CAPTURE 2EC: EFFICACY ON COTTON ARTHROPOD PESTS

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Abstract

Capture 2EC (bifenthrin) has been extensively evaluated in field efficacy and laboratory bioassay trials during the past years for control of the major insect and mite pest of cotton. Laboratory photolysis studies have demonstrated longer residual with Capture than Baythroid or Karate with an established half-life of 58.8, 45.6 and 34.7 hours, respectively, when subjected to continuous illumination of ultraviolet light. In field efficacy trials, Capture applied at 0.06 lb ai/A provided commercially acceptable control of Heliothis virescens (F.), Helicoverpa zea (Boddie), Anthonomus grandis Boheman, Lygus spp., Aphis gossypii Glover and phytophagous Pentatomidae equal to or better than that of Karate, Baythroid and Scout X-tra at 0.03, 0.03 and 0.019 lb ai/A, respectively. Capture at 0.06 lb ai/A also provided Tetranychus urticae and Tetranychus cinnabarinus control equal to that of the standard miticides. Superior arthropod control with Capture subsequently resulted in greater yields than that of the standard pyrethroids.

Introduction

Capture 2EC is a pyrethroid insecticide that has been used successfully throughout the cotton belt for many years to control a variety of pest both alone and in tank mix combinations. Capture's strength is in its broad-spectrum control and its ability to handle not only the numerious insect pest of cotton but the spider mite complex as well, an ability unique in the pyrethroid class of chemistry.

For the past several years, Capture has been evaluated in university/extension efficacy studies under a broad range of environmental conditions, cotton insect / mite pests and infestation levels across the cotton belt. Reported herein, are summary results of these studies with regard to the efficacy of Capture for control of the CBW/TBW complex, boll weevil (Anthonomus grandis Boheman), plant bug (Lygus spp.), cotton aphid (Aphis gossypii Glover), stink bug (Pentatomidae), two spotted (Tetranychus urticae) and carmine (Tetranychus cinnabarinus) spider mite.

Materials and Methods

A thin layer photolysis study was conducted to evaluate the stability of Capture 2EC, Baythroid 2E and Karate 1E to degradation by ultraviolet light. Glass cover slips (12 mm dia., #12-545-80, Fischer Scientific, Pittsburgh, PA) were spotted with 10 μl of solvent (ACN, MeOH) containing the dissolved insecticide (1 mg/ml). The solution was allowed to dry, leaving a thin film of insecticide on the top of each cover slip. The cover slips were placed in a water-cooled chamber and covered with a quartz plate, which formed the exposure bed. Cover slip temperature was maintained at ~25°C. A filtered Xenon lamp, which provides illumination of a similar spectrum and intensity as sunlight, was use as the light source. Samples were taken following appropriate intervals (~0, 3, 6, 12, 24, 48 and 96 hours) of continuous exposure to light. Dark controls (non-exposed) were prepared and analyzed at the end of the experiment to ensure compound stability on the glass surface. Four cover slips for each treatment were removed at each sampling time interval and transferred each to a 20 ml scintillation vial. The cover slips were then extracted with 1 ml acetonitrile, solution transferred to a 2 dram vial and subjected to analysis by HPLC.

Samples were analyzed using Waters HPLC systems with UV detection. The column and mobile phase were selected based on the chemical class of the compounds tested. The average peak area from analysis of the unexposed (time 0) extracted cover slips defined the initial compound level with peak area associated with a photolyzed treatment being proportional to the percent remaining. The percent remaining was used to generate degradation curves. First order kinetic analysis was conducted by plotting the natural log of the percent remaining against time in hours and half-life calculated.

Field efficacy results presented herein were obtained from small plot trials conducted by university/extension, contract research and FMC personnel across the cotton belt utilizing similar test procedures. Test plot size generally ranged from 6 to 8 rows wide by 40 to 100 feet in length, replicated 4 to 6 times in a randomized complete block design. Applications were typically made with compressed air or CO2 charged small plot sprayers using water as the carrier. Total spray volume ranged from 3 to 10 gallons/acre. Cotton varieties, planting dates and production practices were typical of each geographic area.

Capture 2EC was evaluated at 0.06 lb ai/A and compared against the standard pyrethroid insecticides, Karate 1E, Baythroid 2E and Scout X-tra at 0.03, 0.03 and 0.019 lb ai/A, respectively, plus an untreated check. Trials were initiated and subsequent treatments made in accordance with insect pest control recommendations for the region. Capture 2EC was evaluated in the two spotted and carmine spider mite trials against the standard miticides, Curacron 8E, Kelthane 4EC and Comite 6.55EC at 1.0, 1.5 and 1.5 lb ai/A, respectively.

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Insect infestation levels were determined by standard evaluation procedures that varied by species. CBW, TBW and boll weevil infestations were determined by examination of a set number of cotton terminals, squares and/or bolls per plot prior to and following subsequent applications. Data were then compiled and analyzed based on a seasonal mean percent live larvae (terminal + square larvae) and square damage over multiple applications and evaluations. Fury was analyzed against the specific competitive pyrethroid only in those replicated trials where both treatments occurred. By analyzing the data in this manner, variability due to pest infestation levels, application methods and environmental conditions could be eliminated.

Plant bug infestations were determined using the standard sweep net technique. Numbers of plant bug adults and nymphs were obtained from a sample size of no less than 25 sweeps per plot taken 3 to 5 days post-treatment. Data were summarized using a combined total of both adult and nymph stages. In the plant bug cage study, three mesh cages per plot were placed on cotton plants two weeks after squaring began. Five adult tarnished plant bugs, collected from alfalfa, were placed in each cage. Percent mortality was recorded at 2 days after treatment. . In the stink bug cage study, three mesh cages per plot were placed at the terminal area of mature cotton plants. Three adult southern green stink bugs, collected from soybean and millet, were placed in each cage. Percent mortality was also recorded at 2 days after treatment.

Cotton aphid and spider mite populations were assessed by counting the number of pests per square inches of leaf surface or total pests per leaf taken from a designated location on the plant. In both cases, percent control values were generated based on the untreated check.

Results and Discussion

Results of the thin layer photolysis study are shown in Figure 1. Capture resulted in a half-life of 58.8 hours of continuous ultraviolet light illumination compared to 45.6 and 34.7 hours for Baythroid and Karate, respectively. This was a 29 and 69 percent increase in residual over that of Baythroid and Karate, respectively. Assuming that approximately ten hours of exposure is equivalent to one sunny summer day across the cotton belt, 50 percent of Capture, Baythroid and Karate would be remaining following 6, 5 and 4 days after application, respectively during sunny conditions.

Results of the efficacy of Capture for control of the CBW/TBW complex against the standard pyrethroids are shown in Tables 1, 2 and 3. Capture at 0.06 lb ai/A resulted in seasonal mean percent live larvae and square damage equal to that of Karate, Baythroid and Scout X-tra at rates of 0.03, 0.03 and 0.019 lb ai/A, respectively, based on 19, 14 and 8 replicated head-to-head trials, respectively. All treatments were significantly better than the untreated check.

Capture at 0.06 lb ai/A resulted in numerically less seasonal mean percent boll weevil square damage than that of Karate, Baythroid and Scout X-tra (Tables 1,2,3). This equated into 27, 0, and 50 percent less weevil square damage with Capture than that of Karate, Baythroid and Scout X-tra, respectively. All treatments were significantly better than the untreated check.

Subsequent yields followed a similar pattern to that of the efficacy data (Tables 1, 2, 3). A numerical reduction in insect square damage resulted in a numerical, though not significant, increase in seed cotton yield with Capture over the standard pyrethroids evaluated. All treatments produced significantly greater yields than the untreated check. Capture at 0.6 lb ai/A resulted in a yield increase over that of Karate, Baythroid and Scout X-tra by 28, 22 and 309 pounds seed cotton per acre, respectively, based on 6, 7 and 4 replicated head-to-head trials, respectively.

In two replicated field trials and one field cage study, Capture at 0.06 lb ai/A was evaluated against Karate, Baythroid, Decis, Orthene, Provado, and Vydate at 0.028, 0.03, 0.023, 0.5, 0.047 and 0.25 lb ai/A, respectively, for plant bug control in cotton (Table 4). Capture provided plant bug control equal to that of Karate and Vydate and superior to that of Baythroid, Decis, Orthene and Provado at 2-5 days after treatments.

Results of numerous head-to-head field trials to evaluate the efficacy of Capture against standard miticides for spider mite control are shown in Table 5. Capture at 0.06 lb ai/A was evaluated against Curacron, Kelthane and Comite at 1.0, 1.5 and 1.5 lb ai/A for two spotted and carmine spider mite control. In all cases, Capture provided 2 to 11 percent greater control than that of the standard miticides for both species. The ability for Capture to effectively control the cotton spider mite complex is an ability unique to the pyrethroid class of chemistry.

In replicated cotton aphid trials conducted over the past ten years, Capture at 0.06 lb ai/A has resulted in aphid suppression numerically better than that of Karate and Baythroid at 3-5 days after treatment (Table 6). Although the level of aphid control with all pyrethroids has fluctuated over the years, Capture has consistently provided the greatest level of aphid control of the pyrethroid class of chemistry.

In a replicated field cage study, Capture at 0.06 lb ai/A was evaluated against Baythroid, Provado, Vydate, Orthene and Bidrin at 0.033, 0.047, 0.25, 0.8, and 0.375 lb ai/A, respectively, for southern green stink bug control in cotton (Table 7). Capture provided stink bug control equal to that of Baythroid, Orthene and Bidrin and superior to that of Provado and Vydate at 2 days after treatments.

These results show that Capture 2EC demonstrates greater stability when exposed to ultraviolet light than Baythroid and Karate resulting in longer field residual. Additionally, these data also have demonstrated that Capture at 0.06 lb ai/A provides cotton bollworm, tobacco budworm, boll weevil, plant bug, stink bug and aphid control comparable to that of Karate, Baythroid and Scout X-tra at the equivalency rates tested. Capture also provides two spotted and carmine spider mite control equal to that of standard miticides, an ability unique to the other cotton pyrethroid insecticides. Excellent insect control with Capture subsequently results in greater yields than that of the other cotton pyrethroids.

Table 1. Efficacy of Capture 2EC vs Karate 1EC for control of bollworm/budworm, boll weevil and subsequent yield.

		Seasonal Mean Percent			
Treatment	Rate (lb ai/A)	Hel. Square Larvae	Hel. Square Damage	Weevil Square Damage	Yield (lb sc/A)
Capture	0.06	3.9	7.6	4.0	2824
Karate	0.03	4.4	6.6	5.5	2796
Check		17.5	20.2	15.1	2397
n =		33*	43*	25*	6**

* Number of post treatment evaluations from 19 replicated head-to-head trials.
** Number of replicated head-to-head trials.

Table 2. Efficacy of Capture 2EC vs Baythroid 2EC for control of bollworm/budworm, boll weevil and subsequent yield.

		Seasonal Mean Percent			
Treatment	Rate (lb ai/A)	Hel. Square Larvae	Hel. Square Damage	Weevil Square Damage	Yield (lb sc/A)
Capture	0.06	4.6	5.6	3.4	3485
Baythroid	0.03	5.3	5.8	3.4	3463
Check		14.1	16.9	5.8	3124
n =		40*	57*	21*	7**

* Number of post treatment evaluations from 14 replicated head-to-head trials.
** Number of replicated head-to-head trials.

Table 3. Efficacy of Capture 2EC vs Scout-Xtra 0.9EC for control of bollworm/budworm, boll weevil and subsequent yield.

		Seasonal Mean Percent			
Treatment	Rate (lb ai/A)	Hel. Square Larvae	Hel. Square Damage	Weevil Square Damage	Yield (lb sc/A)
Capture	0.06	3.8	4.8	13	2757
Scout-Xtra	0.019	3.6	5.4	26	2448
Check		8.4	7.4	45	2497
n =		13*	23*	10*	4**

* Number of post treatment evaluations from 8 replicated head-to-head trials.
** Number of replicated head-to-head trials.

Table 4. Efficacy of Capture 2EC for control of plant bug in cotton.

Treatment	Rate (lb ai/A)	Adults and Nymphs per 25 sweeps (3-5 DAT)*	Percent Mortality (2 DAT)**
Karate	0.028	3.7	---
Baythroid	0.03	5.6	98
Decis	0.023	4.7	---
Orthene	0.5	4.1	---
Provado	0.047	---	92
Vydate	0.25	---	97
Untreated Check		7.2	25

** Field cage mortality trial.

Table 5. Efficacy of Capture 2EC for control of spider mite in cotton .

		Percent Control	
Treatment	Rate (lb ai/A)	Two Spotted	Carmine
Capture	0.06	70	--
Curacron	1.0	68	--
n =		(11)*	(-)
Capture	0.06	74	90
Kelthane	1.5	71	81
n =		(12)	(2)
Capture	0.0687		
Comite	1.5		--76
n =		(–)	(6)

* Number of replicated head-to-head trials.

Table 6. Efficacy of Capture 2EC for control of cotton aphid (10 year average) in cotton .

Treatment	Rate (lb ai/A)	Percent aphid control 3-5 DAT
Capture	0.06	83(38)*
Karate	0.03	53(20)
Baythroid	0.03	40 (18)

* Number of replicated trials in mean.

Table 7. Efficacy of Capture 2EC for control of stink bug in cotton .

Treatment	Rate (lb ai/A)	Percent mortality 2 DAT*
Capture	0.06	96
Baythroid	0.033	96
Provado	0.047	33
Vydate	0.25	85
Orthene	0.8	96
Bidrin	0.375	100

*Field cage mortality trial.

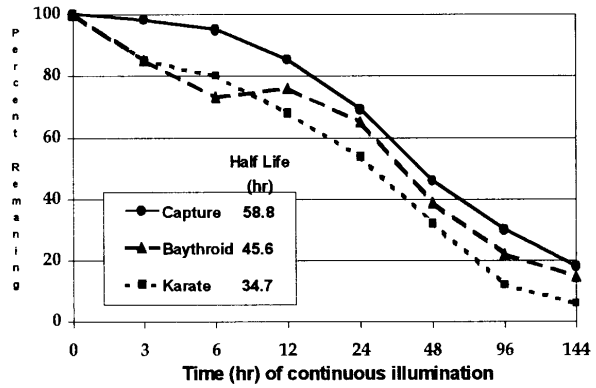

Figure 1. Degradation and half-life in hours of Capture, Baythroid and Karate subjected to continuous illumination of ultraviolet light.