EVALUATION OF REGENT® (FIPRONIL) FOR THE CONTROL OF COTTON FLEAHOPPERS

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Abstract

The cotton fleahopper is an early-season pest that damages pinhead size and smaller squares and may directly affect yield. Chemical selection for early-season pests such as fleahoppers is becoming limited as we try to and limit the early use of the better aphicide materials for the management of resistant/tolerant cotton aphids. Regent® (Fipronil) was evaluated for the control of cotton fleahoppers and compared to a grower standard and untreated check over three years. Fleahopper numbers (adults plus nymphs), did not differ significantly due to treatment in the 3-5 DAT evaluations in any year, although there were numerically more in the untreated check**.** Regent® provided effective control of fleahoppers without causing any delay in the buildup of beneficial population or secondary pest problems.

Introduction

The cotton fleahopper, *Pseudatomoscelis seriatus* [Revter], is a primary pest to cotton in Texas (Table 1). They are early-season pests that damage pinhead size and smaller squares and may directly affect yield. Adults move into cotton from wild weed hosts when cotton begins to square. Both adults and nymphs suck sap from the tender portion of the plant, including small squares. As plants increase in size and fruit load, larger fleahopper populations can be tolerated without yield reduction. In most years treatment is rarely justified after first bloom.

The decision to apply insecticide is based on the number of fleahoppers present and the percent square set. During the first 3 weeks of squaring, the economic threshold as established by the Texas Agricultural Extension Service for the High Plains is 25 to 30 fleahoppers per 100 terminals combined with less than 75 percent square set. Chemical selection for early-season pests such as fleahoppers is becoming limited as we try to limit the early use of the better aphicide materials for the management of resistant/tolerant cotton aphids.

The objective of this three year study was to evaluate Regent® (Fipronil), Rhone-Poulenc's entry into the new family of insecticides called phenyl pyrazoles, for the control of cotton fleahoppers compared to a grower standard and untreated check.

Materials and Methods

1995

This experiment consisted of five treatments with four replications arranged in a randomized complete block design. Treatments were Regent® 80WG at 0.05 a.i./A, Regent® 2.5 EC at 0.05 and 0.038 a.i./A, Cygon® 4E at 0.1875 a.i./A (6 oz./A) and an untreated check. Treatments were applied July 18, 1995 with a CO_2 backpack sprayer using 3 TX-6 nozzles per row, 40 psi and 9.5 GPA. Plots were eight rows of solid planted center pivot irrigated cotton 30 ft. long with a 10 ft. buffer between blocks. The cotton variety was All-Tex Atlas and planted May 13. Plots were sampled one day prior to treatment and 3, 10 and 20 days after treatment (DAT).

1996

Five treatments with four replications were arranged in a randomized complete block design. Treatments consisted of Regent® 80WG at 0.05 a.i./A, Regent® 2.5 EC at 0.05 and 0.038 a.i./A, Dimethoate 4E at 0.1875 a.i./A (6 oz./A) and an untreated check. Treatments were applied July 3, 1996 with a High-Trac sprayer, 3 TX-6 Hollow-cone nozzles per row at 42 psi and 13 GPA. Plots were eight rows of solid planted center pivot irrigated cotton 75 ft. long. The cotton variety Tejas was planted on 40 in. centers May 14. Plants were sampled one day prior to treatment and 5 and 12 DAT.

1997

Six treatments with four replications were arranged in a randomized complete block design. Two of the treatments were experimental insecticides and not reported in this report. Treatments consisted of Regent® 2.5 EC at 0.025 and 0.038 a.i./A, Vydate® 3.76 C-LV at .25 a.i./A (8.5 oz./A) and an untreated check. Treatments were applied July 24, 1997 with a Hydra-Trac sprayer using 3 TX-6 nozzles per row at 40 psi and 14.9 GPA. Plots were 6 cotton rows of 2 x 1 planted furrow irrigated cotton 100 ft. long. The cotton variety HS-26 was planted on 40 in. centers on May 30. Plants were sampled one day prior to treatment and 5 and 12 DAT.

All evaluations were conducted in a standardized sampling area consisting of the middle two rows in each plot. Whole plant inspections from 10 plants per plot per sample date were used for sampling the number of cotton fleahoppers (adults and nymphs), beneficial arthropods (spiders, adult and immature lady beetles, adult and immature minute pirate bugs, adult and immature big-eyed bugs and lacewing larvae), bollworms, bollworm eggs and aphids.

Yields were estimated by hand harvesting 13 feet of row in each plot. Cotton was ginned at the Texas Agricultural Experimental Station in Lubbock, Texas.

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Results and Discussion

Fleahopper numbers (adults plus nymphs), did not differ significantly due to treatment in the 3-5 DAT evaluations in any year, although there were numerically more in the untreated check (Tables 2, 3 & 4). At the 10-12 DAT observations in 1995 & 1996, the Regent® treatments had significantly fewer fleahoppers than did both the grower standard and the untreated check, while the grower standard had significantly fewer than did the check. In 1997, all insecticides treatments had fewer fleahoppers than the check but they did not differ from each other.

Fleahopper nymphs comprised 45%, 95% and 82% of the total number of fleahoppers counted in 1995, 1996 and 1997 respectively. Therefore, the differences for fleahopper nymphs counts followed those of the total fleahopper counts except for the 10 DAT observations in 1995 in which there were no differences (Tables 5, 6 & 7) There were no statistical differences at any time when evaluating adult fleahoppers. (Tables 8, 9 & 10). Percent control was calculated using Henderson's formula (Tables 11, 12 and 13).

Beneficial arthropod populations on the High Plains are typically low at the time fleahopper control treatments are being applied and this may explain why there were no significant differences at any time during this study (Tables 14, 15 & 16).

Bollworm eggs (Tables 17 & 18) and larvae (Tables 19 &20) were also counted but there were no statistical differences except at 12 DAT in 1996 where two of the Regent® treatments had significantly more worms than did the grower standard and untreated check. Bollworm activity was non-existent in 1995 in test plots during time at observation. Aphids were extremely low during all observations and therefore they were not reported.

In all three years, the producer treated the remainder of the field for fleahoppers by ground-rig either the day-of or the day-after the test plots were treated. In each case, the producer used the same chemical as the grower standard from the test.

Several observations would appear to show differences; i.e. 1996, DAT for number fleahopper nymphs and total fleahoppers, except the variation between plots was so great. The data reported for 1997 is from a test in which two experimental numbered compounds were included.

The yield differed by 147, 76 and 86 pounds per acre between the highest and lowest yielding treatments in 1995, 1996 and 1997 respectively. However, there were no significant differences between treatments in any year (Table 21). This may be explained by the variation due to such a small harvest area (1/1,000 A). When comparing the untreated check, the grower standard and the Regent® 2.5 EC @ .038 a.i./A treatment, a constant through all three years, there is a range of 145, 73 and 40 pounds per acre in 1995, 1996 and 1997 respectively. However, when averaged across all 3 years the Regent® treatment and the untreated check were the same (747 lbs./A) and 26 lbs./A less than the grower standard (773 lbs./A). There may be some differences with whole field treatments that are not realized in small plot work.

Conclusions

Regent® provided effective control of fleahoppers without causing any delay in the buildup of beneficial population or secondary pest problems. If Regent® provides effective control or suppression of other key insect pests such as overwintered boll weevils, worms, etc., this product would be an important tool for early season cotton insect management on the High Plains.

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Table 1. Importance of Cotton Fleahoppers across the Cotton Belt, Texas (TX) and the Texas High Plains (THP).[1/]

Region	Infested Acres	Treated Acres	Bales Lost	Rank of Importance[2/]
Belt	3.67 million	1.25 million	15,627	9.3
TX	2.61 million (71%)	930,000 (75%)	13,288 (85%)	5.0
THP	530,000 (20%)	80,000 (9%)	277 (2%)	4.7

1/ Average compiled from the insect damage reports in the National Cotton Council Beltwide Cotton Conferences Proceedings (1991-1996).

2/ Rank from the 20-21 insects accounted for in the National Cotton Council Beltwide Cotton Conferences Proceedings (1991-1996).

Table 2. Mean number of fleahoppers (adults plus nymphs). Lynn County, Texas 1995.

	Mean number of Fleahoppers / 100 Plants			
Treatment Rate (a.i.)/A[1/]	Pre	3 DAT	10 DAT	20 DAT
Regent 80WG @ 0.05	100 a[3/]	52.5 a	0 a	5 a
Regent 2.5EC @ 0.05	70 a	82.5 a	2.5 a	0 a
Regent 2.5EC @ 0.038	120 a	27.5 a	2.5 a	2.5 a
Cygon 4E @ 0.19[2/] (6 oz.)	100 a	42.5 a	27.5 b	7.5 a
Check	97.5 a	120 a	55 c	12.5 a

1/ Treated July 18, 1995.

2/ Grower standard.

3/ Means in the same column followed by the same letter are not significantly different at P=0.05 level (Analysis of Variance, Duncan's (1955) Multiple Range Test).

Table 3. Mean number of fleahoppers (adults plus nymphs). Dawson County, Texas 1996.

Mean Number of Fleahoppers / 100 Plants			
Treatment Rate (a.i.)/A[1/]	Pre	5 DAT	12 DAT
Regent 80WG @ 0.05	162.5 a [3/]	2.5 a	0 c
Regent 2.5EC @ 0.05	102.5 a	2.5 a	5.0 c
Regent 2.5EC @ 0.038	105.0 a	7.5 a	2.5 c
Dimethoate 4E @ 0.19[2/] (6 oz.)	97.5 a	2.5 a	30.0 b
Check	137.5 a	35 a	42.5 a

1/ Treated July 3, 1996.
2/ Grower standard.
3/ Means in the same column followed by the same letter are not significantly different at P=0.05 level (Analysis of Variance, Duncan's (1955) Multiple Range Test).

Table 4. Mean number of fleahoppers (adults plus nymphs). Lynn County, Texas 1997.

Mean Number of Fleahoppers / 100 Plants			
Treatment Rate (a.i.) / A[1/]	Pre	5 DAT	12 DAT
Regent 2.5EC @ 0 .025	37.5 a[3/]	0 a	2.5 a
Regent 2.5EC @ 0 .038	52.5 a	7.5 a	2.5 a
Vydate 3.76C-LV @ 0.25[2/] (8.5 oz.)	60 a	2.5 a	2.5 a
Check	30 a	22.5 a	25 b

1/ Treated July 24, 1997.
2/ Grower standard.
3/ Means in the same column followed by the same letter are not significantly different at P=0.05 level (Analysis of Variance, Duncan's (1955) Multiple Range Test).

Table 5. Mean number of fleahopper nymphs. Lynn County, Texas 1995.

Mean number of Fleahopper Nymphs / 100 Plants				
Treatment Rate (a.i.) / A[1/]	Pre	3 DAT	10 DAT	20 DAT
Regent 80WG @ 0.05	62.5 a[3/]	0 a	0 a	2.5 a
Regent 2.5EC @ 0.05	50 a	0 a	2.5 a	0 a
Regent 2.5EC @ 0.038	77.5 a	2.5 a	2.5 a	2.5 a
Cygon 4E @ 0.19[2/] (6 oz.)	67.5 a	0 a	17.5 a	2.5 a
Check	67.5 a	10 a	40 a	5 a

1/ Treated July 18, 1995.
2/ Grower standard.
3/ Means in the same column followed by the same letter are not significantly different at P=0.05 level (Analysis of Variance, Duncan's (1955) Multiple Range Test).

Table 6. Mean number of fleahopper nymphs. Dawson County, Texas 1996.

Mean Number of Fleahoppers Nymphs / 100 Plants			
Treatment Rate (a.i.) / A[1/]	Pre	5 DAT	12 DAT
Regent 80WG @ 0.05	157.5 a[3/]	2.5 a	0 c
Regent 2.5EC @ 0.05	100 a	0 a	2.5 c
Regent 2.5EC @ 0.038	97.5 a	7.5 a	0 c
Dimethoate 4E @ 0.19[2/] (6 oz.)	90 a	2.5 a	27.5 b
Check	132.5 a	35 a	42.5 a

1/ Treated July 3, 1996.
2/ Grower standard.
3/ Means in the same column followed by the same letter are not significantly different at P=0.05 level (Analysis of Variance, Duncan's (1955) Multiple Range Test).

Table 7. Mean number of fleahopper nymphs. Lynn County, Texas 1997.

Mean Number of Fleahopper Nymphs / 100 Plants			
Treatment Rate (a.i.) / A[1/]	Pre	5 DAT	12 DAT
Regent 2.5EC @ 0.025	35 a[3/]	0 a	2.5 a
Regent 2.5EC @ 0.038	42.5 a	5 a	0 a
Vydate 3.76C-LV @ 0.25[2/] (8.5 oz.)	52.5 a	2.5 a	0 a
Check	25 a	17.5 a	17.5 b

1/ Treated July 24, 1997.
2/ Grower standard.
3/ Means in the same column followed by the same letter are not significantly different at P=0.05 level (Analysis of Variance, Duncan's (1955) Multiple Range Test).

Table 8. Mean number of fleahopper adults. Lynn County, Texas 1995.

Mean number of Fleahoppers Adults / 100 Plants				
Treatment Rate (a.i.) / A[1/]	Pre	3 DAT	10 DAT	20 DAT
Regent 80WG @ 0.05	37.5 a[3/]	52.5 a	0 a	2.5 a
Regent 2.5EC @ 0.05	20 a	82.5 a	0 a	0 a
Regent 2.5EC @ 0.038	42.5 a	25 a	0 a	0 a
Cygon 4E @ 0.19[2/] (6 oz.)	32.5 a	42.5 a	10 a	5 a
Check	30 a	110 a	15 a	7.5 a

1/ Treated July 18, 1995.
2/ Grower standard.
3/ Means in the same column followed by the same letter are not significantly different at P=0.05 level (Analysis of Variance, Duncan's (1955) Multiple Range Test).

Table 9.Mean number of fleahopper adults. Dawson County, Texas 1996.

Mean Number of Fleahoppers Adults / 100 Plants			
Treatment Rate (a.i.) / A[1/]	Pre	5 DAT	12 DAT
Regent 80WG @ 0.05	5 a[3/]	0 a	0 a
Regent 2.5EC @ 0.05	2.5 a	2.5 a	2.5 a
Regent 2.5EC @ 0.038	7.5 a	0 a	2.5 a
Dimethoate 4E @ 0.19[2/] (6 oz.)	7.5 a	0 a	2.5 a
Check	5 a	2.5 a	0 a

1/ Treated July 3, 1996.
2/ Grower standard.
3/ Means in the same column followed by the same letter are not significantly different at P=0.05 level (Analysis of Variance, Duncan's (1955) Multiple Range Test).

Table 10.Mean number of fleahopper adults. Lynn County, Texas 1997.

Mean Number of Fleahopper Adults / 100 Plants			
Treatment Rate (a.i.) / A[1/]	Pre	5 DAT	12 DAT
Regent 2.5EC @ 0.025	2.5 a[3/]	0 a	0 a
Regent 2.5EC @ 0.038	10 a	2.5 a	2.5 a
Vydate 3.76C-LV @ 0.25[2/] (8.5 oz.)	7.5 a	0 a	2.5 a
Check	5 a	5 a	7.5 a

1/ Treated July 24, 1997.
2/ Grower standard.
3/ Means in the same column followed by the same letter are not significantly different at P=0.05 level (Analysis of Variance, Duncan's (1955) Multiple Range Test).

Table 11. Percent control of fleahoppers by treatment. Lynn County, Texas 1995.

Treatment Rate (a.i.) / A[1/]	% Control[2/]		
	3 DAT	10 DAT	20 DAT
Regent 80WG @ 0.05	65	100	68
Regent 2.5EC @ 0.05	21.4	94.8	100
Regent 2.5EC @ 0.038	84.7	97.0	86.7
Cygon 4E @ 0.19[3/] (6 oz.)	71.7	60.0	52
Check	----	----	----

1/ Treated July 18, 1995.
2/ Percent control as adjusted using Henderson's formula.
3/ Grower standard.

Table 12. Percent control of fleahoppers by treatment. Dawson County, Texas 1996.

Treatment Rate (a.i.) / A[1/]	% Control[2/]	
	5 DAT	12 DAT
Regent 80WG @ 0.05	93.5	100
Regent 2.5EC @ 0.05	90.2	85.0
Regent 2.5EC @ 0.038	69.8	92.3
Dimethoate 4E @ 0.19[3/] (6 oz.)	89.2	0.4
Check	----	----

1/ Treated July 3, 1996.
2/ Percent control as adjusted using Henderson's formula.
3/ Grower standard.

Table 13. Percent control of fleahoppers by treatment. Lynn County, Texas 1997.

Treatment Rate (a.i.) / A[1/]	% Control[2/]	
	5 DAT	12 DAT
Regent 2.5EC @ 0.025	100	92
Regent 2.5EC @ 0.038	80.9	94.3
Vydate 3.76C-LV @ 0.25[2/] (8.5 oz.)	94.5	95
Check	----	----

1/ Treated July 24, 1997.
2/ Percent control as adjusted using Henderson's formula.
3/ Grower standard.

Table 14. Mean number of beneficial arthropods. Lynn County, Texas 1995.

Mean number of Beneficial Arthropods / 100 Plants				
Treatment Rate (a.i.) / A[1/]	Pre	3 DAT	10 DAT	20 DAT
Regent 80WG @ 0.05	4.7 a[3/]	0.7 a	1.5 a	2.5 a
Regent 2.5EC @ 0.05	4 a	0.2 a	0.7 a	2.5 a
Regent 2.5EC @ 0.038	1.2 a	0.2 a	0.7 a	1.5 a
Cygon 4E @ 0.19[2/] (6 oz.)	2.7 a	1.5 a	2 a	0.7 a
Check	3 a	0.5 a	1.5 a	2.5 a

1/ Treated July 18, 1995.
2/ Grower standard.
3/ Means in the same column followed by the same letter are not significantly different at P=0.05 level (Analysis of Variance, Duncan's (1955) Multiple Range Test).

Table 15. Mean number of beneficial arthropods. Dawson County, Texas 1996.

Mean Number of Beneficial Arthropods / 10 Plants		
Treatment Rate (a.i.) / A[1/]	5 DAT	12 DAT
Regent 80WG @ 0.05	1.5 a[3/]	1 a
Regent 2.5EC @ 0.05	0.7 a	1.2 a
Regent 2.5EC @ 0.038	1.5 a	1.7 a
Dimethoate 4E @ 0.19 (6 oz.)[2/]	2 a	1 a
Check	3 a	2 a

1/ Treated July 3, 1996.
2/ Grower standard.
3/ Means in the same column followed by the same letter are not significantly different at P=0.05 level (Analysis of Variance, Duncan's (1955) Multiple Range Test).

Table 16. Mean number of beneficial arthropods. Lynn County, Texas 1997.

Mean Number of Beneficial Arthropods / 10 Plants		
Treatment Rate (a.i.) / A[1/]	5 DAT	12 DAT
Regent 2.5EC @ 0.025	1.2 a[3/]	2 a
Regent 2.5EC @ 0.038	0.5 a	1.5 a
Vydate 3.76C-LV @ 0.25 (8.5 oz.)[2/]	0.7 a	2.7 a
Check	1.7 a	5.2 a

1/ Treated July 24, 1997.
2/ Grower standard.
3/ Means in the same column followed by the same letter are not significantly different at P=0.05 level (Analysis of Variance, Duncan's (1955) Multiple Range Test).

Table 17. Mean number of bollworm eggs. Dawson County, Texas 1996.

Mean Number of Bollworm Eggs / 10 Plants		
Treatment Rate (a.i.) / A[1/]	5 DAT	12 DAT
Regent 80WG @ 0.05	1.2 a[3/]	3.5 a
Regent 2.5EC @ 0.05	3.2 a	1 a
Regent 2.5EC @ 0.038	1.5 a	4.7 a
Dimethoate 4E @ 0.19 (6 oz.)[2/]	1.7 a	2.2 a
Check	1.7 a	5 a

1/ Treated July 3, 1996.
2/ Grower standard.
3/ Means in the same column followed by the same letter are not significantly different at P=0.05 level (Analysis of Variance, Duncan's (1955) Multiple Range Test).

Table 18. Mean number of bollworm eggs. Lynn County, Texas 1997.

Mean Number of Bollworm Eggs / 10 Plants		
Treatment Rate (a.i.) / A[1/]	5 DAT	12 DAT
Regent 2.5EC @ 0.025	1 a[3/]	1 a
Regent 2.5EC @ 0.038	0 a	1.2 a
Vydate 3.76C-LV @ 0.25 (8.5 oz.)[2/]	0.2 a	4.7 a
Check	0 a	1 a

1/ Treated July 24, 1997.
2/ Grower standard.
3/ Means in the same column followed by the same letter are not significantly different at P=0.05 level (Analysis of Variance, Duncan's (1955) Multiple Range Test).

Table 19. Mean number of bollworms larvae. Dawson County, Texas 1996.

Mean Number of Bollworm Larvae / 10 Plants			
Treatment Rate (a.i.) / A[1/]	Pre	5 DAT	12 DAT
Regent 80WG @ 0.05	0 a[3/]	1 a	4 a
Regent 2.5EC @ 0.05	0 a	1.7 a	6.2 b
Regent 2.5EC @ 0.038	0.2 a	6.5 a	1.7 c
Dimethoate 4E @ 0.19 (6 oz.)[2/]	1 a	2 a	1.5 c
Check	0 a	0.5 a	1 c

1/ Treated July 3, 1996.
2/ Grower standard.
3/ Means in the same column followed by the same letter are not significantly different at P=0.05 level (Analysis of Variance, Duncan's (1955) Multiple Range Test).

Table 20.Mean number of bollworms larvae. Lynn County, Texas 1997.

Mean Number of Bollworm Larvae / 10 Plants		
Treatment Rate (a.i.) / A[1/]	5 DAT	12 DAT
Regent 2.5EC @ 0.025	0 a[3/]	2.5 a
Regent 2.5EC @ 0.038	0 a	2 a
Vydate 3.76C-LV @ 0.25 (8.5 oz.)[2/]	0 a	2.7 a
Check	0.2 a	0 a

1/ Treated July 24, 1997.
2/ Grower standard.
3/ Means in the same column followed by the same letter are not significantly different at P=0.05 level (Analysis of Variance, Duncan's (1955) Multiple Range Test).

Table 21. Lint production as effected by foliar Regent® for fleahopper control. Lynn and Dawson Counties, Texas 1995-1997.

	Yield (lbs. / A)			
	Treatment Rate (a.i.) / A	1995	1996	1997	Avg
	Regent 80WG @ 0.05	613 a[1/]	765 a		(689)
	Regent 2.5EC @ 0.05	662 a	754 a		(708)
	Regent 2.5EC @ 0.025			791 a	
	Regent 2.5EC @ 0.038	715 a	689 a	837 a	747
Grower Standard	Cygon 4E @ 0.19 (6 oz.)	747 a			
Grower Standard	Dimethoate 4E @ 0.19 (6 oz.)		718 a		773
Grower Standard	Vydate 3.76C-LV @ 0.25 (8.5 oz.)			854 a	
	Check	602 a	762 a	877 a	747

1/ Means in the same column followed by the same letter are not significantly different at P=0.05 level (Analysis of Variance, Duncan's (1955) Multiple Range Test).