ARE THERE CRITICAL PERIODS OF CATERPILLAR DAMAGE TO BAY OF PLENTY KIWIFRUIT?

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Summary

In the Bay of Plenty, evidence from insecticide screening trials in 1975/76 and 1976/77 suggested caterpillars of *Stathmopoda skelloni* and the leafroller *Ctenopseustis obliquana* attacked kiwifruit (*Actinidia chinensis* var. *chinensis*) during specific periods of a season. Periods of serious fruit damage were reasonably distinct occurring soon after flowering, in January, in February (1975/76 only), and at harvest. An insecticide timing trial in 1976/77 applying phosmet before these periods reduced fruit damage to a level comparable with that of the recommended regular six-spray programme. Continuing trials based on these preliminary observations are necessary.

INTRODUCTION

Export kiwifruit must, by regulation, be free from insects or their damage. Much of the insect problem is due to caterpillars (Ferguson 1980) but spraying to prevent fruit damage was not practised until the late 1960's (Ford 1971) when two or three DDD sprays were applied in a season. This insecticide was superseded by organophosphates in the early 1970's and the frequency of application steadily increased over the years. By 1975 some orchards received as many as eight insecticide sprays a season for caterpillar control. Ford (1971), however, considered four sprays to be satisfactory.

More accurate timing of applications could reduce the number of sprays if generations of the main pests were distinct in the Bay of Plenty. In addition, the biological activity of an insecticide may be relatively longer on kiwifruit than other crops because of the increased initial deposit on the hairy fruit which is then reasonably well protected from rapid degradation (Love and Ferguson 1977).

The research reported here investigates the effect on fruit damage levels when insecticides were applied at specific times in the season.

METHODS

Unsprayed and sprayed fruit were sampled for larvae or their damage at three Tauranga orchards (sites 1, 2 and 6, Table 1) and three Te Puke orchards (sites 3, 4 and 5, Table 1). The season and cultivars are also shown in Table 1.

Between two and fifty single-vine replicates were used for each treatment. The sample unit was a fruit cluster and equal numbers were inspected from each side of the vine. The number of clusters examined was 6 per vine when there were 30 - 50 vines a treatment, 24 when there were 2-4, or 36 per vine from 6 vines. From December 1975 fruit clusters at site 1 were searched each month to the end of February. At sites 1 - 4 mid-January and early March assessments were made. After this, weekly observations were made until 16.4.76 at sites 1 to 3 (Tables 1 and 2). During 1976/77 fruit damage assessments were made in mid-January and at harvest.

At site 2, 1976/77, a trial was conducted on two-vine replicates comparing timed and routine insecticidal applications. The treatments and rates are shown in Table 3. Application was by motorized knapsack. Spraying dates are shown in Table 2 for each routine treatment. Applications were on 12/11, 8/12, 20/12 and 4/4 for the timed phosmet; and over flowering (23, 26/11,) 8/12, 1/2 and 4/4 for the timed *Bacillus thuringiensis* sprays. Routine sprayings followed MAF recommendations whilst dates

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for the timed treatments were based on the evidence from the previous year in conjunction with concurrent *C. obliquana* adult activity as indicated by molasses bait traps (Ferguson unpub.).

RESULTS AND DISCUSSION

On unsprayed vines leafroller larvae, mostly third and fourth instar *C. obliquana*, were observed damaging fruit on 22.12.75. By mid-January this damaged tissue had calloused at each site and was easily distinguished from fresh attacks which often had larvae present (Table 1). These larvae were mainly early-mid stages of *C. obliquana* and the native moth, *S. skelloni*; the same identification and damage classification was evident in January 1977 (Table 1). The occurrence of these two types of damage suggested that at least two sprays would be required between flowering and mid-January.

TABLE 1: Percentage of total larval damage calloused on unsprayed kiwifruit at various times during 1975-76 and 1976-77

Site No.*	Percentage larval damage calloused at:				
	14 - 20/1	1 - 3/3	13 - 16/4	harvest	(date)
1975-76					
1	76.5	78.3	100.0	97.9	(11/5)
2	39.4	97.8	100.0	99.7	(27/4)
3		100.0	100.0	98.2	(21/5)
4	14.3	100.0 +		90.3 + +	(10/5)
5		98.9**	100.0		
1976-77					
6	79.7			100.0	(9/5)
2	39.6			100.0	(14/4)
* site cvs: 1, 6 'Bruno'; 2 'Abbott'; 3, 4, 5 'Hayward'					
** 25 days post 2nd spray					
+ 10 days post 3rd spray					
+ + one 1° <i>Stathmopoda</i> sp. larvae 19 days post 8th spray, all other sites had leafroller larvae at all samples except 14 - 20/1					

Spraying in late December or early January at sites 1, 2 and 4 resulted in no fresh damage by mid-January. This indicated that the damage found on 1.3.76 in the sprayed treatment at site 3 (Table 2) occurred between flowering and the initial application on 7.1.76. More damage to sprayed fruit was evident in January 1976 at sites 1 and 4, with no post-flowering application, than at site 2 where more damage occurred in unsprayed plots (Table 2).

Therefore, spraying one week after flowering and again in late December - first week of January appeared critical. The need for a pre-flowering application (sites 2 and 4, Table 2) was not clear and may depend on larval density (Ford 1971).

Early in March there was some fresh damage at most sites, especially site 1 (Table 1). At this orchard dead larvae, mostly *C. obliquana*, were often found with fresh damage in treated, but not the control, plots. This suggests that an early February application was essential in 1976, as shown by the other sites (Table 2).

After the 1-3.3.76 sampling, no larvae were found on fruit during the subsequent weekly observations (Table 1). However, *C. obliquana* larvae were noted each week, at every site, on the leaves of the vines. Although adult *S. skelloni* were seen on the vines at site 2 on 2.3.76 no larval damage to fruit was subsequently observed at any site.

Fruit with larvae are not exportable. Their presence on unsprayed (Table 1) and some sprayed (sites 1, 3 and 4) fruit at harvest indicated that an insecticide application was required close to harvest in 1975-76. The absence of larvae on harvested fruit in the

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TABLE 2: Kiwifruit damaged by larvae at various times and sites during 1975-76 and 1976-77

Site No.*	Percentage larval damage at:								Spray dates	
	14 - 20/1		1 - 3/3		13 - 16/4		harvest			
	unsp.	sp.	unsp.	sp.	unsp.	sp.	unsp.	sp.		
1975-76										
1	32.3	7.4	34.4	1.9	37.1	3.6	55.3	18.4	22/12, 18/1, 23/2, 6/4, 22/4	
2	35.9	2.1	33.4	2.9	31.7	1.2	36.9	2.6	24/10, 5/12, 5/1, 2/2, 3/3, 2/4	
3			20.2	15.0	23.9	19.1	34.6	28.3	7/1, 21/1, 13/2, 6/4	
4	14.4	3.4	14.5+	2.2			4.3	1.0	15/10, 22/12, 20/1, 11, 20/2, 5, 21/3, 4, 14, 21/4	
5				10.3		5.4			15/12, 7/2	
1976-77										
6	8.7	1.0					4.3	0.3	9, 24/12, 27/1, 24/2, 24/3, 10/4	
2	25.0	0.9					33.7	1.9	12/11, 8/12, 5/1, 1/2, 2/3, 4/4	

* site cvs: 1, 6 'Bruno'; 2 'Abbott'; 3, 4, 5 'Hayward'

+ 10 days post 3rd spray

following year (Table 1) was probably because the fruit was picked on 14.4.77 which was prior to attack at site 2; and may have been due to the low density of larvae on site 6.

TABLE 3: Kiwifruit damaged by larvae at 17.1.77 (48 fruit clusters/treatment) and at harvest, 14.4.77 (422 fruit/treatment). Each percentage is an average of two vines

Treatment/rate per 100 l	Number of sprays	Percentage larval damage at:		
		17.1.77 clusters	17.1.77 fruit†	14.4.77 fruit
control	0	41.7 a	25.0 a	33.7 a
<i>B. thuringiensis</i> (timed) 4.8 g	5	22.9 ab	14.0 ab	14.9 b
<i>B. thuringiensis</i> (routine) 3.2 g	6	12.5 b	5.8 bc	9.2 bc
phosmet (timed) 112.5 g	4	6.3 b	3.3 bc	3.8 cd
phosmet (routine) 112.5 g	6	8.3 b	4.9 bc	4.2 cd
azinphos-methyl (routine) 50 g	6	2.1 b	0.9 c	1.9 d
CV%		37.1	34.1	21.2

* ANOVA of arcsin transformed data

† ►100 fruit per sample

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In the timed application trial phosmet applied pre- and post-flowering, late December and pre-harvest, gave fruit damage levels not significantly different from any routine schedule (Table 3). A timed phosmet spray was not applied in early February due to a relatively low moth density in bait traps during January and February (Ferguson unpub.) compared to other years. The inferior result at 17.1.77 from timed *B. thuringiensis* was due to the omission of the late December application which resulted in live larvae on fruit. There were no larvae observed in the *B. thuringiensis* routine treatment because a spray was applied about the "correct" time (5.1.77).

CONCLUSIONS

The answer to the title of this paper is affirmative but further investigations are required because there appears to be yearly variation in periods of fruit damage. This is especially true later in the season (see Ford 1971).

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