

Commercial Field Performance of Confirm and Success on Head Lettuce and Broccoli

John C. Palumbo and Todd A. Hannan

Abstract

Field trials were conducted in the Yuma and Gila Valleys to assess the commercial field performance of Confirm and Success insecticides against beet armyworm and cabbage looper larvae. Ten lettuce and five broccoli fields were treated with combinations of Confirm, Success, and standard insecticides on various stages of plant growth. Success provided quick knockdown of larvae, but ultimately Confirm provided equitable control. Cabbage looper control with Confirm appeared to be influenced by application volume and plant size. Addition of pyrethroid to Confirm did not provide additional efficacy. Success provided good suppression of leafminer adults and thrips. Both products provided control equal to conventional standards and will become valuable components of future lettuce pest management programs in Arizona.

Introduction

In 1997, a emergency exemption (Section 18) registration was granted for Confirm (tebufenozide) and Success (spinosad) insecticides for control of beet armyworm. These new products are considered "reduced risk" with many favorable attributes, but have had minimal testing under commercial growing conditions. Intensive research of these products under controlled conditions at the Yuma Ag Center has shown that they have good efficacy against beet armyworm (BAW) and cabbage looper (CL) in lettuce and cole crops. Confirm is slow acting because it is an IGR and requires ingestion. Success has been shown to act rapidly due to its unique modes of action and translaminar activity. However, we were not certain how these products would perform in commercial lettuce fields as a stand alone products. The primary goal of this project was to provide objective information concerning use patterns of these products. Ultimately, these field evaluations can be used to demonstrate how Confirm and Success can be used in a cost/effective manner by Arizona vegetable growers and PCAs. Our primary concern was that growers and PCAs would be unfamiliar activity of these products against worms in lettuce, particularly for Confirm. Therefore, a simple project was designed to provide an objective evaluation of commercial field applications of Confirm and Success compared with commercial standards insecticide applications under various growing conditions in lettuce and broccoli

Materials and Methods

All trials were conducted in commercial lettuce and broccoli fields in the Yuma and Gila Valleys with the cooperation of Barkley Co. of Arizona. A total of 15 trials were conducted, 10 in head lettuce and 5 in broccoli. Plots were established by splitting fields into halves and applying treatments respectively. Field plots varied from 8.5-20 acres in size. A description of spray dates, treatments, application methods and plant size for each trial is shown in Table 1. All insecticides included a spreader/sticker. The Confirm treatments all contained Latron at 5.2 oz. All other treatments received Latron (5.2 oz), or Silwet (0.8 oz). A buffer (0-8-0) was included with all treatments. Applications were made with commercial application equipment. Ground applications were made with a Melroe 12 row sprayer with 4 nozzles per equipment per bed (Border Applicators, Somerton, AZ) and the single air application were made with an Ayers TurboThrush (Pierce Aviation, Somerton, AZ).

Field performance of insecticide treatments against cabbage looper and beet armyworm larvae was measured by sampling before and after application. Prior to application, each plot was separated into quadrants and 5 infested plants

within each quadrant were selected and tagged. A minimum of 20 larvae /plot were used in each trial. At various intervals following the applications, the number of dead, missing and alive larvae on infested plants was recorded. Percentage larval mortality was measured by dividing the number of missing or dead larvae found on plants after application by the number of larvae on plants before the application. Diagnostic mortality was reported as percentage of dead larvae found on the plant after application. In tests 9, 10 and 11, the performance of Success against leafminers and thrips was assessed. Leafminer activity was estimated by making visual counts of dead and alive adults on plants at 2-d after treatment (2 reps of 100 plants / field). Estimates of thrips were made by placing yellow sticky traps in each plot and counting the number of thrips found on traps for 5 days following the applications.

Results and Discussion

Small Broccoli. Comparisons between Confirm and Larvin+ pyrethroid showed that both treatments provided similar control of beet armyworm and cabbage looper on small broccoli during late September-early October (Table 2). In most cases, less than 20% of the larvae were found dead on the plant. With the exception of the 2-3 % live found on the plant after 5 days, the majority of larvae were missing from the plant. This is consistent with these products which require ingestion and are slow acting.

Large Broccoli. Success provided consistent mortality of larvae after 5 days (Table 3). Confirm appeared to be more inconsistent during these tests. Total larval mortality did not reach 100% in 2 of the 3 plots, but in general provided good control. Lower temperatures occurring during the test significantly reduced larval feeding and activity in all plots.

Lettuce - Stand establishment. Success was compared to Lannate+pyrethroid for control of small beet armyworm on pre-thinned lettuce stands in November (Table 4). Both treatments provided excellent control of larvae. Diagnostic mortality was similar for both treatments, resulting in >50% dead larvae at 72 hours post-treatment. Both treatments performed well when applied by air (test 14). This is encouraging considering the test was conducted in cool temperatures.

Lettuce - Thinning stage. In the two tests in which Success was applied, 100% BAW mortality was observed after 1½ days. CL mortality was less consistent but had achieved complete mortality following 3 DAT. The majority of the larvae were found dead on the plant after 5 days. Confirm provided greater than 95% control of total larvae at 5 DAT in each test. As expected, fewer (<20%) larvae were found dead on the plants. The addition of pyrethroid to Confirm provided quicker knockdown of larvae, but did not improve performance.

Lettuce - Post-thinning. The performance of Success and Confirm were directly compared in 4 tests on plants ranging from 8-12 leaves and spray volumes at 30-50 GPA (Table 6). Success provided excellent control (>95%) of BAW at 1½ DAT. Similar control of CL was achieved at 3 DAT. At high volumes on 12 leaf plants both the Success or Confirm provided marginal control at 5 DAT. This could be partially due to dilution of active ingredients in the high spray volume, and CL feeding behavior. In most cases, Confirm provided good BAW control at 5 DAT. Confirm performance was marginal (@80% control) at high application volumes of 50 gpa. Again dilution of active ingredients in the high spray volume, and CL feeding behavior may have prevented optimal performance. By 7 DAT, only 82% control of CL was obtained suggesting that Confirm is less consistent on this Lep species compared with Success. Averaged over all 4 tests, Success provided significantly quicker mortality of BAW and CL than Confirm. AT 5 DAT, there were no significant differences in mortality between the two products.

Leafminer and Thrips Activity. The number of live leafminer adults were significantly reduced in the Success treated plots at 2 DAT (Table 7). Sticky trap counts were similarly low in the Success plots. Thrips were significantly suppressed in the Success plots based on sticky trap counts. These data are consistent with results from small plot trials where Success has shown to provide control of leafminer, *Liriomyza sativa* and western flower thrips. The lack of control against these pests in the Confirm plots was expected because it is selective against lepidopterous species through ingestion.

Conclusion. These commercial field trials verify results from small plot studies conducted at the Yuma Ag Center over the past 3 years. Success showed consistent performance against both BAW and CL under a wide range of conditions.

It also has suppressive activity against thrips and leafminers. Confirm showed consistent control of BAW across all the studies, and CL on thinning stage lettuce. CL control was inconsistent and appeared to be influenced by application volume on post-thinning stage lettuce. Finally, both products provided control equal to conventional standards and will become valuable components of future lettuce pest management programs in Arizona.

Table 1. Description of Confirm/Success Commercial Leafy Vegetable Trials

Test	Spray date	Crop	Treatments (rate/acre)	Application	Plant size
1	Sep 20	Broccoli	Confirm (8 oz) Larvin (34.5 oz)+Karate (3.45 oz)	Ground, 30 GPA	4 leaves/plant
2	Sep 29	Broccoli	Confirm (8 oz) Larvin (34.5 oz)+Strykr (3.41 oz)	Ground, 30 GPA	8 leaves/plant
3	Sep 29	Lettuce	Confirm (8 oz) Larvin (30 oz)+Strykr (3.41 oz)	Ground, 30 GPA	4 leaves/plant
4	Oct 4	Broccoli	Confirm (8 oz) Larvin (35.5 oz)+Karate (3.55 oz)	Ground, 30 GPA	4 leaves/plant
5	Oct 6	Lettuce	Confirm (7.7 oz) Success (5.8 oz)	Ground, 30 GPA	8 leaves/plant
6	Oct 9	Lettuce	Confirm (8 oz) Larvin (30 oz)+Karate (3.5 oz)	Ground, 30 GPA	4 leaves/plant
7	Oct 9	Lettuce	Success (5.33) Larvin (30 oz)+Strykr (3.34 oz)	Ground, 30 GPA	4 leaves/plant
8	Oct 3	Lettuce	Confirm + Stryker (3.41 oz) Confirm +Karate (3.84 oz)	Ground, 30 GPA	6 leaves/plant
9	Oct 16	Lettuce	Confirm (6 oz) Success (4 oz)	Ground, 30 GPA	4 leaves/plant
10	Oct 16	Lettuce	Confirm (8 oz)+Ronilan (2.0 lbs) Success (6 oz)+Ronilan (2.0 lbs) Larvin (30 oz)+Ronilan (2.0 lbs)	Ground, 50 GPA	8 leaves/plant
11	Oct 16	Lettuce	Confirm (8 oz)+Ronilan (2.0 lbs) Success (6 oz)+Ronilan (2.0 lbs)	Ground, 50 GPA	12 leaves/plant
12	Oct 28	Broccoli	Confirm (8 oz) Success (6 oz)	Ground, 30 GPA	18 leaves/plant
13	Oct 28	Broccoli	Confirm (8 oz) Confirm (8 oz)+Ammo (5.0 oz)	Ground, 30 GPA	12 leaves/plant
14	Nov 3	Lettuce	Success (5.7 oz) Lannate (0.80 lb)+Karate (3.65 oz)	Air, 7 GPA	3 leaves/plant
15	18 Nov	Lettuce	Success (4.7 oz) Lannate (0.71 lb)+Ammo (4.5 oz)	Ground, 30 GPA	3 leaves/plant

Table 2. Confirm and Larvin/Pyrethroid evaluations on small broccoli, Yuma Valley, Fall 1997.

Date	Treatment	% Larval mortality (Days After Treatment)												Diagnostic mortality (% dead larvae)		
		1½ DAT				3 DAT				5 DAT						
		BAW	CL	TOT	BAW	CL	TOT	BAW	CL	TOT	BAW	CL	TOT	BAW	CL	TOT
20 Sep (1)	Larvin+ Karate	33	77	74	100	89	90	100	100	100	100	100	100	0	3	3
	Confirm	73	12	43	96	85	90	100	100	96	98	12	8	10		
29 Sep (2)	Larvin+Stryker	83	63	65	100	92	93	100	100	98	98	33	8	11		
	Confirm	0	61	59	0	86	84	100	100	97	97	0	8	8		
6 Oct (4)	Larvin+ Karate	75	81	79	100	95	97	100	100	100	100	18	14	18		
	Confirm	71	67	69	100	94	96	100	100	100	7	11	9			
Average over 3 treats ^a																
	Larvin+ Pyrethroid	64	74	73	100	92	93	100	100	99	99	17	8	9		
	Confirm	48	47	57	65	88	91	100	100	98	98	3	9	11		

^aNo significant differences between any of the treatment comparisons (t test, P=0.05)

Table 3. Confirm and Success evaluations on large broccoli, Yuma Valley, Fall 1997

Date	Treatment	% Larval mortality (Days After Treatment)												Diagnostic mortality (% dead larvae)			
		3 DAT				5 DAT				7 DAT				BAW	CL	TO	T
		BAW	CL	TOT	TOT	BAW	CL	TOT	TOT	BAW	CL	TOT	TOT				
1 Nov (12)	Success	-	96	96	100	100	100	100	-	-	100	100	100	-	30	30	30
	Confirm	-	70	70	93	93	93	93	-	-	100	100	100	-	30	30	30
1 Nov (13)	Confirm	100	39	44	100	83	84	84	100	91	92	92	92	0	9	8	8
	Confirm+ Ammo	20	87	63	63	100	78	78	81	100	89	89	89	6	40	20	20

Table 4. Comparison of Success and Lannate/Pyrethroid during lettuce stand establishment (pre-thinning), Yuma Valley, Fall 1997

Date (Test)	Treatment	% Mortality of small BAW (Hours after treatment)			Diagnostic mortality (%)	
		12 hr	36 hr	72 hr	Dead	Missing
4 Nov (14)	Lannate+Karate	73	95	95	50	50
	Success	66	91	97	45	47
18 Nov (15)	Lannate+Ammo	84	100	100	55	45
	Success	81	97	100	65	35
Average across both trials	Lannate+Pyrethroid	79	98	98	53	45
	Success	74	94	99	58	41

Table 5. Confirm and Success evaluations on small lettuce, thinning stage, Yuma and Gila Valleys, Fall 1997.

Date (Test)	Treatment	% Larval mortality (Days After Treatment)												Diagnostic mortality (% dead larvae)		
		1½ DAT			3 DAT			5 DAT			TOT					
		BAW	CL	TOT	BAW	CL	TOT	BAW	CL	TOT	BAW	CL	TOT			
Sep 29 (3)	Confirm	41	13	35	96	90	95	96	90	95	96	90	95	11	20	14
	Larvin/Strykr	93	0	88	98	100	98	100	100	100	100	100	100	9	0	8
11 Oct (6)	Confirm	88	-	88	92	-	92	100	-	100	100	-	100	16	-	16
	Larvin/Karate	71	-	71	86	-	86	93	-	93	93	-	93	16	-	16
11 Oct (7)	Success	100	100	100	100	100	100	100	100	100	100	100	100	56	25	52
	Larvin/Strykr	88	100	93	94	100	97	94	100	97	94	100	97	25	55	38
3 Oct (8)	Confirm/Karate	84	-	84	96	-	96	96	-	96	96	-	96	24	-	24
	Confirm/Strykr	80	-	80	95	-	95	98	-	98	98	-	98	57	-	57
Oct 16 (9)	Confirm	56	19	38	81	73	77	94	100	97	94	100	97	13	20	16
	Success	100	81	90	100	100	100	100	100	100	100	100	100	87	50	68

Table 6. Analysis of Confirm/Success evaluations across rate, volume and plant size, Post-thinning, Yuma and Gila Valleys, Fall 1997.

Date (Test)	Treatment (Rate, oz/acre)	% Larval mortality (Days After Treatment)												Diagnostic mortality (% dead larvae)							
		1½ DAT				3 DAT				5 DAT											
		BAW	CL	TOT	TOT	BAW	CL	TOT	TOT	BAW	CL	TOT	TOT		BAW	CL	TOT				
Oct 8 (5)	Confirm (8) Success (6)	47	14	31	68	84	14	68	95	86 ^a	94	11	29	16	95	100	100	42	22	40	
Oct 16 (9)	Confirm (6) Success (4)	56	19	38	77	81	73	77	94	100	97	13	20	16	100	100	100	87	50	68	
Oct 16 (10)	Confirm (8) Success (6)	50	18	29	71	83	64	71	92 ^b	77 ^c	82	33	18	24	100	100	100	82	67	79	
Oct 16 (11)	Confirm (8) Success (6)	40	29	32	73	100	65	73	100	76	82	40	18	23	100	100	94	94	88	57	65
Averaged over the 4 tests																					
	Confirm (8)	48	20	33	72	87	54	72	95	85	89	24	21	20							
	Success (6)	99	89	91	99	100	98	99	100	96	99	75	50	63							
<i>t</i>		14.2	9.3	13.3	10.8	2.9	3.2	10.8	2.8	2.1	2.3	1.7	1.3	1.9							
<i>Pr > t</i>		.0001	.0001	.0001	.0001	.06	.05	.0001	.07	.07	.06	.001	.03	.01							

^a Percent larval mortality had reached 100% by 7-DAT.

^b Percent larval mortality had reached 100% by 7-DAT.

^c Percent larval mortality had reached 82% by 7-DAT.

Table 7. Evaluation of Confirm and Success against Leafminer and thrips, Gila Valley, Fall 1997.

Treatment	Test	Lvs	Rate (oz)	Mean/leafminer adults/100 plants ^a		Mean / sticky trap / day ^b	
				Alive	Dead	Leafminer	Thrips
Confirm	9	4	6	18.0	1.5	1.8	5.5
Success			4	1.0	2.0	2.8	1.4

Confirm	10	8	8	49.0	4.0	2.2	6.2
Success			6	0.5	31.0	0.3	0.2

Confirm	11	12	8	18.0	3.0	3.0	12.4
Success			6	0.5	40.5	0.2	1.0

Average across the 3 tests							
Confirm	-	-	-	28.3	2.8	2.33	8.0
Success	-	-	-	0.7	24.5	1.1	0.9
	<i>t</i>			2.8	1.9	1.3	3.3
	<i>Pr>t</i>			0.05	0.10	0.25	0.03

^a Counts made by visual observation of plants at 2-d after treatment (2 reps of 100 plants / field)

^b Counts made from yellow sticky traps exposed for 5 days after treatment.