REDUCING INSECTICIDE USE IN PIPFRUIT: NELSON DEMONSTRATION TRIALS

D.M. SUCKLING¹, J.T.S. WALKER², and P.W. SHAW³

*DSIR Plant Protection
Christchurch¹, Havelock North², and Nelson³*

SUMMARY

Pheromone traps for four leafroller species placed around 10 pipfruit orchards in the Nelson district in 1988/89 and 1989/90 found large variations in male leafroller activity between properties. Three groups of orchards were defined from catches: a) low catches of all leafroller species throughout the season, b) low catches of all species up until Christmas, and c) high catches of one or more species throughout the season. In orchards with historically low trap catches intervals between insecticide applications in November and December were extended from the recommended 10-14 days, to 19-31 days. Fruit damage assessment confirmed the effectiveness of leafroller control under this programme. The risks of reducing insecticide usage in the absence of local pheromone trap data are discussed.

INTRODUCTION

Leafrollers are key quarantine pests for the export apple industry. Control of these insects in Nelson is generally achieved by the application of insecticides at 10-14 day intervals from early November to 2 or 3 weeks before harvest. DSIR pheromone traps were made available to selected Nelson pipfruit growers, for monitoring leafroller pests, with the aim of reducing the insecticide spray programme. Previous work on the DSIR Appleby Research Orchard had shown that a reduction of one or two applications in the November-December period resulted in no difference in the level of leafroller damage on harvested fruit (Suckling *et al* 1988). The aim of the work described here was to determine whether similar results could be achieved on commercial orchards.

The leafroller fauna of Nelson is dominated by *Epiphyas postvittana* (Walker) (lightbrown apple moth or LBAM) (DSIR unpublished data) and there is currently little problem with codling moth (*Cydia pomonella* L.). For this reason traps for codling moth were not generally incorporated in this programme.

MATERIALS AND METHODS

Locally manufactured triangular ("delta") sticky traps (28 cm long x 20 cm base x 15 cm x 15 cm) were baited with rubber caps dosed with sex pheromone. A full description of the traps appears elsewhere in this volume (Suckling and Shaw 1990).

Traps were placed at 1.5 m height in apple trees inside or on the perimeter of orchards at Lower Moutere (Orchards A, I), Tasman (B), Riwaka (C, E, F), Appleby (D), Waimea Plain (F), Waimea (G), Riwaka Valley (H), and Kina (J) to monitor moth populations. At most orchards, four LBAM traps were located around the perimeters of each block, and two in the centre, while two traps were operated for each native leafroller (three species) near each block. Two orchards (at Appleby and Waimea) were the exception, with three external traps being used for each of the four species. Caps were changed six-weekly, and sticky bases were changed monthly or more often if needed.

Pheromone traps for LBAM and native leafrollers were operated from November until the end of April or May depending on the latest harvest date. Results from the first year of trapping established differences in the leafroller fauna between orchards, which generally fell into three broad categories:

Proc. 43rd N.Z. Weed and Pest Control Conf. 1990: 306-310

- Low catches of all leafroller species throughout the season.
- Low catches of all species up to November-December, with higher catches thereafter.
- High catches of one or more species throughout the season.

These categories were chosen with the aim of simplifying the interpretation of trapping data for consultants and growers. A winter meeting was held with participating growers to describe the methodology for testing the effect on leafroller control of removing either one or two insecticide applications ("windows") from the spray programme on their orchard. The "windows" corresponded to early season troughs in flight activity recorded at some locations in the region (Suckling *et al* 1988). Trap catches (per trap.day) were plotted for presentation to growers after the first season of trapping. Growers maintained the use of pheromone traps for the second season, and followed a reduced insecticide programme on some part of their orchard, of their own choosing. DSIR recommendations on the size of test area were conservative (1 ha for the two "window" programme), but most participating growers reduced insecticide use over larger areas, in some cases over their entire orchards (Table 2). Trap catch data during the season were not recommended for use as the basis for reactive spraying by growers, as there is no known leafroller spray threshold. The absence of any moth activity in pheromone traps does not guarantee zero infestation risk.

Harvest data was collected in cooperation with packhouses, who recorded bin tallies and saved suspected leafroller damage for confirmation. Analysis of variance was performed on angular transformed percentage fruit damage to compare damage after one or two savings in spray application.

Fig. 1: Results from three Nelson pipfruit orchards (A, B, and C) with different levels of leafroller activity, according to pheromone traps operated by growers in 1988/89 and 1989/90. Mean daily catch in externally located pheromone traps of lightbrown apple moth (LBAM) and the most prevalent native leafroller (*Ctenopseustis obliquana* or *C. herana*) are shown.

RESULTS AND DISCUSSION

Weekly trap servicing was conducted by orchardists or their staff, except for Orchards D and G (operated by Ken Jeffery, Fruitfed Supplies Ltd.). The period of pheromone trapping in the first year varied between orchards, with an average period of 26 weeks (range 13-34 weeks). Several growers trapped until the end of April or later.

Results for all orchards cannot be presented in full here. Instead mean catch per trap.day for LBAM and the most abundant native leafroller are reported for the November-December and January-March periods (Table 1). Reductions in the number of insecticide applications are only being recommended during the November-December period, because moth activity during the January-March period represents a more significant threat to the harvest.

We have chosen three orchards as examples of the three different categories of leafroller pest status. Some orchards had very low populations of all leafroller species throughout both seasons (e.g. Orchard A, Fig. 1). Other orchards tended to have low catches of LBAM and native leafrollers in November-December, with higher catches thereafter (Orchard B) or had consistently high catches of LBAM and/or at least one species of native leafroller throughout the season (Orchard C).

TABLE 1: Seasonal leafroller catches (mean catch per trap.day) in pheromone traps at 10 Nelson orchards, from two to four traps outside each orchard. Only the most abundant native leafroller species is indicated.

Orchard	Year	LBAM trap catch		Native leafroller trap catch Species ¹	Native leafroller trap catch	
		Nov-Dec	Jan-Mar		Nov-Dec	Jan-Mar
A	1988/89	0.02	0.09	P. ex.	0.01	0.01
	1989/90	0.23	0.20	C. ob.	0.02	0.01
B	1988/89	0.28	2.05	C. ob.	0.40	0.77
	1989/90	0.61	0.63	C. ob.	0.08	0.05
C	1988/89	0.22	2.85	C. her.	0.16	0.13
	1989/90	0.54	1.19	C. her.	0.02	0.02
D	1988/89	0.11	0.98	C. ob.	0.18	0.22
	1989/90	0.52	2.14	C. her.	0.37	0.56
E	1988/89	0.10	0.52 ²	P. ex.	0.07	0.04 ²
	1989/90	0.60	1.43 ²	C. ob.	0.03	0.04 ²
F	1988/89	0.04	0.70	P. ex.	0.28	0.40
	1989/90	0.52	0.82	P. ex.	0.12	0.11
G	1988/89	0.55	2.58	C. her.	0.40	0.27
	1989/90	0.46	1.83	C. her.	0.03	0.07
H	1988/89	0.10	1.80	P. ex.	0.34	0.45
	1989/90	0.17	0.58	P. ex.	0.01	0.13
I	1988/89	0.07	0.21	C. ob.	0.00	0.02
	1989/90	0.26	0.23	C. ob.	0.01	0.00
J	1988/89	0.25	1.67	—	—	—
	1989/90	0.24	0.43	C. ob.	0.03	0.02

¹ Most abundant native leafroller (P. ex. = *Planotortrix excessana*; C. ob. = *Ctenopseustis obliquana*; C. her. = *Ctenopseustis herana*).

² Traps operated until mid February.

The generally low levels of native leafroller activity around most of the orchards confirmed earlier results for the Nelson district. However, trap efficiencies for the four species may be different. LBAM is known to be the most abundant species in Nelson, but traps for LBAM may also be more attractive. Hence while comparisons between equivalent pheromone trapping data sets for the same species are valid, comparisons between different species give only a guide to their relative abundance. Until relative trap efficiencies are known, caution should be used in interpreting pheromone trap data.

Major differences in the timing and size of peaks for particular species were evident between orchards (Fig. 1, LBAM at Orchards B and C). Not all orchards had concurrent reductions in trap catch of all species in November or December. Therefore district-wide recommendations for removal of insecticide applications in November or December derived from the use of pheromone traps in individual orchards appears risky. Pheromone traps also indicated differences between orchards in the abundance of males (and presumably the threat of leafroller damage) over the harvest period (Fig. 1, Orchard A compared to B and C).

Traps located outside orchard blocks caught significantly more LBAM per trap than those inside (data not presented) for Orchards C, F, J, and H. There was no difference between internal and external catches for Orchards A, B, E, and I which had very low LBAM catches. Locally important factors which could be expected to influence this result include block size, trap location, insecticide use, and the proximity and area of host plant vegetation. This type of result has led us to recommend a standardised procedure of locating traps near known alternative host plants outside the influence of insecticides, in order to reflect the highest risk of insect immigration.

Variation in trap catch at particular sites over the November-December or January-March periods can be expected between years (Table 1). Despite a reportedly high level of leafroller damage in the Nelson district in 1990 (J. Heaton pers. comm.), trap catches during the January-March period were not consistently higher than in 1988/89 (Table 1) or previous years (unpublished data). Leafroller damage was rare in all fruit from trial blocks, and was undetectable in some cases (Table 2). However, several orchardists were of the opinion that damage was generally worse than normal on their orchards in 1989/90, which may be reflected in individual results (e.g. Orchard J).

In the absence of adequate numbers of blocks treated with the standard programme, statistical comparisons have only been made between the blocks which received either one or two spray reductions (windows 1 or 2, Table 2). There was no

TABLE 2: Incidence of leafroller damage in relation to approximate orchard area and organophosphate insecticide spray programme in 1989/90, expressed as a percentage of the crop reaching the packhouse (assuming 2500 fruit per bin) for three varieties.

Orchard	Area (ha)	Length of interval		Total no. insecticide applications ¹	Leafroller damage		
		Window 1 Mid-Nov (days)	Window 2 Mid-Dec (days)		COP ²	Gala ³	GS ⁴
A	10	23	29	8	0.0008	—	0.0006
	5	23	—	9	0.0000	—	0.0008
B	36	22	29	7	0.0003	0.0212	0.0048
C	0.5	20	22	10	—	—	0.0000
	1	20	—	11	—	—	0.0000
D	15	25	26	10	—	0.0030	0.0051
E	2.5	22	20	7	0.0016	—	0.0046 ⁵
F	1	19	31	9	—	0.0004	0.0058
	5	—	31	10	0.0027	0.0076	0.0020
	1	—	—	11	0.0040	—	0.0010
G	8	21	—	13	0.0049	—	0.0055
H	12	26	28	9	0.0000	—	0.0003
		26	—	8	0.0004	—	0.0000
I	3	29	—	9	—	—	0.0017
J	20	21	34	7	0.0176	0.1580	0.0335

¹ Applied to 'Granny Smith' apples

² 'Cox's Orange Pippin' (mean = 244 bins per orchard)

³ 'Gala' or 'Royal Gala' (mean = 160 bins)

⁴ 'Granny Smith' (mean = 425 bins)

⁵ 'Braeburn'

difference in level of leafroller damage on 'Cox's Orange Pippin' apples harvested from blocks treated with either one or two fewer pre-Christmas insecticides than the standard programme (analysis of variance on transformed percentage leafroller damage fruit, $F_{1,7} = 0.27$). A similar conclusion was reached for 'Granny Smith' apples (Table 2) (analysis of variance on transformed percentage leafroller damaged fruit, $F_{1,11} = 0.74$). However, this analysis does not separate the effects of many other variables, such as different spray intervals, total number of organophosphate insecticides, use of carbaryl sprays, tree height and the pruning regime, all of which can affect leafroller control.

Trap data have been used here as the historical basis for indicating local leafroller population levels around particular orchards, rather than as the basis for spray decisions during the season. However, in future heavy moth catches could be used by orchardists as indicative of the need to exercise greater vigilance in leafroller control, for example by reducing spray intervals or by applying carbaryl between repeated selective picks. Reductions in insecticide without this information would clearly be risky, and orchardists would be advised to proceed cautiously without trapping data. Longer term changes in leafroller populations at particular sites are possible, and variations in weather patterns between years could be expected to change infestation risk. Pheromone traps would seem to offer orchardists a valuable tool for monitoring key pests, and providing them with ongoing information. Orchardists with consistently low trap catches (e.g. Orchard A) may in future be able to reduce spraying further.

The reduction in insecticide use by two applications represents a significant saving to orchardists, amounting to an average of 20-25% of insecticide material costs, depending on variety. This is likely to be a saving of \$50-60 per ha for each insecticide application. The cost-benefit of the trapping operation to the grower therefore appears positive.

ACKNOWLEDGEMENTS

Original funding for the development of the reduced insecticide programme was provided by the New Zealand Apple and Pear Marketing Board. Ken Jeffery kindly permitted us to include his trap data from two orchards.

REFERENCES

- Suckling, D.M. and Shaw, P.W., 1990. Preliminary trials of mating disruption of lightbrown apple moth in Nelson. *Proc. 43rd N.Z. Weed and Pest Control Conf.*: this volume.
- Suckling, D.M., Walker, J.T.S., Shaw, P.W. and White, V., 1988. Spray less for leafroller control. *The Orchardist of New Zealand November*: 21-24.