

**COTTON PEST AND BENEFICIAL INSECT  
MANAGEMENT STRATEGIES WITH  
STEWARD™, INSECT CONTROL  
PRODUCT IN THE SOUTHEASTERN U.S.**

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**Introduction**

Cotton insect management in the Southeastern U.S. is unique due to the impact of boll weevil eradication and a high percentage of cotton acreage in B.t. transgenic varieties. The tobacco budworm, bollworm, tarnished plant bug, and fall armyworm are considered the most important primary economic pests. Beet armyworm, soybean/cabbage loopers, and brown, green and southern green stinkbugs are the most important secondary economic pests. Conserving beneficial populations is a key component in southeast cotton pest management systems.

Steward™ has been tested for potential fit in both conventional and B.t. transgenic insect management systems. The data in the following tables are summaries from trials conducted from 1996-1998 in the Southeast by DuPont development, private consultants and university investigators.

**Results and Discussion**

Full season control of Heliothines and the impact on cotton yields is presented in Table 1. Percent damage and live worms are the average of square and boll evaluations taken from full season trials. The majority of trials included in the summaries are from conventional cotton and ratings are for mixed populations of tobacco budworm and cotton bollworm. Steward® performance and resulting yields at the use rates of .09 - .11 lbs. a.i. / acre are similar to the standards Karate® .028 lbs. a.i. and Tracer® at .063 lbs. a.i.

Table 2 summarizes four years data on loopers (soybean / cabbage), fall armyworm and beet armyworm. Steward™ at .065 lbs. a.i. / acre provides looper control and beet armyworm control similar to the standard Pirate® at .2 - .25 lbs. active. Four trials with Steward™ at .11 lbs active per acre indicates a higher degree of activity on fall armyworm than the Pirate®, Tracer®, or Larvin® standards.

Comparative activity of Steward™ at use rates of .065, .09, and .11 lbs. a.i. / acre on tarnished plant bug and cotton fleahopper is provided in Table 3. Data indicates a flat rate response from .09 and .11 lbs. a.i. regarding percent tarnished plant bug control and square retention. Data summarized over three years show Steward™ as providing plant bug control at 5 – 7 days post treatment similar to the standards Orthene® and Vydate® C-LV. Results on cotton fleahopper verify good activity at rates as low as .065 lbs. a.i. and complete control of cotton fleahopper at .11 lbs. a.i. Additional trials are intended for evaluation of cotton fleahopper to provide additional rate definition, application timing, and residual activity.

**Parasite / Predator Selectivity**

Steward™ has been extensively screened for its impact on beneficial insects. Data provided in Table 4 summarize percent beneficial survival at 5–7 days post treatment across sixteen tests. Steward™ at all rates tested, provides a high degree of selectivity on geocorids, *Orius* spp. , nabids and lacewings. The degree of selectivity on the four key predators is numerically equal to the Tracer® standard and less impactive than Pirate® on all species tested.

In addition to predators, Steward™ has been evaluated for impact on key parasitic wasps exposed to dry foliar residues. In these trials at one day post treatment, Steward™ at its highest use rate (.11 lbs. a.i. / acre) had no effect on survival of adult *Apanteles congestus*, *Bracon mellitor*, and *Micropletus crocipes*. In a lab trial conducted at Tifton Georgia, by Dr's J. Ruberson and P. Glynn Tillman, Steward® at .11 lbs. a.i. resulted in survival of *Cotesia marginiventris* and *Trichogramma pretiosum* similar to the untreated check when adult parasites were exposed to cotton leaf residues at one-hour post application.

**Conclusions**

Data in Tables 1-4 summarized from Southeastern U.S. trials demonstrates that Steward™ controls all major worm pests plus plant bug while protecting beneficials. Steward™ can be used alone, tank mixed or in alternation with other chemistry classes such as pyrethroids, spinosad or IGR's. Steward's™ strength is its activity on Heliothines, beet armyworm, fall armyworm, plant bugs and selectivity of parasites and predators. Field tests show excellent knockdown plus 10-14 day residual looper control.

**Application timing**

**Pinhead square – bloom**

Steward™ will help manage plant bug, armyworms or fleahopper populations while conserving beneficials in B.t. systems.

\* Steward™ will help manage tobacco budworm, bollworm, fleahopper, armyworms and the plant bug complex in conventional cotton while conserving beneficials.

Mid-season - early boll set

\* Steward™ will help manage tobacco budworm, bollworm, plant bugs, fleahoppers, armyworms, soybean / cabbage loopers in both conventional and B.t. production systems and maintain beneficials

Steward™ will be tested in 1999 under an experimental use permit. The Objective in these studies will be to confirm rates and range of pest activity, timing, and effectiveness of Steward® using commercial cotton scouting and application equipment.

Table 1. "Steward" vs Standards: Full Season Budworm Bollworm Control Summary. 1993-1998 Field Tests.

Treatment	Rate lbs. ai/ac	% Damaged Squares / Boll	% Live Worms Squares / Boll	Yield lbs./acre
Steward	.065	4.5	1.0	1188
Steward	.09	4.4	1.6	1160
Steward	.11	3.7	2.3	1052
Tracer	.063	3.6	.99	1114
Karate	.028	3.3	2.1	1155
Untreated		27.0	10.8	892

Damage assessments made at 3 days following treatment. Seasonal mean following 4 applications. Lint yields are 38% turnout seed cotton to lint.

Table 2. "Steward" vs Standards for Armyworm and Looper Control. 1993 - 1998 Field Trials

Treatment	Rate lbs. ai/ac	SBL/CBL % Control	No. Tests	FAW % Control	No. Tests	BAW % Control	No. Tests
Steward	.065	97%	10	83%	1	91%	9
Steward	.09	97%	10	78%	1	92%	10
Steward	.11	98%	7	86%	4	96%	8
Tracer	.063	85%	10	59%	5	87%	11
Pirate	.2 -.35	96%	10	45%	3	93%	7
Larvin	.6-.8	53%	1	79%	2	61%	2

Percentages based on number larvae / 100 row feet compared to the untreated or precounts at 5 dat.

Table 3. "Steward" vs Standards: Tarnished Plant Bug (TPB) / Cotton Fleahopper (CFH) Evaluation. 1996-1998.

Tmt	Rate lb ai/ac	TPB #/100ft	TPB % Cntrl	% Square Retention	CFH #/100 ft	CFH % Cntrl	No. Tests in Mean
Steward	.065	17.7	75%	88%	3	97%	17
Steward	.09	10.8	80%	89%	32	70%	19
Steward	.11	8.6	79%	88%	0	100%	17
Tracer	.063	106.8	-17%	70%	68	35%	6
Vydate	.25	22.0	79%	88%	**	**	15
Orthene	0.5	10.6	82%	88%	40	62%	14
Karate	0.28	20.6	63%	94%	157	36%	2
Untreated		53.6	utc	82%	105	**	19

Means calculated as the average of 3, 5, and 7 dat evaluations. Percent control based on percent treatment reduction vs precounts or the untreated check in each respective trial.

Table 4. Beneficial Insect Summary. Percent Survival. 1994-1998

Treatment	Rate lbs ai/ac	Pirate Bug	Damsel Bug	Big Eyed Bug	Lady Beetle	Spiders	Lace Wing	No. Tests
Steward	.065	89%	80%	82%	62%	71%	119%	15
Steward	.09	72%	95%	75%	49%	70%	84%	16
Steward	.11	82%	163%	76%	59%	68%	88%	14
Vydate clv	.25	58%	75%	88%	65%	50%	110%	11
Pirate	.035	77%	43%	50%	43%	67%	87%	9
Tracer	.063	100%	98%	69%	61%	54%	85%	16