PR # 7333
Imidacloprid

IMIDACLOPRID FOR APHID CONTROL ON BANANA IN HAWAII
FINAL REPORT
SEPTEMBER 1, 1999

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Banana is cultivated on nearly 2,000 acres in Hawaii. Banana bunchy top virus (BBTV) was discovered on the island of Oahu in 1989 and has spread to the islands of Hawaii and Kauai. Diseased plants do not produce marketable bananas. The banana aphid, *Pentalonia nigronervosa*, transmits the disease. Disease management practices include the combined use of diazinon insecticides for aphid control and the destruction of infected plants. Diazinon (Prentox Diazinon) is currently registered under a 24(c) Special Local Needs label; however, the insecticide is an organophosphate insecticide that is part of the EPA's review of tolerances under FQPA.

OBJECTIVE

To demonstrate the efficacy of the low risk insecticide, imidacloprid, for aphid control on banana.

METHODS

Imidacloprid was evaluated using three application methods; drench, drip, and spray. For each test, treated (diazinon) and untreated check treatments were included as comparisons. Treatments were made to young banana plants that were about 3-5 weeks old. Each plant was situated on a separate plant mat. Since imidacloprid was not labeled for use on banana, cooperating growers limited the size of each study to ten plants per treatment. Aphids were commonly found on the pseudostems in the leaf axils. Full coverage applications were made for all diazinon treatments, and for the untreated check and each imidacloprid treatments in the spray-method study. Untreated check plants in all three studies were treated with surfactant and water. Treatment plots were arranged using a completely randomized design with 4 treatment replications. A description of imidacloprid application in each field study is provided below.

TEST #1 (DRENCH). The drench test was conducted at Keaau, Hawaii. For each rate of imidacloprid, the appropriate amount of chemical was mixed in solution and each sucker was saturated with 2-gallons at the base.

TEST #2 (DRIP). The drip test was conducted at Kahuku, Oahu, Hawaii. The test field was pre-irrigated for one hour prior to application. A Mazzei injector board was inserted into the irrigation line of two designated rows of bananas. The solutions were dripped in over a period of one hour. Following application, the field was irrigated for one hour.

TEST #3 (SPRAY). The spray test was conducted at Kahuku, Oahu, Hawaii. Treatments were applied using a CO_2 backpack sprayer until the entire surface of the leaves was wet.
Aphid surveys were conducted by counting all of the aphids visible on each plant at the designated intervals.

RESULTS

TEST #1 (DRENCH). Based on the effect of imidacloprid on aphids infesting other hosts, we expected to observed "aphid free" treated plants soon after the treatment application. However, although reduction in population was observed eight days after treatment, only 10-20% of the imidacloprid treated trees were aphid free compared to 60% of the diazinon treated trees (Table 1). Sixteen days after treatment, 50% of the trees treated with the higher rate of imidacloprid were aphid free. The aphid population on the

remaining trees was decreasing until there were no aphids at the last survey. A similar trend was observed at the lower rate.

The aphid population on the diazinon treated suckers remained significantly lower than the untreated check from eight days after treatment, but ants were observed on the plants with no aphids indicating there were some individuals present that were not visible. In fact, an increase in numbers was counted at the last survey.

TEST #2 (DRIP). The aphid population on suckers that were treated with imidacloprid via drip irrigation remained relatively high until the end of the field test (Table 2). The mean number of aphids decreased significantly lower than the untreated check twenty-three days after treatment for both rates of imidacloprid but the majority of the plants were not aphid free plants until 46 days after treatment. Reduction in the population required more time than anticipated.

The aphid population on the diazinon treated suckers was reduced significantly immediately following treatment application but the population was increasing by the end of the test.

TEST #3 (SPRAY). The spray application of imidacloprid was excellent in reducing the number of aphids (Table 3). Nine days after treatment, 60-70% of the treated suckers were aphid free. The remaining suckers which aphids were counted on only recorded 1-3 individuals.

Observations of the aphid population on the diazinon treated plants were consistent with the events that occurred in the drench and drip field trials.

No grower field day was held. Information was distributed with the assistance of local Extension Agents, and oral presentations of the results were made at grower meetings.

DISCUSSION AND CONCLUSIONS

Imidacloprid was very effective in controlling the banana aphid although effectiveness took longer to achieve in banana suckers that were treated by drench or drip irrigation methods. In other crop systems, control was observed by 7-days after treatment but in bananas, complete control took as long as 43 days when the product was applied by drenched or drip irrigation. Placement in the root zone may have been a factor. Improper application could deposit the insecticide above or below the root zone and result in poor uptake by roots.

Also, the size of the plants may have been a factor in the delay in achieving quick post treatment control of the aphids. The banana suckers that we used were larger than typical crops where immediate control of aphids is observed on. Larger plants may require more time to distribute the product into its system. Foliar sprays allowed suckers immediate uptake of the product into its system therefore quick control was observed. The low risk insecticide was quite effective; however, research is needed to determine proper application of the insecticide for drip irrigation and drench application practices.

APPENDIX 1

TEST NO.	Test #1 (drench application)
COOPERATOR	Keaau Banana Plantation
CROP	Banana
PEST	Banana aphid, *Pentalonia nigronervosa*
LOCATION	Keaau, Hawaii
FIELD SIZE	0.09 acres
EXPERIMENT DATES	June – September 1999
SPRAY EQUIPMENT	Tractor mounted PTO pump
GPA	450

TREATMENT	imidacloprid (Admire 2F) @ 0.25 lb. ai/A	imidacloprid (Admire 2F) @ 0.50 lb. ai/A	diazinon (Diazinon 500AG) @ 0.50 lb. ai/A	Untreated Check
NO. SINGLE PLANT REPS	10	10	10	10
APPLICATION DATE	29 Jun 99			

EVALUATION DATES		
	Pretreatment	29 Jun 99
	8 DAT	7 July 99
	16 DAT	15 July 99
	29 DAT	28 July 99
	43 DAT	11 Aug 99
	57 DAT	25 Aug 99

DAT = Days after treatment

APPENDIX 2

TEST NO.	Test #2 (drip irrigation application)
COOPERATOR	Fukuyama and Matsuda Farms, Inc.
CROP	Banana
PEST	Banana aphid, *Pentalonia nigronervosa*
LOCATION	Kahuku, Oahu, Hawaii
FIELD SIZE	0.08 acres
EXPERIMENT DATES	July – September 1999
SPRAY EQUIPMENT	Mazzei Injector (in-line)
GPA	0.08 gallons/minute

TREATMENT	imidacloprid (Admire 2F) @ 0.25 lb. ai/A	imidacloprid (Admire 2F) @ 0.50 lb. ai/A	diazinon (Diazinon 500AG) @ 0.50 lb. ai/A	Untreated Check
NO. SINGLE PLANT REPS	10	10	10	10
APPLICATION DATE	20 July 99			

EVALUATION DATES	Pretreatment	20 July 99
	9 DAT	7 July 99
	16 DAT	15 July 99
	23 DAT	12 Aug 99
	29 DAT	18 Aug 99
	46 DAT	3 Sept 99
	58 DAT	15 Sept 99

DAT = Days after treatment

APPENDIX 3

TEST NO.	Test #3 (foliar spray application)
COOPERATOR	Fukuyama and Matsuda Farms, Inc.
CROP	Banana
PEST	Banana aphid, *Pentalonia nigronervosa*
LOCATION	Kahuku, Oahu, Hawaii
FIELD SIZE	0.08 acres
EXPERIMENTAL DATE	July – September 1999
SPRAY EQUIPMENT	CO_2 pressurized backpack sprayer equipped with drench application nozzle
GPA	200

TREATMENT	imidacloprid (Provado 1.6F) @ 0.25 lb. ai/A	imidacloprid (Provado 1.6F) @ 0.50 lb. ai/A	diazinon (Diazinon 500AG) @ 0.50 lb. ai/A	Untreated Check
NO. SINGLE PLANT REPS	10	10	10	10
APPLICATION DATE	20 July 99			

EVALUATION DATES	Pretreatment	20 July 99
	9 DAT	7 July 99
	16 DAT	15 July 99
	23 DAT	12 Aug 99
	29 DAT	18 Aug 99
	46 DAT	3 Sept 99
	58 DAT	15 Sept 99

DAT = Days after treatment

Table 1. Imidacloprid for Banana aphid Control on Banana via Drench Application. Mean ± SEM aphids counted at each survey date. The post treatment surveys were combined to calculate the seasonal mean. Keaau, Hawaii. 1999

		Mean + SEM aphids counted at each survey				
Treatment	Rate/A	Pre-treatment (29 JUN 99)	8 DAT (7 JUL 99)	16 DAT (15 JUL 99)	29 DAT (28 JUL 99)	43 DAT (11 AUG 99)
imidacloprid (Admire 2F)	0.25 lb. ai	237.0±54.5a	107.4±55.4ab	28.1±18.0b	1.9±1.1b	0.4±0.3b
imidacloprid (Admire 2F)	0.50 lb. ai	186.2±33.2a	48.5±15.3bc	5.6±2.8b	0.1±0.1b	1.0±1.0b
diazinon (Diazinon 500AG)	0.50 lb. ai	290.0±60.8a	12.1±9.6c	9.5±6.9b	16.5±5.3b	16.30±6.8ab
UTC	--	173.8±23.2a	146.3±37.4a	203.4±73.9a	133.5±48.2a	83.70±43.5a

Means in the same column followed by a different letter are significantly different (LSD T-test; $P<0.01$; SAS for Windows version 6.12).

Table 1. Continued.

Treatment	Rate/A	Mean + SEM aphids counted at each survey 57 DAT (25 AUG 99)	 SEASONAL MEAN
imidacloprid (Admire 2F)	0.25 lb. ai	1.2±1.0b	27.8±12.6b
imidacloprid (Admire 2F)	0.50 lb. ai	0b	11.0±4.0b
diazinon (Diazinon 500AG)	0.50 lb. ai	44.0±23.4a	19.7±5.6b
UTC	--	23.8±14.1ab	118.1±22.1a

Means in the same column followed by a different letter are significantly different (LSD T-test; $P<0.01$; SAS for Windows version 6.12).

Table 2. Imidacloprid for Aphid Control on Banana via Drip Irrigation. Mean ± SEM aphids counted at each survey date. The post treatment surveys were combined to calculate the seasonal mean. Kahuku, Oahu, Hawaii. 1999

Treatment	Rate/A	Mean + SEM aphids counted at each survey				
		Pre-treatment (20 JUL 99)	9 DAT (29 JUL 99)	16 DAT (5 AUG 99)	23 DAT (12 AUG 99)	29 DAT (18 AUG 99)
imidacloprid (Admire 2F)	0.25 lb. ai	87.2±16.4b	202.4±6.9a	155.5±46.7a	113.2±38.9ab	101.0±40.4b
imidacloprid (Admire 2F)	0.50 lb. ai	255.2±49.8a	217.9±50.7a	112.4±42.3a	62.3±32.0bc	55.7±23.6bc
diazinon (Diazinon 500 AG)	0.50 lb. ai	211.0±33.3ab	8.3±7.8b	17.8±13.0b	13.0±10.9c	19.6±10.7c
UTC	--	180.308±29.6a	111.9±21.5a	132.1±24.4a	137.1±22.6a	210.1±35.1a

Means in the same column followed by a different letter are significantly different (LSD T-test; $P<0.01$; SAS for Windows version 6.12).

Table 2. Continued.

Treatment	Rate/A	Mean + SEM aphids counted at each survey 46 DAT (3 SEPT 99)	 58 DAT (15 SEPT 99)	 SEASONAL MEAN
imidacloprid (Admire 2F)	0.25 lb. ai	54.8±31.1b	38.1±28.2bc	110.8±18.3b
imidacloprid (Admire 2F)	0.50 lb. ai	4.6±3.4c	1.9±1.9c	75.8±15.6c
diazinon (Diazinon 500AG)	0.50 lb. ai	36.2±9.0b	54.7±22.3ab	24.9±5.5d
UTC	--	160.3±31.4a	98.3±27.3a	141.6±11.5a

Means in the same column followed by a different letter are significantly different (LSD T-test; $P<0.01$; SAS for Windows version 6.12).

Table 3. Imidacloprid for Aphid Control on Banana via Foliar Spray. Mean ± SEM aphids counted at each survey date. The post treatment surveys were combined to calculate the seasonal mean. Kahuku, Oahu, Hawaii. 1999

Treatment	Rate/A	Mean + SEM aphids counted at each survey				
		Pre-treatment (20 JUL 99)	9 DAT (29 JUL 99)	16 DAT (5 AUG 99)	23 DAT (12 AUG 99)	29 DAT (18 AUG 99)
imidacloprid (Provado 1.6F)	0.25 lb. ai	136.5±20.8b	0.5±0.3b	1.2±0.6b	2.8±2.4b	4.6±2.5bc
imidacloprid (Provado 1.6F)	0.50 lb. ai	126.3±7.5b	0.6±0.3b	1.5±0.8b	0.3±0.2b	1.2±0.9c
diazinon (Diazinon 500AG)	0.50 lb. ai	211.9±33.3a	8.3±7.8b	17.8±13.0b	13.0±10.9b	19.6±10.6b
UTC	--	180.3±29.5ab	111.9±21.5a	132.1±24.4a	137.1±22.6a	210.1±35.1a

Means in the same column followed by a different letter are significantly different (LSD T-test; $P<0.01$; SAS for Windows version 6.12).

Table 3. Continued.

Treatment	Rate/A	Mean + SEM aphids counted at each survey 46 DAT (3 SEPT 99)	58 DAT (15 SEPT 99)	SEASONAL MEAN
imidacloprid (Provado 1.6F)	0.25 lb. ai	0.7±0.5c	8.5±8.4c	3.0±1.5c
imidacloprid (Provado 1.6F)	0.50 lb. ai	0.3±0.2c	3.2±2.5c	1.2±0.5c
diazinon (Diazinon 500AG)	0.50 lb. ai	36.2±9.0b	54.7±22.3b	24.9±5.54b
UTC	--	160.3±31.4a	98.3±27.3a	141.6±11.5a

Means in the same column followed by a different letter are significantly different (LSD T-test; $P<0.01$; SAS for Windows version 6.12).