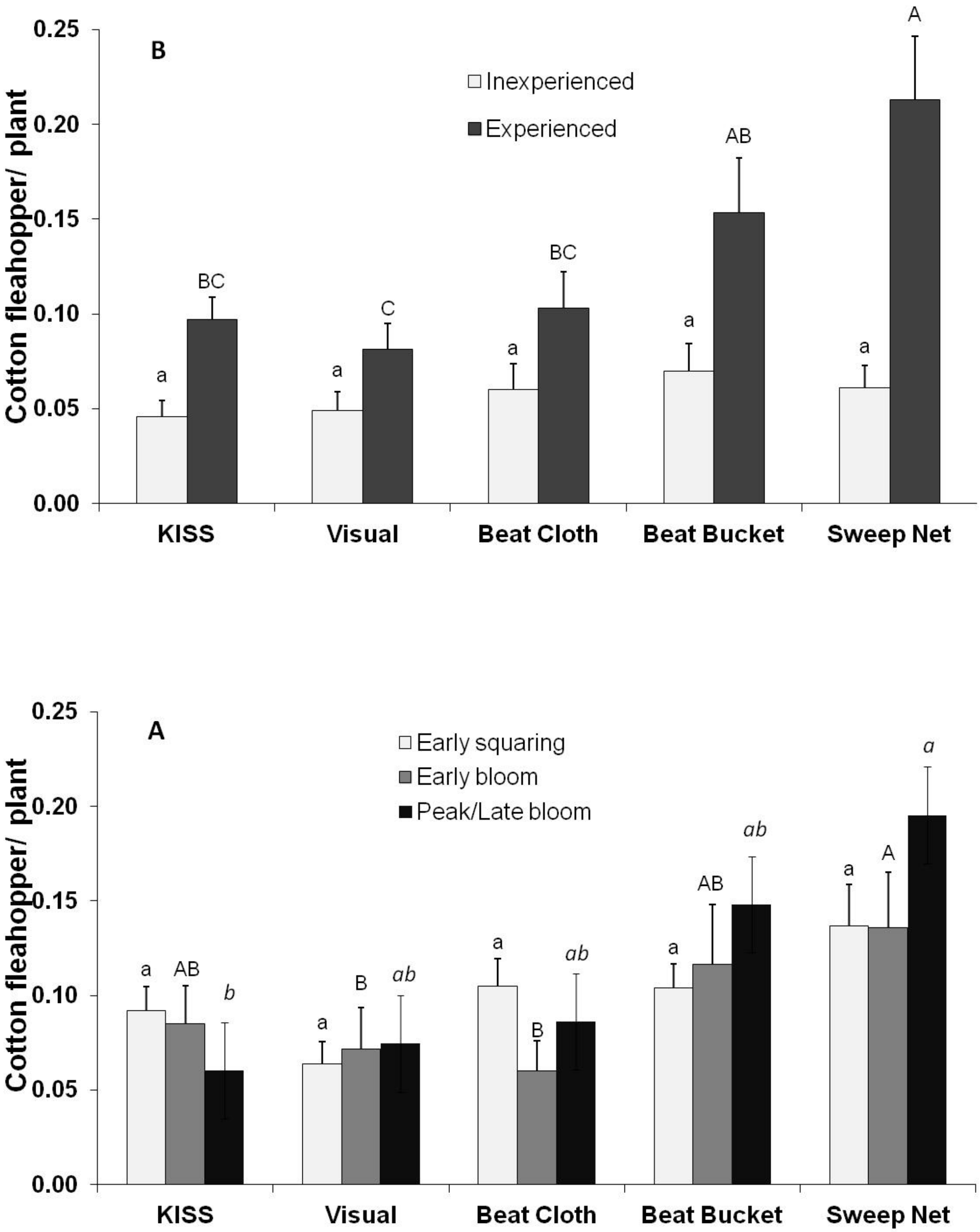


Fig. 2A & 2B. Interactions of sampling method by plant growth stage (A) and sampling method by experience level (B) when estimating densities of cotton fleahopper from cotton fields (n=26) of South Texas (means with the same lower case, upper case, and italics lower case letters across methods are not significant).

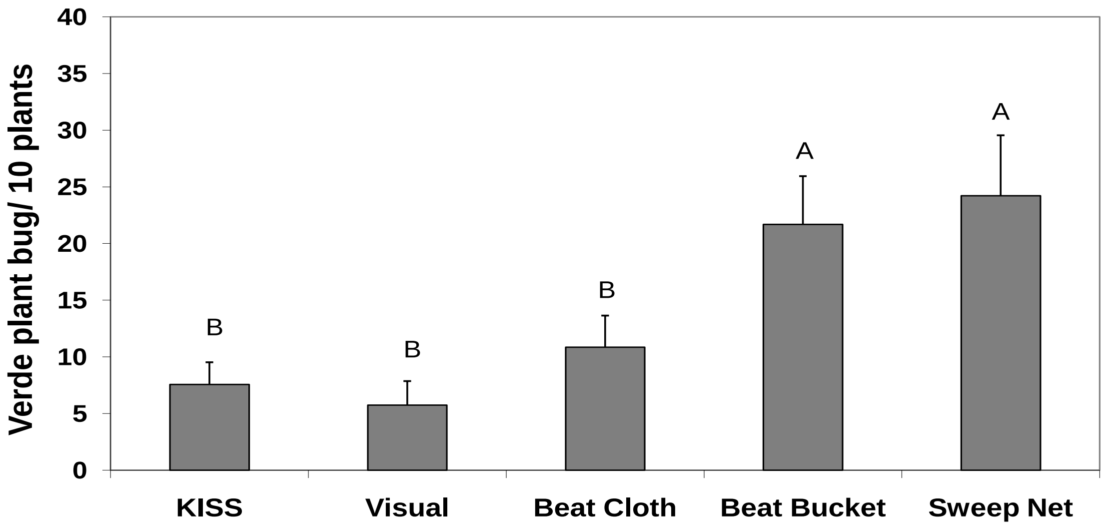
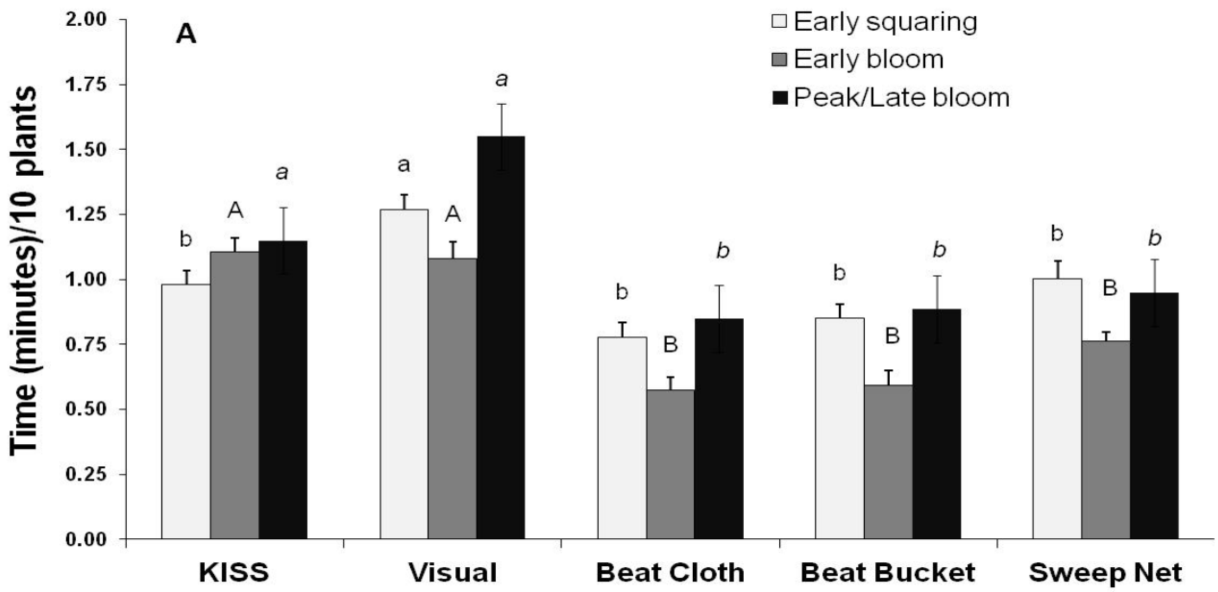


Fig. 3. The sampling methods factor was significant when estimating densities of verde plant bug from cotton fields (n=26) of South Texas, along the Texas Coastal Bend and Rio Grande Valley. The interaction with experience level was not significant. The means presented are averaged across the two experience levels (means with the same letter across methods are not significant).



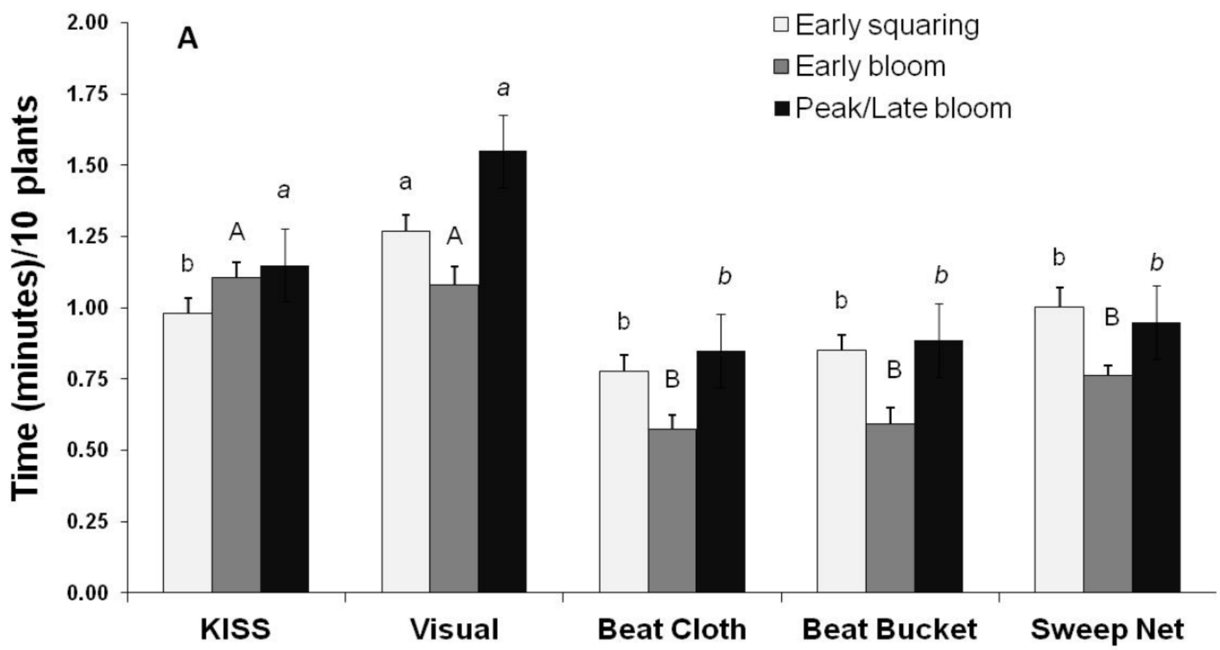


Fig. 4A & 4B. Interactions of sampling method by plant growth stage (A) and sampling method by experience level (B) when recording time needed to sample cotton fleahopper and verde plant bug from cotton fields (n=26) of South Texas (means with the same lower case, upper case, and italics lower case letters across methods are not significant).

Comments on Sampling Methods: Each sampling methodology has value and limitations. Here are some pros and cons of each method:

METHOD	***PROS***	***CONS***
VISUAL	Whole, complete plant sample Allows for agronomic observations Accepted by all layers of the industry Basis of current ET's No equipment needed	Slow and fatiguing Subjective Quality of the data improves with experience
SWEEP NET	Efficient / fast Fairly objective Accepted with ET's in some regions Inexpensive	Data varies with skill level Problematic in high winds Tougher to use with tall plants Moderately fatiguing
BEAT CLOTH	Efficient / fast Skill acquired quickly Excellent for sampling nymphs Inexpensive Accepted with ET's in some regions Fairly objective	Sampler must have "quick eye" Large plants are difficult Difficult under wet field conditions Light to moderately fatiguing Difficult in windy conditions
BEAT BUCKET	Efficient / fast Advantages in windy conditions Inexpensive Skill acquired quickly Little fatigue Used successfully in other crops Fairly objective	No accepted ET's [a] Can form wind tunnel in windy conditions Wet plants are difficult to sample Difficult in cotton <6 inches
KISS SAMPLER	Speed advantage with small plants Works under windy conditions Excellent when insect numbers are low Excellent for quick spot checks Excellent for quick detection of insect presence / migration No established ET's [a] Objective	Difficult with large plants Problematic in high winds Expensive equipment Can be fatiguing especially in muddy conditions Wet plants are difficult to sample

[a] ET = economic threshold

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VERDE PLANT BUG IS ASSOCIATED WITH COTTON BOLL ROT IN SOUTH TEXAS COTTON

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SUMMARY: Verde plant bug was the dominant boll-feeding sucking bug species (>98% of insects collected using a beat bucket) from peak to late bloom in cotton fields near the coast along the Coastal Bend of South Texas, from Port Lavaca to the Lower Rio Grande Valley in 2010 and 2011. It was common in fields within 8 km of coastal waters (average of 0.42 bugs per plant during peak to late bloom), while it was not detected in inland fields. Cotton boll rot was found on up to 25% of the open bolls inspected, the disease was concentrated in coastal fields where verde plant bug was found, and it was the major contributor to boll damage. Results from field surveys and verde plant bug feeding on caged plants supported the positive association of verde plant bug presence and subsequent harvest-relevant cotton boll rot in open bolls at harvest. Based on our findings, we recommend in-season monitoring of verde plant bug to aid in assessing the likelihood of subsequent boll damage from cotton boll rot, especially for fields close to coastal waters. Additional inspection of signs of internal feeding by cracking green bolls (no greater than quarter-sized bolls) may be useful to verify that feeding is occurring in the soft tissue inside the boll, but we caution that inspection for early signs of cotton boll rot in green bolls may be a poor indicator of final disease expression and resulting boll damage. Based on our work, in-season monitoring of the verde plant bug using the beat bucket is currently the best indicator of harvest damage caused by these bugs and potentially magnified by cotton boll rot.

INTRODUCTION AND OBJECTIVES: Plant bugs and stink bugs are traditionally referred to as sucking bugs, and they have reached elevated past status in cotton. Insecticide sprays which traditionally controlled these sucking bugs have been reduced following the introduction of transgenic Bt-cotton for worm control and boll weevil eradication. Sucking bug feeding occurs on reproductive tissue of cotton, and for many species economic damage primarily occurs from feeding on young to mid-sized bolls. Of the sucking bugs, stink bugs have been shown to cause boll abscission, lint staining and loss, and seed loss. Loss is magnified when bacteria causing cotton boll rot are introduced during feeding, as shown for the southern green stink bug (Medrano et al. 2007). Several species of brown and green stink bugs occur along the Coastal Bend cotton growing region of South Texas, and their abundance and damage potential is variable throughout the region, justifying the need for good in-season monitoring of the complex (Hopkins et al. 2009).

A plant bug, the verde plant bug has also emerged as an important boll-feeder along the Gulf Coast during the past 10-15 years. Like the stink bugs, verde plant bug feeding on cotton bolls results in lint and seed staining and loss (Armstrong et al. 2010). The verde plant bug is a native species along the Gulf Coast and in additional to cotton has been collected from weedy plants such as London rocke, pigweed, and nettleleaf goosefoot (Coleman 2007). Verde plant bug has also been collected in high numbers on coastal seepweed and annual seepweed (Armstrong, field observation). Armstrong et al. (2009b) confirmed that verde plant bug can reproduce on cotton.

We investigated whether feeding by verde plant bug is associated with cotton boll rot in the field, which will likely magnify economic damage if it is introduced into the cotton boll as verde plant bug feeds. A replicated grower field survey was done in 2010 and 2011 to capture a range of sucking bug species and observe subsequent boll injury, including cotton boll rot, occurring in cotton along the Gulf Coast region of Texas, from Port Lavaca to the Lower Rio Grande Valley. The vast majority of boll-feeding sucking bugs collected were verde plant bug, which allowed a presumptive association of this insect's feeding to any cotton boll rot that was subsequently detected. To further strengthen the association of verde plant bug and transmission of boll-rotting organisms, a field cage experiment was done to compare characteristics of insect feeding and cotton boll rot on plants exposed to and protected from verde plant bug adults.

MATERIALS/METHODS*:*

Field Survey. In 2010, sucking bugs were collected from 80-200 plants in each of 15 cotton fields along the Coastal Bend of South Texas. Sucking bugs were collected using a beat bucket during peak to late bloom (about 10 to 7 nodes above white flower) and were identified and counted in the field. Nine and six fields were designated as coastal and inland, respectively (Fig.1). Green bolls (n=150) were randomly selected from each of 14 of these fields, representing eight coastal and six inland fields, and brought back to the laboratory to inspect for visible signs of cotton boll rot within the locules (Medrano et al. 2007). The same fields were re-visited near harvest to assess damage to open bolls near harvest. At each field, randomly selected bolls (n=150) judged as a harvestable boll (i.e., expected to be fully open in time for mechanical harvest). A five class locule damage scale was used, ranging from 0 (no damage), through an incremental 1 to 3 gradation as damage progressively worsened within each locule and affected additional locules, to 4 (severe damage to all locules) (Lei et al. 2003). Presence/absence of visible signs of cotton boll rot also was tallied for the bolls inspected.

Drought conditions were severe during 2011: about 3.3 inches of rainfall April 1 through Aug. 30 compared with 18 inches in 2010 and a 14 inches average over the last 125 years (Corpus Christi station, National Weather Service). Sucking bug populations were very low but verde plant bug was detected at potentially damaging levels in two of the 2010 fields (Rio Hondo in the Lower Rio Grande Valley, and the Texas AgriLife Research and Extension Center, Corpus Christi). At these fields, verde plant bug was counted during peak to late bloom, and green and open bolls were scored for damage and presence of cotton boll rot as previously described. During both years, fields were selected from those with sucking bugs detected during bloom and where growers and consultants invited us to conduct this survey. Fields were planted to multiple cultivars adapted to the region. Insecticides were used in some fields at early squaring for cotton fleahopper control, but sampling never occurred within two weeks of an application.

Fig. 1. Locations of 15 cotton fields visited along the Coastal Bend of South Texas, nine fields were designated as coastal and six designated as inland (8 km from the nearest coastline, inland bay, and coastal waterway was the demarcation point for coastal and inland fields).

Controlled Field Cage Experiment. In 2010 and 2011 at the Texas AgriLife Research and Extension Center (Corpus Christi, TX), we exposed caged cotton plants to verde plant bug and measured boll injury and cotton boll rot of green bolls, and compared results to those from non-infested caged plants. Adult verde plant bugs were obtained from a laboratory colony that was established and periodically replenished with field-collected bugs from several wild and cultivated host plants in the Lower Rio Grande Valley. Both years, cages were infested at rates of 0.25 to 4 verde plant bugs per plant (up to 12 plants per cage). Other cages were left uninfested to serve as controls. There were 4 to 5 replications per infestation level, set out in a randomized complete block. Full plant cages made of organza cloth were placed on randomly selected groups of plants when plants were at peak bloom (about 10 to 7 nodes above white flower), which is consistent with the time period of verde plant bug occurrence in commercial fields of the region. Prior to caging, no stink bug and verde plant bug activity was detected for the previous three weeks, and plant inspection also indicated no feeding activity prior to caging. Two days before infesting, all cages were sprayed with short-residual pyrethrins (0.02% by volume, a garden spray formulation). At infestation, randomly selected adults from the colony were placed in one-ounce portion cups in the morning and let loose at the base of the cages at the designated infestation rates. Seven days after the infestation, bugs were killed with a combination of pyrethrins and a longer residual pyrethroid (Mustang Max, FMC, Philadelphia, PA). Two weeks later during late bloom, green bolls were harvested. Cages were left on the plants to further avoid incidental insect feeding.

By macroscopic examination of the exterior and interior carpel wall and locules, collected bolls were scored for insect-piercing and cotton boll rot presence. Microbiological assessment included surface sterilization of the bolls, aseptic harvesting of diseased and asymptomatic locule tissue, processing of the tissues by pulverization or soaking, and plating the prepared tissue on both fungal and bacteriological media. Plates were scored for presence/absence of fungi and bacteria.

Data. To evaluate species composition in the field survey, numbers and percentages for each species relative to the total number of sucking bugs collected and total number of boll-feeding sucking bugs collected were calculated for the coastal and inland fields in 2010.

For fields sampled in 2010 and the two fields in 2011, boll injury data were used to calculate proportion of bolls with signs of cotton boll rot for green bolls inspected during peak to late bloom and open bolls inspected near harvest, and average damage score of open bolls (0-4 scale). Verde plant bug per plant during peak to late bloom was also calculated for each field. Three regressions were done using field averages as the data points: a) damage score linear relationship to proportion of open bolls with cotton boll rot, b) proportion of green bolls with cotton boll rot linear relationship to number of verde plant bug per plant, and c) proportion of open bolls with cotton boll rot linear relationship to number of verde plant bug per plant.

For the controlled field cage experiment each year, percentages of insect-pierced bolls, bolls with disease symptoms, and bolls positive for bacteria (no positives for fungi were detected) were calculated from infested and uninfested plants.

RESULTS:

Field survey. The majority of bugs collected from peak to late bloom were verde plant bug in coastal fields, while none were collected in inland fields in 2010 (Table 1). Both verde plant bug nymphs and adults were collected. In collections from the same fields during squaring and early bloom, over 99% of the insects collected (Brewer, field observation) were cotton fleahopper, which feeds on squares and not bolls. Excluding cotton fleahopper and rice stink bug (which does not feed on cotton bolls), verde plant bug represented the vast majority of boll-feeding sucking bugs (Table 1). Verde plant bug averaged 0.42 bugs per plant in coastal fields, and its abundance was quite variable among fields inspected (0-1.56 bugs per plant). In 2011, drought conditions apparently led to much lower insect activity; therefore monitoring activity was limited to two fields where verde plant bug was found at potentially damaging levels, and other species were not counted due to their negligible numbers.

Table 1. Species composition of sucking bug, taken by beat bucket sampling from peak and late bloom in coastal and inland cotton fields of the Coastal Bend of South Texas, 2010.

Species [b]	Coastal [a]		Inland [a]	
	No. Insects (%)	% Boll-feeding [c]	No. Insects (%)	% Boll-feeding [c]
Cotton fleahopper	258 (30.2)	--	42 (95.5)	--
Rice stink bug	2 (0.2)	--	2 (4.5)	--
Verde plant bug	589 (68.8)	98.9	0 (0)	0
Lygus	2 (0.2)	0.3	0 (0)	0
Green stink bugs	5 (0.6)	0.8	0 (0)	0

[a] Coastal (n=9, total plants inspected=1,400) and inland (n=6, number of plants inspected=720) fields.
[b] Lygus and green stink bugs not identified to species.
[c] '—' signifies that the species was excluded from the boll-feeding sucking bug count

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There was a strong linear relationship of the damage score of the open bolls to the proportion of open bolls with cotton boll rot. Detected cotton boll rot resulted in more damage and a stronger relationship to damage in coastal fields than in inland fields (Fig. 2). Cotton boll rot was found in up to 25% of the open bolls inspected in 2010, and it was most common in coastal fields where verde plant bug was detected. Cotton boll rot detected in inland fields never exceeded 8% (Fig. 2). Damage was mostly seen on bolls on the upper and outer portion of the plant (Brewer, field observation), which is consistent with verde plant bug feeding most frequently on small to mid-sized bolls during late bloom (Armstrong et al. 2009a).

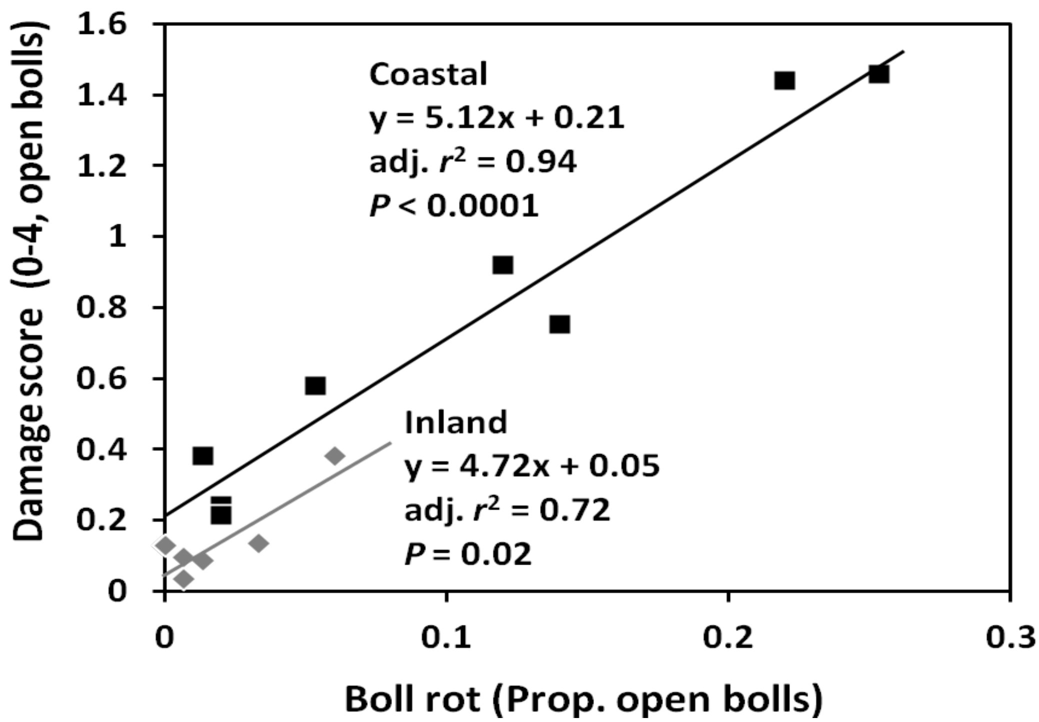

Fig. 2. Regressions of damage of open bolls near harvest to presence of cotton boll rot near harvest for coastal and inland cotton fields of the Coastal Bend of South Texas, 2010-2011. Squares indicate coastal fields and diamonds indicated fields further inland.

The proportion of green bolls with internal signs of cotton boll rot (cracking green bolls) was not linearly related to the number of verde plant bug per plant, with both measurements taken at the same time during peak to late bloom (Fig. 3). But the subsequent proportion of open bolls with signs of cotton boll rot near harvest was linearly related to the number of verde plant bug per plant during peak to late bloom (Fig. 4). In this regression model, there was no difference in the linear relationship between coastal and inland fields (this reflected that no verde plant bug was found in inland fields).

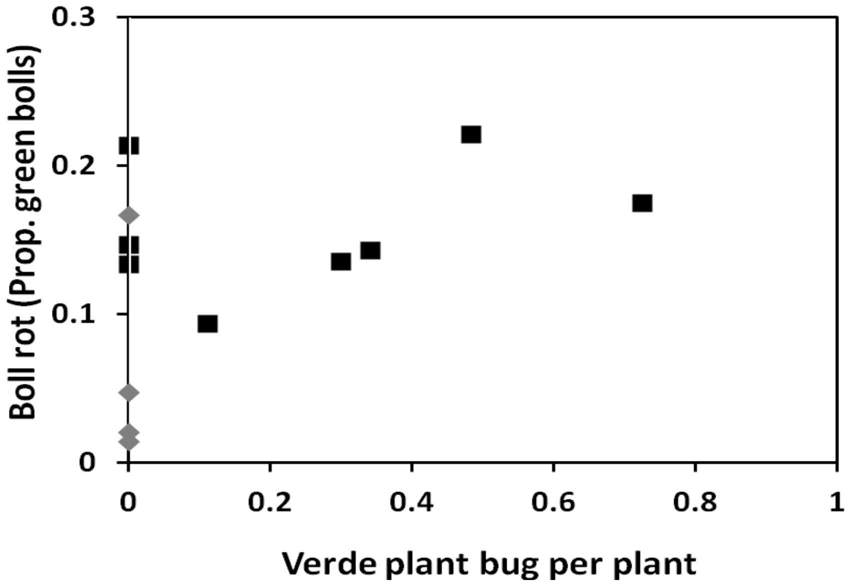

Fig. 3. Non-signficant regression of verde plant bug detected during peak to late bloom to presence of cotton boll rot in green bolls inspected at the same time (P = 0.91) for coastal and inland cotton fields of the Coastal Bend of South Texas, 2010-2011. Squares indicate coastal fields and diamonds indicated fields further inland.

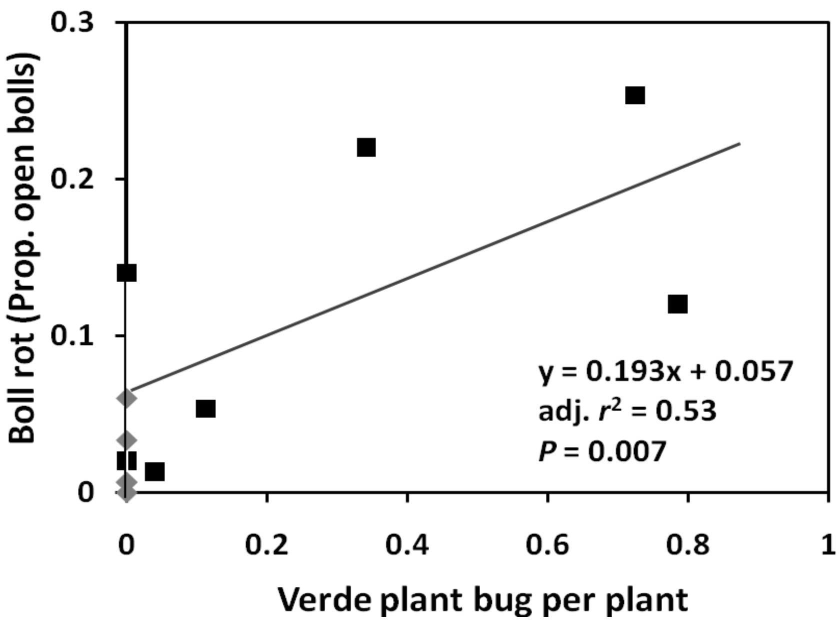

Fig. 4. Regression of verde plant bug detected during peak to late bloom to presence of cotton boll rot near harvest for coastal and cotton inland fields of the Coastal Bend of South Texas, 2010-2011. Squares indicate coastal fields and diamonds indicated fields further inland.

Controlled Field Cage Experiment. In both 2010 and 2011, verde plant bug-infested plants had higher incidence of pierced bolls than the uninfested plants (2010: $P = 0.0002$; 2011: $P < 0.0001$). Disease symptoms of cotton boll rot and plants positive for bacteria were also much higher in the verde plant bug infested plants than the uninfested plants for both years (2010: $P < 0.0001$; 2011: $P = 0.0003$) (Table 2).

Table 2. Frequency distribution of insect-pierced bolls, bolls with cotton boll rot disease symptoms, and bacteria plates tested positive, from infested and uninfested plants of a field cage experiment, Corpus Christi, Texas, 2010-2011.

Year	Total bolls	Insect-pierced bolls		Bolls with disease symptoms		Bacterial plates (+)	
		Infested	Uninfested	Infested	Uninfested	Infested	Uninfested
2010	48	39.6% (n=19)	0% (n=0)	35.4% (n=17)	0% (n=0)	35.4% (n=17)	0% (n=0)
2011	80	35% (n=28)	2.5% (n=2)	22.5% (n=18)	2.5% (n=2)	22.5% (n=18)	2.5% (n=2)

n values following percentage values reflect observed number of insects, bolls or plates per category. The percentage values are based on the 'Total bolls' value for respective year.

DISCUSSION: *Overall, verde plant bug was the dominant boll-feeding sucking bug species along the Coastal Bend cotton growing region of South Texas in 2010 and 2011, and substantiates earlier reports of its activity and damage to cotton (Fig. 5) (Coleman 2007). Collection of both nymphs and adults was expected based on previous reports on verde plant bug oviposition on cotton (Armstrong et al. 2009b). In regard to the affiliation of verde plant bug to coastal fields, coastal seepweed and annual seepweed grow in saline and alkaline soils in the vicinity of cotton fields located near coastal waters. These plants along with weedy annual hosts may provide a resource for verde plant bug populations to increase before migration to cotton. The comparative lack of verde plant bug in inland fields further substantiates the coastal affiliation, but it is worth noting that verde plant bug has been detected inland but always at much lower levels than at coastal areas (Brewer & Armstrong, field observation).*

The relationship of in-season verde plant bug density to early signs of cotton boll rot in green bugs was poor (Fig. 3), but as the disease progressed to near harvest the association of in-season verde plant bug density to cotton boll rot in open bolls was signficant (Fig. 4). Presence of cotton boll rot in open bolls was key to harvest-relevant damage (Figs. 2 and 5). The field cage experiment further implicated verde plant bug as introducing disease agents causing cotton boll rot (Table 2). These results were consistent with greenhouse studies showing bacteria associated with boll-feeding by verde plant bug (Armstrong et al. 2009c) and another sucking bug, the southern green stink bug (Medrano et al. 2007). The better relationship of verde plant bug densities to and disease symptoms when bolls are open, as opposed to in-season symptoms of boll rot, is consistent with those observations of Medrano et al. (2009). They found, using southern green stink bug as a model, the time course of disease development from initial feeding until full expression of cotton boll rot took several weeks. Cracking green bolls to visually observe early stages of disease may have led to false negative in our study.

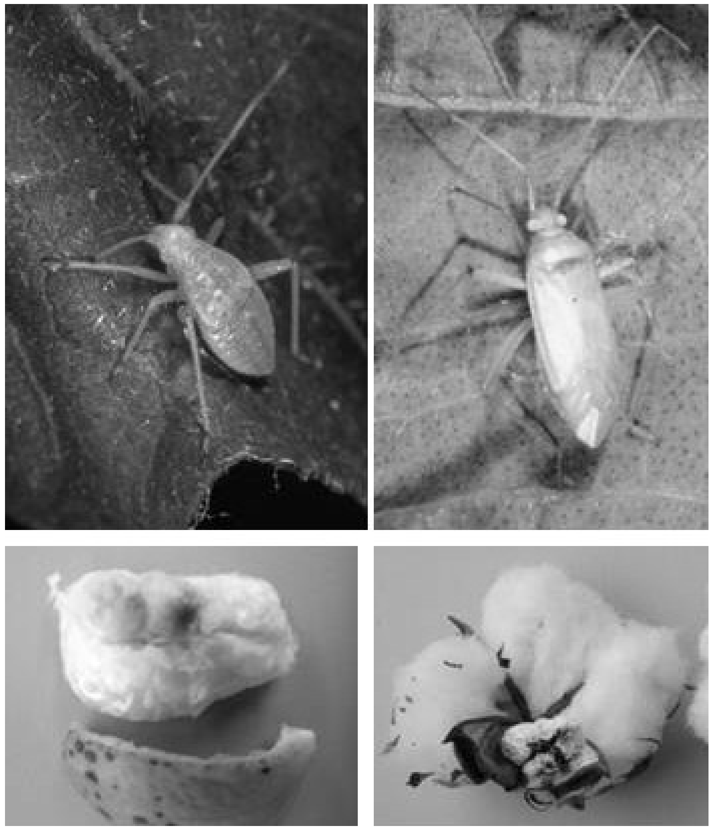

Fig. 5. Verde plant bug and its damage to cotton bolls: nymph (top-left) and adult (top-right) of verde plant bug, and signs of cotton boll rot in green bolls (bottom-left) and open bolls (bottom-right) taken from cotton fields of the Coastal Bend of South Texas, 2010-2011.

The major contribution of cotton boll rot to harvest-relevant damage of open bolls (Fig. 2) and the relationship of verde plant bug density to subsequent damage justified in-season monitoring of verde plant bug. We recommend that verde plant bug monitoring be added to the existing process of sampling for stink bugs in South Texas (Hopkins et al. 2009). When the focus is verde plant bug, special attention should be given to fields near coastal waters. Peak bloom is clearly a critical time for monitoring, although it may be judicious to begin sampling during early bloom to detect initial infestations of verde plant bug. As a precaution, any future shift in its occurrence to earlier during bloom may result in an increase in damage as more bolls contributing to harvest are exposed to infection (Jenkins et al. 1990). Also, there may be potential for greater inland movement of verde plant bug if their activity period on cotton increases.

Additional inspection of signs of internal feeding by cracking green bolls (no greater than quarter-sized bolls) may be useful to verify that feeding is occurring in the soft tissue inside the boll. For those utilizing this practice, we caution that inspection for early signs of cotton boll rot in green bolls may be a poor indicator of final disease expression and resulting boll damage. Currently there is no in-season field procedure to verify that bolls are infected with cotton boll rot. Based on our work, in-season monitoring of the verde plant bug using the beat bucket is currently the best indicator of harvest damage caused by these bugs and magnified by cotton boll rot. On-going economic threshold, boll injury, and pathogenicity work will assist in further quantifying cotton boll rot and harvest risk associated with verde plant bug feeding.

ACKNOWLEDGMENTS: We thank M. Bloemer and J. Martinez for assistance in insect field sampling. Thanks to S. Hopkins, M. Traecy, and J. Norman for identifying sucking-bug infested fields, and we thank field owners for allowing field access. This work was partially supported by a Texas State Support Committee award (11-845TX) to Brewer and Armstrong, and a regional Cotton Inc. award to Medrano (11-952).

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BOLLWORM/TOBACCO BUDWORM PHEROMONE TRAP CATCH IN NUECES COUNTY DURING 2011

Texas Agrilife Research and Extension Center, Nueces County, 2011

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SUMMARY: Both bollworm and tobacco budworm moth catches in traps were lower in 2011 compared with the previous year which most likely resulted for the drought experienced this season. The peak catch for bollworm moths was similar for both years, but the peaks were about one month apart. Tobacco budworm numbers never exceeded 0.5 per trap in 2011; whereas, they did exceed that number during four weeks in 2010. The tobacco budworm trap catch did not exceed 1 per trap in 2011, far below the number found for the bollworm. The lower catch for the budworm probably relates to fewer wild host plants and increased use of Bt cotton varieties.

OBJECTIVES: Trap catch data is collected to monitor relative abundance of the bollworm and tobacco budworm in the current season and to determine fluctuation of their populations during the current and previous seasons.

MATERIALS/METHODS: Moth-ZV 30-inch screen wire cone traps (Hartstack) were deployed March 1 and baited with pheromone for the bollworm and tobacco budworm at the Texas AgriLife Research and Extension Center at Corpus Christi, Texas. Two traps were deployed for each species. Bollworm traps were monitored for 29 weeks, and tobacco budworm traps were monitored for 26 weeks. Moth numbers were recorded daily or ever few days, and each 7-day catch total was divided by 7 to obtain the average catch for the corresponding period. Pheromone was changed monthly.

RESULTS/DISCUSSION: Bollworm trap captures were much lower in the month of April and most of the month of May in 2011 (Fig. 1) compared with the same period in 2010 (see 2010 research report). The peak number of bollworm moths that were captured in 2011 was in the last two weeks of May in 2011; whereas, the peak in 2010 was about a month earlier or in last week of April. Peak moth number in traps for both years was near the same (175 moths/night for a week period). However, during June and later months in 2011, moth trap catch was much lower compared with the previous year. The lower catch in 2011 was probably associated with the extended drought experienced in the region as was the case in 2009.

Tobacco budworm moth catch never exceeded 0.5 per trap on any date in 2011 (Fig. 2). That number was exceeded in 2010 during 4 weekly periods (weeks 1 in April, 2 in May, and 1 and 2 in June). Tobacco budworm trap catch numbers have been relative low in traps since about 2004.

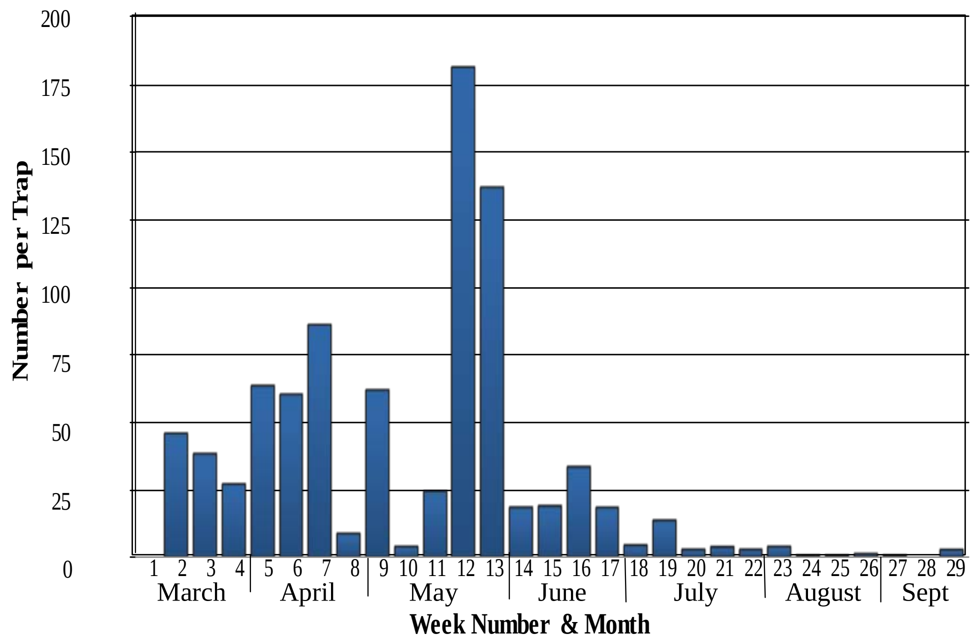

Fig. 1. Bollworm moths captured in pheromone traps per day for the indicated week, Nueces County, TX, 2011.

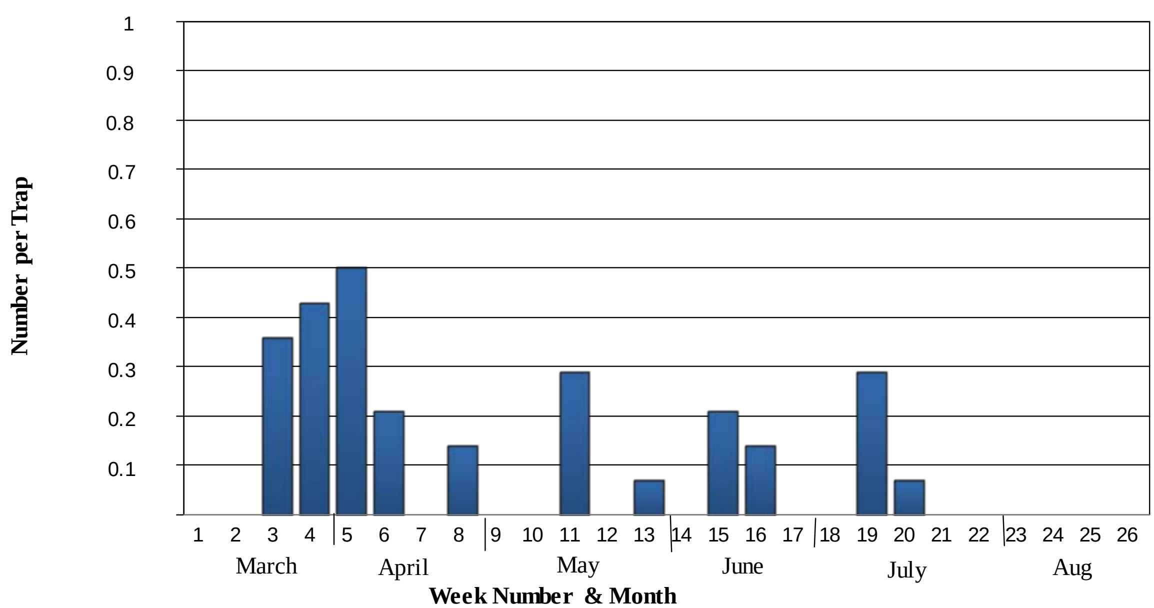

Fig. 2. Tobacco budworm moths captured in pheromone traps per day for the indicated week, Nueces County, TX, 2011.

EVALUATION OF INSECTICIDES ON PECAN FOR CONTROL OF PECAN NUT CASEBEARER AND HICKORY SHUCKWORM

Devereux Foundation, Victoria County, 2011

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SUMMARY: Pecan nut casebearer and hickory shuckworm numbers were very low in the pecan orchard, and damage levels were not great enough to have any impact on yield or nut quality. Following pecan nut casebearer first generation treatment, statistically significant damage was observed on the nontreated trees, but even that damage in the nontreated trees was not high enough to have lasting impact on yield or nut quality. Likewise, hickory shuckworm damage was almost nonexistent. Even though statistical differences were detected in kernel weights, experimental error was thought to have been the cause and not related to insects of any kind.

OBJECTIVES: Insecticides were evaluated for effectiveness on pecan nut casebearer and hickory shuckworm. Treatments were also observed for any non-target effects such as development of aphid populations or chemical effects on leaves.

MATERIALS/METHODS: Insecticides for control of pecan insect pests were evaluated at the Devereux Foundation west of Victoria, Texas along State Highway 59. Individual trees were selected on which to apply treatments and each treatment was replicated 4 times in a modified randomized complete block experimental design. Trees designated for treatments were tagged with different color ribbon. Treatments were applied to trees in a total volume of 5 gallons/tree of finished spray with a hand sprayer. Special care was taken to treat the lower areas of trees from which nut clusters (pecan nut casebearer evaluation) and mature nuts (hickory shuckworm evaluation) were to be taken. Zinc was applied to all test trees including the non-insecticide treated trees. Treatment for first generation casebearer was made on 5/2, second generation casebearer on 6/13 and for hickory shuckworm on 8/11 at half-shell hardening.

Treatments were assessed by (1) examining 25 nut clusters/tree for pecan nut casebearer eggs on 4/29, (2) examining 25 nut clusters for pecan nut casebearer infestation on 5/14 [12 DAT-1] and on 6/28 [14 DAT-2], and (3) collecting 10 nuts/tree on 10/5 just as shucks began to open to determine hickory shuckworm damage. Shuckworm damage to shucks was measured using a 0-8 damage scale in which each of the 4 quadrant shucks were divided into upper and lower half creating a possible maximum damage rating of 8. Once shucks were removed, nuts were dried and weighed, and then shelled so that kernel weight and percentage kernel could be determined.

Agriculture Research Manager (ARM revision 6.1.13) software was used to conduct analysis of variance and means were separated by LSD (least significant difference).

RESULTS/DISCUSSION: Low numbers of pecan nut casebearer developed from a moderate egg lay at first generation based on results of damage counts 12 days after treatment (Table 1). Although significantly lower damage was observed in all insecticide treatments, only 4% damaged nut clusters were found on the nontreated pecan trees. Even fewer damaged clusters were detected 15 days after treatment for the second generation. Only 1% of the nut clusters were found to have pecan nut casebearer damage, and that damage was found on nontreated trees. No statistical differences were found in nut damage following second generation pecan nut casebearer insecticide treatment.

A single treatment was applied in August for hickory shuckworm at the half-shell hardening stage. Nuts collected just as shucks began to split revealed extremely low damage from hickory shuckworm with no differences found among any of the treatments (Table 1). No shell scarring due to hickory shuckworm was observed on any of the nuts evaluated from any treatment. Additional measurements were made for kernel weight and percentage kernel. Unexplained statistical differences were found in kernel weights. Altacor treated trees had higher kernel weight than all but Belay treated trees. Significantly lower kernel weights were observed in the Confirm treatment. It is thought that the statistical differences could possibly be due to experimental error made in selection of trees for treatment with various insecticides. Differences related to such things as tree size, location, variety, or other factors may not have been equally represented among the treatments. Few nuts remained on some trees following loss to squirrels; they may have selected higher quality nuts leaving lower quality for us to examine. Unfortunately we did not note the trees where nut loss was greatest due to the squirrels. There were no differences in percentage kernel produced in nuts. In summary, the hickory shuckworm was not at high enough numbers to cause any effect on nut weight or quality.

ACKNOWLEDGMENTS: Thanks are extended to the Devereux Foundation and especially to Don Edwards, Caretaker of the pecan trees, for help in conducting the study. Companies that supplied insecticide and monetary support for the project included DuPont, Valent, Bayer, and Gowan.

Table 1. Comparison of insecticides on pecan for effect on pecan nut casebearer and hickory shuckworm, Devereux Foundation, Victoria County, TX, 2011.

	Pecan nut casebearer/100 nut clusters					
Treatment (rate)[2/]	eggs pretreat	damaged clusters 12 DAT-1[4/]	damaged clusters 15 DAT-2	HSW damage rating[5/]	Kernel weight grams/nut[6/]	% kernel
Altacor 35WG (3.0 oz/acre)	3.0[a]	0.0[b]	0.0[a]	.00[a]	4.35[a]	51.3[a]
Belay 2.13SC (4.0 oz/acre)	4.0[a]	0.0[b]	0.0[a]	.03[a]	3.94[ab]	48.7[a]
Belt 4SC (4.0 oz/acre)	5.0[a]	1.0[b]	0.0[a]	.00[a]	3.86[b]	52.8[a]
Confirm 2F (12.0 oz/acre)	6.0[a]	0.0[b]	0.0[a]	.00[a]	3.39[c]	49.2[a]
Nontreated	3.0[a]	4.0[a]	1.0[a]	.15[a]	3.86[b]	50.5[a]
LSD (P = 0.05)	NS[3/]	2.39	NS	NS	0.458	NS
P > F	.8346	.0132	.4449	.4968	.0108	.3597

Means in a column followed by the same letter are not significantly different by ANOVA.

[1/]Treatments were applied for pecan nut casebearer on 5/2 (1st generation) and 6/13 (2nd generation), and for hickory shuckworm on 8/11.

[2/]Equivalent to treating 20 trees.

[3/]NS = Not Significant

[4/]DAT = Days After Treatment

[5/]HSW (hickory shuckworm) damage ratings based on 0-8 scale where 0 = no damage up to 8 = all 4 shuck quadrants with tunneling in bottom and top halves.

[6/]Weight differences cannot be explained.