THRIPS MANAGEMENT OPTIONS IN IRRIGATED COTTON ON THE TEXAS HIGH PLAINS

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Abstract

Thrips (Western flower thrips, *Frankliniella occidentalis* (Pergande)) are a perennial problem to seedling cotton in the Texas High Plains and are normally one of the top three most damaging insect pests. This study was conducted to evaluate several thrips management tactics and compare two rates of Temik for the control of thrips in irrigated cotton on the Texas High Plains and was conducted at one site in 2007 and two sites in 2008. Weather conditions and slight thrips densities are likely responsible for the different impact that thrips had on yield in 2007 compared to 2008. These trials indicate that under cool wet conditions thrips may pose a greater risk than if conditions are warm. Temik is the standard against which all thrips management options are currently measured and continues to be a top performer. When considering thrips suppression alone 3.5 lbs/acre will provide the same protection and residual activity as the 5 lbs/acre rate. Cruiser is a convenient and viable thrips management strategy but may give up a small amount of suppression and residual activity. Avicta CC has the same insecticide as Cruiser but has an added nematicide. Avicta CC provides the same thrips suppression as Cruiser but the higher cost is not justified unless nematode suppression is needed. The new Aeris seed treatment (imidacloprid + thiodicarb) is a promising thrips management option. Limited data indicate that the addition of thiodicarb may provide thrips control on its own or it may enhance the thrips activity of imidacloprid. However, more research is needed to make a recommendation. Gaucho Grande has been successfully utilized to suppress onion thrips and tobacco thrips but has not shown to be effective in suppressing Western flower thrips. Since Western flower thrips is the dominant species in the High Plains of Texas, Gaucho Grande should not be depended upon for adequate thrips suppression. Foliar acephate can provide outstanding thrips suppression, but it is likely the most management intensive of the management strategies evaluated.

Introduction

Thrips are a recurring problem to seedling cotton in the Texas High Plains. Thrips infested an estimated 2.0 million of the 3.5 million planted acres in 2007 (Williams 2008). Approximately 1.9 million acres were treated with a preventative insecticide and 1.7 million acres were treated with a foliar remedial insecticide for thrips suppression. In 2007, thrips were the third most damaging cotton insect pest, accounting for 18.4% of all insect damage, closely following bollworms and cotton fleahoppers. Additionally, thrips were estimated to be responsible for a 1.4% yield reduction in the 2007 Texas High Plains cotton crop. Thrips infested virtually 100% of cotton on the Texas High Plains in 2008 and were the second most damaging insect pest accounting for 23.7% of all insect losses (Williams 2009).

Western flower thrips, *Frankliniella occidentalis* (Pergande), is the dominant species of thrips in the High Plains of Texas. The high front-end cost of all effective preventative thrips management tactics is a big factor for producers when considering the adoption of preventative thrips management strategies. Toxicity of the systemic in-furrow applied insecticides, even with the added safety provided by “Lock-and-Load” application system, is a concern for many growers, and some growers do not like the inconvenience of handling these products relative to the ease of using a seed treatment or nothing at all. Finally, there are still producers that do not believe that thrips are as damaging as reported.

The established action threshold for thrips in the Texas High Plains is 1 thrips/true leaf of each plant (Kerns et al 2008). If a preventative or foliar insecticide treatment has been previously made then the thrips population should contain at least 30% immature thrips before a subsequent insecticide application is justified.

Until recently, available alternative preventative treatments have not been competitive with the standard systemic insecticide, Temik (aldicarb), in effectiveness. Temik is the standard against which all thrips management options are currently measured.

Objective

To evaluate several thrips management tactics and compare two rates of Temik for the control of thrips in irrigated cotton on the Texas High Plains.

Materials and Methods

This study was conducted in Parmer County in 2007 and in Parmer and Gaines County in 2008. The trials were planted using the cotton cultivar 'FiberMax 9063B2RF' on the following dates:

Parmer 2007 May 4, 2007
Parmer 2008 May 20, 2008
Gaines 2008 May 13, 2008

All treatments had the same standard fungicide seed treatment plus a premium "over-lay" fungicide for control of seedling disease. Test plots were located within a sprinkler irrigated commercial cotton field. A randomized complete block experimental design was utilized which included 4 replications. Treatments were applied to plots measuring 150-feet long by two 30-inch rows wide. Treatments included the following:

1. Untreated check (UTC)
2. Temik @ 3.5 lbs/acre (T3.5) (aldicarb soil applied granular insecticide)
3. Temik @ 5.0 lbs/acre (T5.0) (aldicarb soil applied granular insecticide)
4. Avicta Complete Cotton (ACC) (abamectin + thiamoxam seed treatment)
5. Aeris (thiodicarb + imidacloprid seed treatment)
6. Foliar acephate @ 3.2 oz/acre (foliar insecticide)
7. Cruiser (CZR) (thiamoxam seed treatment)
8. Gaucho Grande (GG) (imidacloprid seed treatment) (Parmer 2007 only)
9. Aeris + Temik @ 5.0 lbs/acre (Aer+T) (Parmer and Gaines 2008 only)

In-furrow insecticides were applied at planting with the seed using granular-insecticide metering boxes at a depth of 1.5 inches. Foliar sprays were applied on a 50% band with a CO_2 pressurized hand-boom sprayer calibrated to deliver 10 gpa through Teejet XR8001EVS extended range even flat spray tip nozzles at 30 psi. Foliar applications were made May 24 and 30 (20 and 26 DAP) in the Parmer 2007 trial. No foliar insecticide treatments were made in 2008. Adult and immature thrips were sampled by visually inspecting 10 whole plants per plot. Samples were taken weekly from emergence till plants had developed 5 true leaves. Stand counts were made in each plot June 5 by counting the number of plants per 3 row feet at 4 random sites per plot then calculating plants per acre. The numbers of true leaves per plant were estimated for each plot June 5 and 20 (32 and 47 DAP) by counting the number of true leaves from 10 plants per plot (2007 only). Leaf area was estimated after plants had developed at least 5 true leaves by collecting 10 plants per plot and measuring the cm^2 leaf area per plant using a LI-COR, Inc. LI-3100 laboratory area meter. The plots were plant mapped on a weekly basis July 5 through August 10 utilizing the COTMAN cotton expert software (2007 only) (COTMAN 2009). Weather data were collected from nearby weather stations. Entire plots were harvested at the Parmer site October 29, 2007 using a John Deere 7445 cotton stripper harvester equipped with a field cleaner and integral small plot scales. Twenty row feet were hand harvested using a HB#1 hand harvester from the Parmer and Gaines sites in 2008. Bur cotton grab samples were taken from each plot. The samples were ginned at the Texas AgriLife Research Center in Lubbock, Texas and lint samples were submitted to the Texas Tech University International Textile Center in Lubbock, Texas for high volume instrument (HVI) analysis. Commodity Credit Corporation (CCC) loan values based on the respective fiber properties for each plot were determined (2007 only).

Data were subjected to analysis of variance (ANOVA) and when a significant F test was observed, mean separation was performed using the least significant difference (LSD) at the 5% probability level (SAS Institute (2003), ARM (2008)).

Results and Discussion:

Parmer 2007

Environmental conditions were very cool and wet from emergence to 21 DAP (Table 1). All treatments had fewer thrips/plant than the untreated check 20 DAP (Table 2). Both rates of Temik had fewest thrips/plant but were not significantly different than the Avicta CC, Aeris, or Cruiser treatments. This observation was made prior to any foliar application of acephate, it is uncertain why the foliar treatment had fewer thrips/plant than the untreated check. All seed treatments had similar numbers of thrips/plant. There were no significant differences in percent immature thrips between treatments 20 DAP.

Both rates of Temik, Avicta CC, Aeris, foliar acephate, and Cruiser treatments had fewer thrips/plant than the untreated and Gaucho Grande treatments 26 DAP. Only the Temik, Avicta CC, Aeris, foliar acephate, and Cruiser treatments held thrips below action thresholds 26 DAP. The 5 lbs/acre Temik treatment had the lowest percent immature thrips but was not significantly different than the 3.5 lbs/acre Temik, Aeris, and Cruiser treatments. The greatest percentage of immature thrips was observed in the untreated check.

All treatments had similar numbers of thrips/plant and percent immature thrips 32 DAP (Table 3). The greatest number of true leaves/plant 32 DAP were observed in the 5 lbs/acre Temik treatment which was not statistically different than the 3.5 lbs/acre Temik, or Aeris treatments. By 40 DAP only the 3.5 lbs/acre rate of Temik had fewer thrips/plant than the untreated check but was not significantly different than the 5 lbs/acre rate of Temik, foliar acephate or Cruiser treatments. All treatments had similar percentages of immature thrips 40 DAP.

The fewest true leaves/plant were observed in the untreated check which was similar to the Gaucho Grande and foliar acephate treatments (Table 4). Similar plant populations were observed in all treatments; the trial averaged 40,266 plants/acre. The 5 lbs/acre rate of Temik had the greatest leaf area/plant (first 5 true leaves) but was not significantly greater than the 3.5 lbs/acre Temik or Aeris treatments. All seed treatments had similar leaf area/plant. All treatments exhibited greater leaf area/plant compared to the untreated check. The Temik at 3.5 lbs/acre treatment had the greatest plant height on July 5 (62 DAP) but was not significantly greater than the Temik at 5 lbs/acre, Aeris, or foliar acephate treatments. Both rates of Temik, Avicta CC, Aeris, foliar acephate and Cruiser treatments all exhibited greater plant heights compared to the untreated check.

All treatments had more squares/plant than the untreated check on July 5, both rates of Temik and the foliar acephate treatments were grouped together at the upper level (Table 5). The untreated check had more square shed compared to all other treatments. By July 19 all treated treatments exhibited similar plant heights and were significantly greater than the untreated check. The untreated check had the greatest square shed on July 19 but was not significantly greater than the 3.5 lbs/acre Temik, or foliar acephate treatments. The 3.5 lbs/acre Temik treatment had the fewest nodes above white flower (NAWF) on August 10 but was not significantly different than the 5 lbs/acre Temik, foliar acephate, or Cruiser treatments. The COTMAN cotton expert software system calculated a 2 day earlier cutout (NAWF=5) for the Temik and foliar acephate treatments and 1 day earlier cutout for the Cruiser treatment based on NAWF data.

The 3.5 lbs/acre Temik treatment yielded 1,392 lbs of lint/acre which was not significantly different than the 5 lbs/acre Temik, or foliar acephate treatments (Table 6). The Avicta CC, Aeris, and Cruiser seed treatments yielded similarly and were greater than the untreated check. The Gaucho Grande treatment yield was not significantly greater than the untreated check. There were no differences between treatments in percent lint turnout.

There were no significant differences in CCC lint loan values between treatments. The untreated check had a lower micronaire compared to all other treatments (Table 7). The untreated check exhibited the greatest fiber strength but was not significantly greater than the Avicta CC, Aeris, or foliar acephate treatments. There were no other differences between treatments in measured fiber properties.

Parmer 2008

Environmental conditions were warm, dry and very windy from emergence to 21 DAP. Cotton was slow to develop due to environmental stress. Thrips pressure was low and never exceeded recommended action levels (Tables 8 & 9). Since no foliar insecticide application was made that treatment was deleted from the trial. The thrips infestation peaked 26 DAP but averaged less than one thrips/plant. By 33 DAP thrips numbers had declined to 0.33 thrips/plant. Leaf area of the first 5 true leaves and plant height were unaffected by treatments and averaged 83.6 cm^2/plant (Table 10). There were no differences observed in plant height nor square shed between treatments 72 DAP (first bloom), trial averages were 16.6 inches and 12.9% respectively. There were also no differences observed between treatments in lint turnout % or lint yield/acre, trial averages were 20.1% and 741 lbs/acre respectively (Table 11). Fiber property and CCC loan value data were unavailable at the time of the writing of this paper.

Gaines 2008

Environmental conditions were warm, dry and very windy. Thrips pressure was low and never exceeded recommended action levels (Tables 12 & 13). Since no foliar insecticide application was made that treatment was merged into the untreated treatment. All treatments had similar numbers of adult thrips/plant 20 DAP. All insecticide treatments had similar numbers of immature thrips/plant and were less compared to the untreated plots indicating insecticide treatments were suppressing colonization and reproduction. Leaf miners were observed at higher than normal populations and infestation data were collected. All insecticide treatments had a similar percentage of plants infested with leaf miners but only the Temik 3.5, Temik 5.0, and Temik + Aeris were significantly less than the untreated (Table 14). Significant differences in leaf area were observed between treatments but were correlated to leaf miner infestation rather than thrips (Figure 1). There were no differences observed between treatments in plant population, plant height or square shed. There were also no significant differences in lint yield/acre or lint turnout % (Table 15). Fiber property and CCC loan value data were unavailable at the time of the writing of this paper.

Conclusions

Weather conditions and thrips density differences are likely responsible for the different impact that thrips had on yield in 2007 compared to 2008. Even though the cotton in the Parmer 2008 trial was slower to develop compared to the Gaines 2008 trial, the low levels of thrips under warm conditions did not significantly affect the cotton. These trials indicate that under cool wet conditions thrips may pose a greater risk than if conditions are warm. At crop emergence in 2007 all the insecticide treatments evaluated suppressed thrips below action thresholds. The Temik, Avicta CC, Aeris, foliar acephate, and Cruiser treatments held thrips below action thresholds 26 DAP, while Gaucho Grande no longer provided adequate control. Aeris exhibited better thrips activity than Gaucho Grande, which has the same insecticide active ingredient, imidacloprid. This suggests that the added nematicide/insecticide in Aeris, thiodicarb, may have activity towards thrips, or synergizes the activity of imidacloprid.

In 2007, better thrips suppression allowed plants to develop more true leaves at 32 DAP and more leaf surface area on the first 5 true leaves. Plant height was adversely effected by thrips pressure, the greater the thrips/plant and their duration on the plants the more stunted the plants were. Thrips negatively impacted fruit retention and total fruit/plant. Thrips also delayed physiological cutout by as much as two days. The best yields were observed in treatments with better thrips suppression. Slight differences in micronaire and fiber strength were observed between treatments but they did not adversely affect the lint CCC loan value. The lower micronaire in the untreated check is added evidence that thrips delayed maturity.

In 2008, under warmer conditions and sub-threshold thrips pressure, few differences were observed between management tactics including the untreated plots.

Temik is the standard against which all thrips management options are currently measured and continues to be a top performer. When considering thrips suppression alone 3.5 lbs/acre will provide the same protection and residual activity as the 5 lbs/acre rate. Cruiser is a convenient and viable thrips management strategy but may give up a small amount of suppression and residual activity. Avicta CC has the same insecticide as Cruiser but has an added nematicide. Avicta CC provides the same thrips suppression as Cruiser but the higher cost is not justified unless nematode suppression is needed. The new Aeris seed treatment (imidacloprid + thiodicarb) is a promising thrips management option. Limited data indicate that the addition of thiodicarb may provide thrips control on its own or it may enhance the thrips activity of imidacloprid. However, more research is needed to make a recommendation. Gaucho Grande has been successfully utilized to suppress onion thrips and tobacco thrips but has not shown to be effective in suppressing Western flower thrips. Since Western flower thrips is the dominant species in the High Plains of Texas, Gaucho Grande should not be depended upon for adequate thrips suppression. Foliar acephate can provide outstanding thrips suppression, but it is likely the most management intensive of the management strategies evaluated. Other research indicates that foliar application timing is critical and should not be delayed (Kerns et al. 2009). The most important application is made at crop emergence and will likely require one and possibly two sequential applications to achieve acceptable results. Under heavy sustained thrips pressure soil applied insecticides and seed treatments may require a sequential foliar insecticide application to adequately suppress thrips through the 5th true leaf stage.

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Table 1. Average daily high and low temperatures for the first 21 days after emergence.

Location	High ^{o}F	Low ^{o}F
Parmer 2007	82	54
Parmer 2008	94	58
Gaines 2008	96	65

Table 2. Thrips per plant and % immature data from a thrips trial in irrigated cotton, Ryan Williams, Farwell, TX, 2007.

	Thrips/plant 20 DAP	% Immature thrips 20 DAP	Thrips/plant 26 DAP	% Immature thrips 26 DAP
Untreated Check	1.3 a	7.3 a	2.0 a	95.3 a
Temik @ 3.5 lbs/acre	0.1 d	0.0 a	0.2 b	43.8 bc
Temik @ 5.0 lbs/acre	0.1 d	0.0 a	0.1 b	0.0 c
Avicta CP	0.2 cd	0.0 a	0.2 b	75.0 ab
Aeris	0.0 d	0.0 a	0.1 b	25.0 c
Foliar acephate	0.7 b	0.0 a	0.5 b	79.0 ab
Cruiser	0.2 cd	0.0 a	0.3 b	41.8 bc
Gaucho Grande	0.5 bc	0.0 a	1.5 a	80.3 ab
LSD (P=.05)	0.4	NS	0.8	49.6
CV	66.0	565.7	92.8	61.3
Grand Mean	0.4	0.9	0.6	55.0
Treatment Prob(F)	0.0001	0.4586	0.0002	0.0087

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 3. Thrips per plant and % immature data from a thrips trial in irrigated cotton, Ryan Williams, Farwell, TX, 2007.

	Thrips/plant 32 DAP	% Immature thrips 32 DAP	Thrips/plant 40 DAP	% Immature thrips 40 DAP
Untreated Check	1.7 a	32.0 a	2.3 abc	68.8 a
Temik @ 3.5 lbs/acre	1.2 a	12.5 a	1.3 d	38.3 a
Temik @ 5.0 lbs/acre	1.2 a	25.5 a	1.6 bcd	61.8 a
Avicta CP	1.8 a	17.5 a	2.8 a	79.5 a
Aeris	1.2 a	28.0 a	2.3 abc	62.5 a
Foliar acephate	0.8 a	16.8 a	1.5 cd	55.5 a
Cruiser	1.1 a	38.3 a	2.0 a-d	59.8 a
Gaucho Grande	1.5 a	39.5 a	2.5 ab	65.3 a
LSD (P=.05)	NS	NS	0.9	NS
CV	45.8	58.5	30.6	26.3
Grand Mean	1.3	26.3	2.0	61.4
Treatment Prob(F)	0.2967	0.1566	0.0239	0.0849

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 4. Plant structure data from a thrips trial in irrigated cotton, Ryan Williams, Farwell, TX, 2007.

	True Leaves /plant 32 DAP	Plant Population plants/acre	Leaf Area* cm^2/plant	Plant Height inches 62 DAP
Untreated Check	2.1 d	41250 a	26.1 e	7.8 d
Temik @ 3.5 lbs/acre	2.8 ab	39500 a	77.1 a	10.9 a
Temik @ 5.0 lbs/acre	2.9 a	45875 a	75.2 ab	10.1 ab
Avicta CP	2.5 bc	41625 a	62.2 cd	9.1 bc
Aeris	2.8 ab	40125 a	63.5 cd	9.9 abc
Foliar acephate	2.4 cd	39125 a	66.4 bc	10.1 ab
Cruiser	2.5 bc	37500 a	62.1 cd	9.1 bc
Gaucho Grande	2.3 cd	37125 a	55.3 d	8.8 cd
LSD (P=.05)	0.3	NS	10.3	1.2
CV	8.8	9.4	11.5	8.3
Grand Mean	2.5	40266	61.0	9.5
Treatment Prob(F)	0.0003	0.0848	0.0001	0.0005

*Leaf area of the first 5 true leaves in cm^2/plant.

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 5. Fruiting structure, plant height, and NAWF data from a thrips trial in irrigated cotton, Ryan Williams, Farwell, TX, 2007.

	Squares/Plant 5-Jul	Square Shed % 5-Jul	Square Shed % 19-Jul	Plant Height inches July 19	NAWF* 10-Aug
Untreated Check	4.6 d	24 a	24.9 a	12.9 b	4.5 abc
Temik @ 3.5 lbs/acre	6.6 a	18 bc	20.9 abc	17.4 a	3.9 d
Temik @ 5.0 lbs/acre	6.2 abc	13 c	20.2 bc	16.5 a	4.0 d
Avicta CP	5.7 c	18 bc	17.6 c	16.4 a	4.6 ab
Aeris	6.0 bc	19 b	16.4 c	16.5 a	4.5 abc
Foliar acephate	6.4 ab	18 bc	22.9 ab	16.0 a	4.1 cd
Cruiser	5.7 c	16 bc	18.8 bc	16.0 a	4.2 bcd
Gaucho Grande	5.8 bc	17 bc	17.8 c	16.0 a	4.7 a
LSD (P=.05)	0.6	5	4.7	1.4	0.4
CV	6.4	20.0	16.0	6.1	7.0
Grand Mean	5.9	18	19.9	16.0	4.3
Treatment Prob(F)	0.0001	0.0207	0.0169	0.0002	0.006

*Nodes above white flower

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 6. Lint yield, % turnout, and CCC loan value data from a thrips trial in irrigated cotton, Ryan Williams, Farwell, TX, 2007.

	Lint Yield lbs/acre	Lint turnout %	Loan Value* $/lbs
Untreated Check	1041 e	34.9 a	0.5873 a
Temik @ 3.5 lbs/acre	1392 a	35.9 a	0.5740 a
Temik @ 5.0 lbs/acre	1327 ab	35.7 a	0.5699 a
Avicta CP	1250 bc	34.7 a	0.5854 a
Aeris	1181 cd	35.2 a	0.5816 a
Foliar acephate	1294 abc	35.7 a	0.5821 a
Cruiser	1225 bc	36.2 a	0.5771 a
Gaucho Grande	1099 de	35.7 a	0.5788 a
LSD (P=.05)	120	NS	NS
CV	6.6	2.6	1.4
Grand Mean	1226	35.0	0.5800
Treatment Prob(F)	0.0001	0.2848	0.1131

*Commodity Credit Corporation (CCC) loan value

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 7. Fiber property data from a thrips trial in irrigated cotton, Ryan Williams, Farwell, TX, 2007.

	Length inches	Micronaire units	Strength g/tex	Color Rd reflectance	Color +b yellowness
Untreated Check	1.15 a	4.4 b	31.7 a	81.4 a	7.6 a
Temik @ 3.5 lbs/acre	1.12 a	4.8 a	29.6 c	80.9 a	7.4 a
Temik @ 5.0 lbs/acre	1.12 a	4.8 a	29.4 c	80.8 a	7.5 a
Avicta CP	1.14 a	4.7 a	31.3 ab	80.1 a	7.4 a
Aeris	1.13 a	4.7 a	30.6 abc	80.8 a	7.5 a
Foliar acephate	1.13 a	4.7 a	30.5 abc	81.9 a	7.7 a
Cruiser	1.13 a	4.7 a	30.1 bc	81.2 a	7.6 a
Gaucho Grande	1.12 a	4.8 a	30.3 bc	81.8 a	7.7 a
LSD (P=.05)	NS	0.2	NS	NS	NS
CV	2.1	2.2	3.0	1.4	2.6
Grand Mean	1.13	4.7	30.4	81.1	7.6
Treatment Prob(F)	0.4975	0.0013	0.0258	0.4327	0.2967

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 8. Adult and immature thrips per plant data from a thrips trial in irrigated cotton, Kendal Devault, Farwell, TX, 2008.

	Adults/plant 11 DAP	Immatures/plant 11 DAP	Thrips/plant 11 DAP	Adults/plant 18 DAP	Immatures/plant 18 DAP	Thrips/plant 18 DAP
Untreated Check	0.5 a	0.5 a	1.0 a	0.5 a	0.3 a	0.8 a
Temik @ 3.5 lbs/acre	0.3 a	0.0 a	0.3 a	0.5 a	0 a	0.5 a
Temik @ 5.0 lbs/acre	0.0 a	0.0 a	0.0 a	0 a	0 a	0 a
Aeris	0.5 a	0.0 a	0.5 a	0 a	0.3 a	0.3 a
Aeris + Temik	0.0 a	0.0 a	0.0 a	0 a	0 a	0 a
Cruiser	0.5 a	0.0 a	0.5 a	0 a	0.5 a	0.5 a
Avicta CC	0.5 a	0.0 a	0.5 a	0 a	0.3 a	0.3 a
LSD (P=.05)	NS	NS	NS	NS	NS	NS
CV	197.0	529.1	207.2	384.4	254.4	220.0
Grand Mean	0.3	0.07	0.39	0.14	0.18	0.32
Treatment Prob(F)	0.7531	0.4552	0.627	0.5897	0.6589	0.7127

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 9. Adult and immature thrips per plant data from a thrips trial in irrigated cotton, Kendal Devault, Farwell, TX, 2008.

	Adults/plant 25 DAP	Immatures/plant 25 DAP	Thrips/plant 25 DAP	Adults/plant 32 DAP	Immatures/plant 32 DAP	Thrips/plant 32 DAP
Untreated Check	0.7 b	0.13 a	0.83 a	0.13 a	0.05 a	0.18 c
Temik @ 3.5 lbs/acre	0.33 c	0.13 a	0.46 a	0.3 a	0.33 a	0.63 a
Temik @ 5.0 lbs/acre	0.68 b	0.13 a	0.81 a	0.25 a	0 a	0.25 bc
Aeris	0.7 b	0.15 a	0.85 a	0.1 a	0.23 a	0.33 bc
Aeris + Temik	0.65 bc	0.2 a	0.85 a	0.2 a	0 a	0.2 c
Cruiser	0.4 bc	0.2 a	0.6 a	0.1 a	0.15 a	0.25 bc
Avicta CC	1.05 a	0.15 a	1.2 a	0.2 a	0.25 a	0.45 ab
LSD (P=.05)	0.3	NS	NS	NS	NS	0.2
CV	42.9	63.2	40.5	73.5	125.3	60.6
Grand Mean	0.6	1.5	0.8	0.18	0.14	0.33
Treatment Prob(F)	0.036	0.8152	0.103	0.2919	0.104	0.0496

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 10. Plant structure data from a thrips trial in irrigated cotton, Kendall Devault, Farwell, TX, 2008.

	True Leaves* /plant 32 DAP	Plant Population plants/acre	Leaf Area** cm^2 /plant	Plant Height inches 71 DAP
Untreated Check	4	43863 bc	91.8 a	16.0 a
Temik @ 3.5 lbs/acre	4	45313 ab	87.8 a	17.0 a
Temik @ 5.0 lbs/acre	4	38788 cd	79.3 a	16.8 a
Aeris	4	34075 d	74.3 a	16.1 a
Aeris + Temik	4	50025 a	90.5 a	16.8 a
Cruiser	4	48213 ab	81.8 a	17.4 a
Avicta CC	4	36250 d	80.0 a	16.3 a
LSD (P=.05)	---	5741	NS	NS
CV	---	11.1	13.7	5.6
Grand Mean	---	42361	83.6	16.6
Treatment Prob(F)	---	0.0007	0.3125	0.3621

*estimated

**Leaf area of the first 5 true leaves in cm^2/plant.

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 11. Square shed, lint yield, and % turnout data from a thrips trial in irrigated cotton, Kendall Devault, Farwell, TX, 2008.

	Square shed % 71 DAP	Lint turnout %	Lint Yield lbs/acre
Untreated Check	13.1 a	20.8 a	798 a
Temik @ 3.5 lbs/acre	11.8 a	17.0 a	647 a
Temik @ 5.0 lbs/acre	15.2 a	18.8 a	702 a
Avicta CP	12.7 a	22.5 a	907 a
Aeris	12.7 a	21.3 a	648 a
Foliar acephate	13.8 a	19.3 a	775 a
Cruiser	10.9 a	21.3 a	716 a
Gaucho Grande			
LSD (P=.05)	NS	NS	NS
CV	22.9	15.5	23.3
Grand Mean	12.9	20.1	741
Treatment Prob(F)	0.5338	0.2518	0.3728

*Commodity Credit Corporation (CCC) loan value

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 12. Thrips per plant data from a thrips trial in irrigated cotton, Chuck Roland, Seminole, TX, 2008.

	Adults/plant 10 DAP	Immatures/plant 10 DAP	Thrips/plant 10 DAP	Adults/plant 15 DAP	Immatures/plant 15 DAP	Thrips/plant 15 DAP
Untreated Check	0.10 a	0.00 a	0.10 a	0.15 a	0.13 a	0.28 a
Temik @ 3.5 lbs/acre	0.00 a	0.00 a	0.00 a	0.05 a	0.00 a	0.05 a
Temik @ 5.0 lbs/acre	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a
Aeris	0.00 a	0.00 a	0.00 a	0.08 a	0.00 a	0.08 a
Aeris + Temik	0.03 a	0.00 a	0.03 a	0.15 a	0.03 a	0.18 a
Cruiser	0.00 a	0.00 a	0.00 a	0.05 a	0.03 a	0.08 a
Avicta CC	0.00 a	0.00 a	0.00 a	0.08 a	0.00 a	0.08 a
LSD (P=.05)	NS	NS	NS	NS	NS	NS
CV	342.63	NA	342.63	127.78	315.05	129.36
Grand Mean	0.02	0.00	0.02	0.08	0.03	0.10
Treatment Prob(F)	0.169	NA	0.169	0.316	0.230	0.095

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 13. Thrips per plant data from a thrips trial in irrigated cotton, Chuck Roland, Seminole, TX, 2008.

	Adults/plant 20 DAP	Immatures/plant 20 DAP	Thrips/plant 20 DAP	Adults/plant 27 DAP	Immatures/plant 27 DAP	Thrips/plant 27 DAP
Untreated Check	0.54 a	0.40 a	0.94 a	0.05 a	0.01 a	0.06 a
Temik @ 3.5 lbs/acre	0.28 a	0.03 b	0.30 b	0.2 a	0.00 a	0.20 a
Temik @ 5.0 lbs/acre	0.53 a	0.00 b	0.53 ab	0.125 a	0.00 a	0.13 a
Aeris	0.38 a	0.00 b	0.38 a	0.1 a	0.00 a	0.10 a
Aeris + Temik	0.20 a	0.08 b	0.28 a	0.125 a	0.05 a	0.18 a
Cruiser	0.30 a	0.03 b	0.33 a	0.075 a	0.00 a	0.08 a
Avicta CC	0.20 a	0.08 b	0.28 a	0.2 a	0.00 a	0.20 a
LSD (P=.05)	NS	0.1303	0.416	NS	NS	NS
CV	76.19	182.31	79.83	115.98	432.53	117.64
Grand Mean	0.34	0.09	0.43	0.13	0.01	0.13
Treatment Prob(F)	0.199	<0.0001	0.035	0.746	0.455	0.808

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 14. Plant structure and leaf miner data from a thrips trial in irrigated cotton, Chuck Roland, Seminole, TX, 2008.

	True Leaves* /plant 27 DAP	Leaf Mines % plants 27 DAP	Plant Population plants/acre 23 DAP	Leaf Area** cm^2 /plant 27 DAP	Plant Height inches 27 DAP
Untreated Check	5	0.11 a	36620 a	60.03 c	6.01 a
Temik @ 3.5 lbs/acre	5	0.03 b	35122 a	75.28 ab	6.60 a
Temik @ 5.0 lbs/acre	5	0.00 b	37301 a	79.35 a	6.56 a
Aeris	5	0.13 a	33761 a	67.23 bc	6.24 a
Aeris + Temik	5	0.00 b	36756 a	78.07 a	6.46 a
Cruiser	5	0.05 ab	36212 a	82.34 a	6.83 a
Avicta CC	5	0.05 ab	38662 a	78.68 a	6.86 a
LSD (P=.05)	---	0.08	NS	10.80	NS
CV	---	130.02	12.32	15.43	8.74
Grand Mean	---	0.05	36347.63	74.43	6.51
Treatment Prob(F)	---	0.018	0.869	0.005	0.135

*estimated

**Leaf area of the first 5 true leaves in cm^2/plant.

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 15. Plant population, lint yield, and % turnout data from a thrips trial in irrigated cotton, Chuck Roland, Seminole, TX, 2008.

	Square shed % 37 DAP	Lint turnout %	Lint Yield lbs/acre
Untreated Check	2.9 a	28.4 a	1038 a
Temik @ 3.5 lbs/acre	5.3 a	26.3 a	1106 a
Temik @ 5.0 lbs/acre	2.6 a	30.5 a	1237 a
Aeris	0.0 a	28.0 a	975 a
Aeris + Temik	3.5 a	28.0 a	1057 a
Cruiser	2.0 a	28.5 a	1012 a
Avicta CC	1.6 a	26.3 a	932 a
LSD (P=.05)	NS	NS	NS
CV	144.52	10.18	17.54
Grand Mean	2.6	28.0	1051
Treatment Prob(F)	0.672	0.326	0.231

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

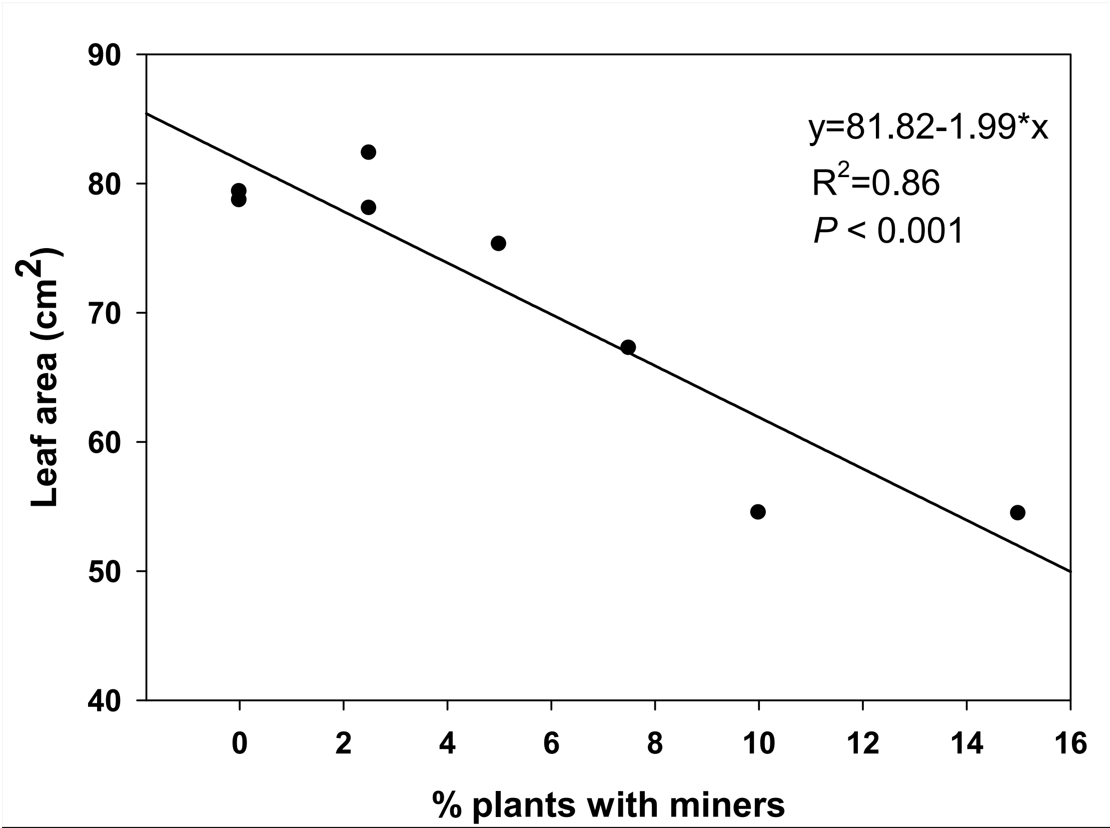

Figure 1. Correlation of % plants infested with leaf miners and leaf area/plant from a thrips trial in irrigated cotton, Chuck Roland Farm, Seminole, TX 2008.