RESIDUAL ACTIVITY OF CAPTURE 2EC AND OTHER PYRETHROID INSECTICIDES AS INDICATED BY CONTROL OF TOBACCO BUDWORM ON COTTON

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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 pests of cotton. Several field-laboratory bioassays have demonstrated that the residual control achieved with Capture® 2EC is longer than that achieved with Karate® Z or Baythroid® 2EC. Supporting the theory that the decreased photodegradation rate of Capture would result in greater biological control. These trials also revealed a more rapid decline in residual activity for Karate® Z when compared to Karate® 1EC. In the absence of rainfall, the level of Heliothis virescens (F.) control for Karate® Z drops significantly between 4 and 6 days after treatment. Rainfall accelerated this decline with a significant drop in activity ocurring less than 3 days after treatment.

Introduction

Capture 2EC is a pyrethroid insecticide that has been used successfully throughout the cotton belt for many years to control a variety of pests. Capture's strength is its broadspectrum insect control (plant bugs, budworm/bollworm complex, etc.) and its ability to control the spider mite complex.

A summary of university/extension efficacy studies from across the cotton belt demonstrated that Capture 2EC provides cotton bollworm and tobacco budworm control comparable to that of Karate 1EC, Baythroid 2EC and Scout-Xtra® (Mitchell and Hatfield, 1999). The results of a laboratory photolysis study showed that Capture 2EC demonstrated greater stability when exposed to ultraviolet light than Baythroid 2EC and Karate 1EC suggesting longer field residual (Figure 1.).

The objective of these studies was to evaluate the residual activity of Capture 2EC compared to other pyrethroid insecticides under field environmental conditions.

Materials and Methods

Treatments were applied 12 July in Test 1. The experimental design was a randomized complete block, with 3 treatments and a control each replicated 4 times. Cotton was planted on 12 May with plots consisting of 4 rows x 50 ft and foliar sprays were applied with a tractor mounted boom equipped with a CO2 spray system calibrated with water to deliver 10 gal/acre total spray volume at 48 psi and 3.5 mph (2 TX-6 nozzles/row). Treatments were evaluated 2 hrs, 1, 3, and 5 days after treatment (DAT). Treatments tested were (1) an untreated check, (2) Capture® 2EC (FMC Corp., Philadelphia, PA) at 0.05 lb AI/acre, (3) Karate® Z (Zeneca Inc., Wilmington, DE) at 0.028 lb AI/acre, (4) Baythroid® (Mobay Corp., Kansas City, MO) at 0.03 lb AI/acre. All products tested were obtained from a local agricultural chemical dealer. Three-quarters of an inch of rainfall was recorded six hours after application, eight-tenths of an inch of rainfall was recorded between the 1 and 3 DAT sampling.

Effectiveness on tobacco budworm, Heliothis virescens, was evaluated by randomly collecting 10 terminal leaves from the center 2 rows of each plot and placing them immediately into a #8 paper bag. Paper bags were then placed into styrofoam coolers for transportation. In the laboratory, a leaf punch or sampler (Rabbit Tool Co., Rock Island, IL) was used to remove a 1 cm^2 leaf disk from each leaf. Each excised leaf disk was transferred to a 50x9mm petri dish (Gelman Sciences, Ann Arbor, MI) containing a 4.25cm diameter filter paper (VWR Scientific Products, Atlanta, GA) to which 0.5 ml of distilled water was added using an Eppendorf Repeater Pipette (Brinkman Instruments Inc., Westbury, NY). One 1st instar tobacco budworm (0.04-0.63mg) obtained from the FMC insectory (FMC Corporation Princeton, NJ) was placed into each dish using a camel hair brush (Royal 10/0 RG 595 USA). Dishes were stacked onto a fiberglass tray and placed into a proofing chamber (Percival MFG Co., Boone, IA) and stored at 28°C. Mortality was recorded 72 hours post challenge. Mortality being defined as the lack of response to prodding.

The FMC Heliothis virescens colony was originally obtained from the USDA laboratory in Stoneville Mississippi greater that seventeen years ago. Eggs were placed on artificial diet (FMC Lep. casein/wheatgerm diet) in C-D International rearing trays (C-D International, Pitman, NJ) and shipped overnight to the test location. The FMC colony was subjected to dose/mortality tests during the trial and

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confirmed to be non-resistant to cypermethrin. The topical LC_{50} for neonate larvae was 0.0057 µg/larva which is a susceptible level.

Treatments were applied 27 July in Test 2. The experimental design was a randomized complete block, with 4 treatments and a control each replicated 4 times. Cotton was planted on 12 May with plots consisting of 2 rows x 50 ft and foliar sprays were applied with a CO_2 backpack sprayer calibrated with water to deliver 10 gal/acre total spray volume at 42 psi and 3.3 mph (2 TX-6 nozzles/row). Pix® (BASF Corp., Research Triangle Park, NC) was applied on 26 July at a rate of 8 oz/acre. Treatments were evaluated 1, 3, 6, 13 and 21 days after treatment. Treatments tested were (1) an untreated check, (2) Capture® 2EC at 0.05 lb AI/acre, (3) Baythroid® at 0.03 lb AI/acre (4) Karate® 1E at 0.028 lb AI/acre, and (5) Karate® Z at 0.028 lb AI/acre. All products tested were obtained from a local agricultural chemical dealer. Three-tenths of an inch of rainfall was recorded between the 6 & 13 DAT sampling, and six-tenths of an inch of rainfall was recorded between the 13 & 21 DAT sampling.

Effectiveness on tobacco budworm, Heliothis virescens, was evaluated by the same method described for Test 1.

Treatments were applied 12 August in Test 3. The experimental design was a randomized complete block, with 4 treatments and a control each replicated 4 times. Cotton was planted on 15 June with plots consisting of 2 rows x 25 ft and foliar sprays were applied with a CO_2 backpack sprayer calibrated with water to deliver 10 gal/acre total spray volume at 42 psi and 3.3 mph (2 TX-6 nozzles/row). Treatments were evaluated 1, 4, and 7 days after treatment. Treatments tested were: (1) an untreated check, (2) Capture® 2EC at 0.05 lb AI/acre, (3) Baythroid® at 0.03 lb AI/acre, (4) Karate® 1E at 0.028 lb AI/acre, and (5) Karate® Z at 0.028 lb AI/acre. Four-tenths of one inch of rainfall was recorded between the 1 and 4 DAT sampling.

Effectiveness on tobacco budworm, Heliothis virescens, was evaluated by the same method described for Test 1.

Results

The data from Test 1 revealed no statistical difference in tobacco budworm mortality among treatments (Table 1). Between the time of application and the 3 DAT sampling, 1.55 inch of rainfall was recorded. The treatment means in the 3 DAT sample indicated a reduction in activity of 15% for Capture, 25% for Baythroid and a 30% drop in activity for Karate Z when compared to the efficacy achieved at 2 hours after application. The treatment means in the 5 DAT sample indicated an additional 12% drop in efficacy for Capture, 35% for Baythroid and 27% for Karate Z.

The data from Test 2 revealed no statistical difference in tobacco budworm mortality among treatments at 1 and 3 DAT (Table 2). However, data from the 6 DAT sampling revealed that Karate Z resulted in statistically lower level of control (73%) when compared to all other products. All other products resulted in 95 to 100% mortality. Between the 6 DAT and 13 DAT sampling, three-tenths inch of rainfall was recorded. The treatment means in the 13 DAT sample indicated that Karate Z resulted in statistically less mortality than all other treatments. Between the 13 and 21 DAT sampling, six-tenths of an inch of rainfall was recorded. The treatment means in the 21 DAT sample indicated that Capture resulted in statistically greater mortality than Karate Z. The mortality level achieved with Capture (75%) was numerically greater than that of Karate 1E (58%) and Baythroid (58%) but statistically equivalent.

The data from Test 3 revealed no statistical difference in tobacco budworm mortality among treatments at 1 and 4 DAT (Table 3). At 7 DAT, Capture 2EC resulted in significantly greater control (100%) than Karate Z (75%) and similar control compared to Baythroid and Karate 1E.

Discussion

The results of the photolysis study showed that Capture 2EC demonstrates greater stability to ultraviolet light than Baythroid and Karate suggesting longer field activity. When averaged together, the data from the three field-laboratory tests conducted with 1st instar tobacco budworm demonstrate that the residual activity of Capture is longer than that achieved with Karate Z or Baythroid under field environmental conditions (Figure 2.).

The data from the three tests conducted with 1st instar tobacco budworm suggests a more rapid loss of residual activity for Karate Z when compared to the other compounds evaluated. The data also suggests that, in the absence of significant rainfall, the level of control achieved with the Zeon formulation of Karate drops significantly between 4 and 6 days after treatment (Table 2 and 3) when compared to the level of control achieved with the other products evaluated (95-100%). Gas chromatographic analysis revealed that the Karate Z sample used was 23.0% active ingredient and was within specifications.

References

Mitchell, H.R. and L.D. Hatfield. 1999. Capture 2EC: efficacy on cotton arthropod pests. Proceedings Beltwide Cotton Conferences. 1095-1098.

Table 1. Residual control of first instar tobacco budworm on cotton, Test 1.

Treatment	Rate (lbai/ac)	Percent Mortality			
		2 HAT[1]	1DAT[2]	3DAT	5DAT
Check		0 b	3 b	3 b	0 b
Capture 2EC	0.05	100 a	98 a	85 a	73 a
Baythroid 2EC	0.03	100 a	93 a	75 a	40 a
Karate Z	0.028	100 a	98 a	70 a	43 a
		↑ 0.75" rainfall	↑ 0.80" rainfall		

[1] HAT = Hours after treatment

[2] DAT = Days after treatment

Means in each column followed by the same letter do not significantly differ by ANOVA (P=0.05, LSD) using Student-Newman-Keuls.

Table 2. Residual activity of cotton insecticides for control of first instar tobacco budworm on cotton, Test 2.

Treatment	Rate (lbai/ac)	Percent Mortality (Days after treatment)				
		1	3	6	13	21
Check		0 b	3 b	0 c	3 c	0 c
Capture 2E	0.05	98 a	100 a	100 a	88 a	75 a
Baythroid	0.03	100 a	95 a	95 a	95 a	58 ab
Karate 1E	0.028	100 a	100 a	100 a	95 a	58 ab
Karate Z	0.028	98 a	93 a	73 b	58 b	40 b
				↑ 0.3" rainfall	↑ 0.6" rainfall	

Means in each column followed by the same letter do not significantly differ by ANOVA (P=0.05, LSD) using Student-Newman-Keuls.

Table 3. Residual activity of cotton insecticides for control of first instar tobacco budworm on cotton, Test 3.

Treatment	Rate (lbai/ac)	Percent Mortality		
		1 DAT	4DAT	7DAT
Check		0 b	0 b	0 c
Capture 2EC	0.05	100 a	95 a	100 a
Baythroid 2EC	0.03	100 a	98 a	98 a
Karate 1EC	0.028	100 a	100 a	95 a
Karate Z	0.028	98 a	95 a	75 b
		↑ 0.4" rainfall		

Means in each column followed by the same letter do not significantly differ by ANOVA (P=0.05, LSD) using Student-Newman-Keuls.

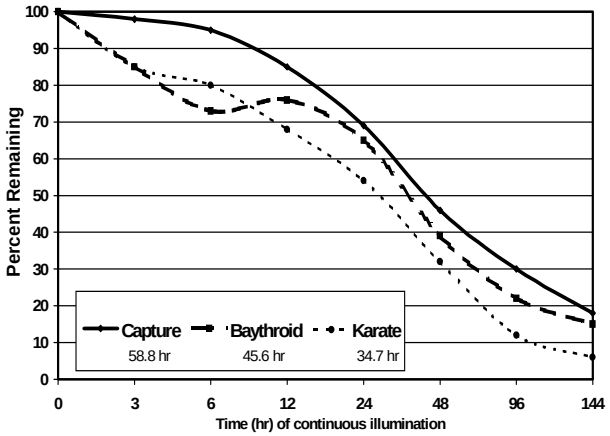

Figure 1. Degradation of Capture, Baythroid and Karate subjected to continuous illumination of ultraviolet light (Mitchell & Hatfield, 1999).

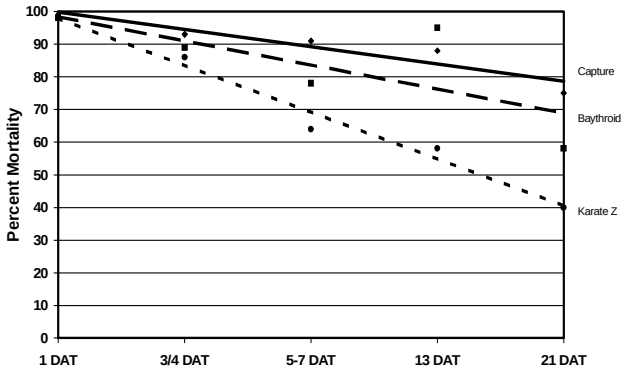

Figure 2. Average residual activity on tobacco budworm from three trials conducted.