Wenatchee Valley Pear IPM Project (WVPP)
1999 Summary Report

Ted Alway, TC Alway Consulting, Peshastin, WA

Project Objective and Rationale

The Wenatchee Valley Pear IPM Project has the objective of demonstrating, in commercial orchards, the increased use of biological control of key pear pests to develop more effective and economical pear pest control programs. The need for such a program has been brought about by two principal factors: 1) the cost of effective pear pest control has risen greatly in recent seasons, due to new, more expensive pesticides, pest resistance and favorable conditions for pest development, and 2) new and increasing regulations regarding pesticide use and availability has increased the importance of creating effective pest control programs that rely less upon broad spectrum insecticides.

Pear orchards in the Wenatchee Valley have among the highest average pest control costs of the pear production areas in western North America. This is a result of several factors, including growing D'Anjou pears (a highly susceptible and vigorous cultivar), having conditions conducive to pear psylla development, having high and damaging levels of grape mealybug (rarely a pest in other regions), and growing pears in fairly extensive and contiguous areas. Many Wenatchee Valley pear orchards also have contact with or close proximity to native habitat, which can serve as a reservoir for key natural enemies. The successful use of biological control in pear pest management has been demonstrated on a limited scale by researchers in Wenatchee, WA, and Hood River and Medford, OR. Pear producers in the Okanagan Valley of British Columbia, Canada, use biological control effectively on an extensive, commercial scale. These examples serve as models and inspiration for the WVPP, but the successful integration of biological control needs to be demonstrated reliably and repeatedly in the Wenatchee Valley, a distinct region with its own particular conditions and challenges.

1999 was the first year of an anticipated three to four year project to develop and demonstrate this new pest control program. The Washington State Tree Fruit Research Commission, the Program for Strategic Pest Management (Pew Charitable Trust), and the Environmental Protection Agency provided funding for the first year. Additional grants are being sought for the coming years and the participating growers will be asked to pay a fee.

Participants

Fifteen growers participated in Year 1, providing 141 acres in 15 blocks (Table 1). These pear blocks are located throughout the Wenatchee Valley, from the western edge of the City of Wenatchee to just outside of Leavenworth. The blocks varied considerably in their surroundings (native vegetation vs. orchard, narrow canyon vs. extensive farmed area). D'Anjou pear was the cultivar sampled in each orchard. The fruit from these blocks went to six different fruit packers. Fourteen fieldmen participated in the WVPP, representing the six packers and two agrochemical distributors.

Sampling Methods and Reporting

Every block was sampled on a weekly basis, beginning in early March before the first sprays were applied, and continuing until early September, just prior to D'Anjou harvest. In addition, all blocks were sampled again in early October after harvest, resulting in 25 to 27 monitoring visits per block. The sample methods varied with the stage of development of the pests and crop. The sample data from each visit was recorded on a monitoring form and sent the same day to the grower and relevant fieldmen. This prompt turnaround time allowed the grower to closely monitor the development of pests and natural enemies and use the information in making pest control decisions. Ted Alway, WVPP coordinator, and Betsy Valdez, WVPP IPM technician, did all sampling. Sample methods and sizes closely followed those in the recently published "Orchard Pest Monitoring Guide for Pears".

Sample method	Timing	Targets
Beating tray	March-October	Psylla adults, natural enemies, true bug pests
Fruiting spur exam	March (3 exams)	Psylla eggs, Euro. red mite eggs, McDaniel mites
Flower clusters	April-early May (4-5)	Psylla eggs and nymphs, spider mites, rust mites, mealybug
Leaves	May-early September	Spider mites, predator mites, rust mites, psylla, mealybug
Fruitlets	May-early June (3-4)	Rust mite
Top shoots	June-early September	Psylla eggs and nymphs, mealybug, spider mites
Pheromone traps	May-September	Codling moth, pandemis and obliquebanced leafroller
Earwig traps	May-August	Earwigs (crumpled newspaper placed in tree crotch)

No pest control recommendations were provided by the WVPP. A monthly newsletter was sent to all participants, presenting information on pests, natural enemies, pest control options and WVPP developments. In addition, a lunch meeting and discussion was held each week with the participating fieldmen and guests. Two field sessions for growers and fieldmen were held in June to review sampling methods and identification of pear pests and natural enemies, and a field day was held in August to present information on the WVPP and the USDA cover crop management study.

1999 OBSERVATIONS

1999 was a cooler than normal season. Pear psylla pressure was above normal, while spider mite and codling moth pressures were generally reduced. A severe frost in early May reduced and marked the pear crop in many Wenatchee Valley orchards, including most of those in the WVPP; damage was so severe in two WVPP blocks that they were mostly unharvested.

<u>Spray Programs</u>

The growers managed their pest control programs using the sampling data and background information provided by the WVPP. All growers shared the interest in encouraging the development of more biological control in their orchards and had to balance this with the risk of pest-caused fruit damage. Consequently, no two blocks followed the same spray program, varying most widely in the approach used post bloom (Table 2). In general, they were in two groups: 1) "hard", those using a broad spectrum insecticide post bloom (AgriMek or Provado) for control of psylla and/or mealybug; 2) "soft", those not using these insecticides and relying instead upon one or several more selective pest control materials (Surround or kaolin, horticultural mineral oil and soap/wetting agent). "Hard" and "soft" are used because they are convenient terms, but they are also misnomers. All WVPP growers in 1999 followed softer pest control programs than in 1998 and made changes to reduce broad spectrum insecticide use.

Ten of the 16 blocks (one of the 15 orchards was divided to follow two separate programs) were soft blocks. Of these 10 soft blocks, 7 used AgriMek or Pyramite for psylla control in 1998. One of the soft blocks was in the sixth year of an organic management program, and a second block's acreage was in the third and fourth years of organic management.

After one season, several general observations on the spray programs can be made

1. Pesticide costs in hard blocks averaged $603/acre, $160 more than the soft block average of $443/acre (Table 3). 7 of the 8 least expensive programs were in soft blocks; the two organic blocks were the least expensive.
2. More pesticide applications were made in soft blocks (10.2 vs. 6.2), negating some of the cost savings.
3. Pest damage to fruit was almost entirely due to psylla; soft blocks averaged more than the hard blocks (Table 4).
4. Natural enemy populations were much higher in soft blocks. Deraeocoris was the most common psylla predator, and was found in 8 of 10 soft blocks (summer average of 0.34/tray) and only 1 of 6 hard blocks (average 0.01/tray) (Table 5). Natural enemy diversity was far higher in soft blocks, with twice as many natural enemy types per tray (2.8 vs. 1.4)(Table 6).

Many growers used more selective spray materials to control psylla and spider mites and to preserve natural enemies. Some observations on these materials:

<u>Sulfur</u>- used by many growers with oil in the delayed dormant for psylla control. Oil plus sulfur reduced psylla adult numbers on average 60-65%; the addition of Thiodan, or the use of oil plus Thiodan without sulfur, reduced psylla numbers 90-95%. Three WVPP growers applied sulfur or lime sulfur post harvest for psylla and rust mite control. One observation where sulfur was applied alone post harvest showed no change in psylla or Deraeocoris numbers with the spray. In another orchard, where micronized sulfur (16#ac) and oil (1.6 gal/ac) were applied, psylla reduction averaged 50%. However, counts of Deraeocoris and campylomma were reduced 60% and 80% respectively, with 0% to 20% drop in the control blocks.

<u>Codling moth mating disruption</u>- eleven of the 16 blocks used mating disruption in 1999, up from only 3 the previous year. Only one of these growers supplemented the pheromone with an insecticide for codling moth, applying Imidan once at a half rate. Two of the five blocks not using mating disruption sprayed for codling moth.

Surround (kaolin, "clay")- this new pest control technology received registration this year and was widely used in the Wenatchee Valley. One WVPP grower used it as the key part of his pre-bloom pest control program, with 4 applications (50#/ac) from the beginning of psylla egg lay until just prior to bloom. Psylla control was outstanding. Psylla adult counts were reduced from 16 to 0.1/tray, and the percent of infested clusters remained at 10% or below, versus 50-90% in the adjacent conventional control.

Five growers used Surround in the post-bloom period, with two to six applications. Rates ranged from 50 to 90 lbs./acre. There was a consistent reduction in psylla adult numbers with each application, but the percent of infested shoots and the numbers of psylla eggs and nymphs continued to increase unless applications were made every 7-10 days. Once applications ceased, psylla numbers again climbed. In the three blocks where Surround was used most frequently the counts of natural enemies, especially predatory bugs, were relatively low or zero despite abundant psylla. In addition, high spider mite populations developed in these blocks (5 –10+/lf. before miticides were applied). Of interest, there was little transpiration burn despite the high mite levels, perhaps due to the cooling effect of the kaolin.

Foliar oil- oil was applied post bloom as an insecticide in all 16 blocks. In the hard blocks it was applied 1 to 3 times in combination with AgriMek and/or Provado, at rates of 0.75 to 2.5 gpa. The soft blocks relied upon the oil itself as an insecticide and applied it 2 to 6 times. Rates were generally 1 to 1.5 gpa from mid May to mid July, and 2 to 2.5 gpa thereafter. Almost all applications were of the SafTSide formulation, containing 80% oil. No fruit marking related to oil sprays was found in any WVPP blocks.

Pear psylla populations were not clearly reduced by oil applications, measured as percent infested shoots or counts of eggs, nymphs and adults,. The rate of increase of psylla did appear to be reduced, when compared with untreated blocks at that time. Psylla nymphs counts did drop substantially in 4 of 6 cases when an oil spray closely followed a high volume application of a soap or wetting agent. Foliar oils appeared to have little or no effect on key psylla predators, as populations of Deraeocoris, campylomma and lacewings on average were unchanged or increased following an oil application.

Oil sprays regularly reduced spider mites. Counts from leaf samples showed that mite counts were lower over 70% of the time the week following an oil spray, with an average 55% decline in mite numbers. Predatory mites were not found consistently in most blocks but in the two blocks where higher numbers were counted it appeared that their numbers also declined with an oil spray.

Soap/wetting agent- these materials were applied at a high spray volume per acre (400 to 650 gpa) to wash small psylla nymphs and honeydew from the leaves. The most common material used was inexpensive laundry detergent without bleach, applied at 0.75-1.0 #/100gallons. One grower used high rates of the surfactant formulation Regulaid as a wetting agent. One grower applied detergent repeatedly in late June, targeting the young nymphs of the first summer generation of psylla; psylla numbers increased throughout the applications. Four other growers applied a detergent 1 or 2 days prior to an oil spray, and appeared to get greater psylla reduction from the oil. No reduction of spider mites or psylla predators was observed. Central to the effectiveness of the soap tree wash is the application of high water volume; 500 to 600 gpa is probably a minimum for summer applications on full sized pear trees.

The Pests

Pear psylla

Pear psylla is the principal pest in Wenatchee Valley orchards. Growers in this area have generally sprayed more often and spent more money on psylla control than other Western pear production areas. 1998 year was a difficult year for psylla control, with many growers having both higher fruit damage and greater control costs than in previous years. This scenario was repeated in 1999.

The effect of several soft materials was reviewed above. Esteem and Dimilin were used pre-bloom by WVPP growers for psylla control. Seven growers used both materials, three used Dimilin only, two Esteem only, and four used neither. This project was not designed to accurately evaluate their effectiveness; summer psylla populations had no apparent relationship to their pre-bloom use. AgriMek and Provado were the broad-spectrum insecticides used for psylla control. AgriMek applications soon after bloom provided only fair control for most growers and all growers using AgriMek returned with a second AgriMek or 1 to 2 Provado sprays. The AgriMek/Provado blocks did have, on average, less fruit marking from psylla than the soft blocks.

The primary objective of the WVPP is to develop substantial biological control of pear psylla. None of the six blocks using AgriMek and Provado developed significant populations of psylla predators. Deraeocoris and campylomma were never found in most hard blocks; the highest count of Deraeocoris was 0.2/tray (once), and the summer average of Deraeocoris and campylomma combined was less than 0.01/tray. In the soft blocks the summer combined average was 0.41/tray, with 7 of 10 blocks having tray counts of 0.4 or greater in the summer. The three soft blocks with the lowest natural enemy counts were either surrounded by orchard and/or had the least contact with large areas of native habitat.

There are examples in 1999 of psylla predators, often with help from 1 to 2 oil applications, causing large declines in psylla numbers. Three soft blocks (9903, 9906 & 9911) show big drops in August, with the percent of infested shoots dropping from 100% to 40%, 75% and 35% respectively. Counts of psylla adults were 20 to 40 per tray in early August in these blocks; by early September, adult numbers had declined 95% or more in each case, and psylla egg and nymph counts showed similar large drops. Deraeocoris had reached high numbers in these blocks by late August, with counts of 1 per tray or higher. Psylla numbers remained low in post harvest counts.

In contrast, the blocks with few or no psylla predators often showed large psylla increases late in the season. Post harvest numbers were 10 to 20 times higher in several cases (9907, 9908, 9910, 9914). However, there are exceptions to the above examples. 9915, a soft block, developed the highest Deraeocoris counts (2-3 per tray in the August and post harvest counts) yet psylla numbers declined only moderately in August and increased in the October count. In contrast, two hard blocks (9901, 9902), with few or no predators, showed only small increases in the post harvest psylla counts. Even with the fairly intense sampling of this project we cannot explain much of what we find!

Spider mites

European red mites were rarely seen in the WVPP blocks, but McDaniel or twospotted spider mites (TSSM) were common. Mite control was good in most cases, with growers relying upon AgriMek, Apollo/Savey or oil for control. Very high populations developed in three soft blocks, where mite numbers exceeded 5 per leaf (topping out at 12 and 16 per leaf in two cases!). Each of these blocks had relied upon Surround for summer psylla control and in each case, when foliar oil was later applied, mite numbers declined sharply.

Biological control of spider mites on pears has been rare in the Wenatchee Valley, due to a very susceptible cultivar (D'Anjou) and the use of pesticides that eliminate predator mites. Predator mites (*Typhlodromus)* were found in leaf samples from 10 blocks, but exceeded 0.1/leaf in only four blocks. They were found in pre-bloom cluster samples in two blocks (9904, 9913) where high numbers of overwintering TSSM were also found. Spider mite populations declined in these blocks and stayed low, with the only miticides being two summer oils. In 9915, spider mites remained at very low levels with one 4 oz. Apollo and two summer oils. The two organic blocks (9909, 9911) had low mite levels throughout the season, the only miticides applied being summer oils. Stethorus larvae, effective mite predators, were found in August in two soft blocks that developed high mite populations.

D'Anjou pear growers in the Okanagan of British Columbia generally apply fewer miticides, and at lower rates, than Wenatchee Valley growers. Predator mites have become fairly common in their orchards, with the limited use of disruptive pesticides. Studies there have shown that spring and summer herbicide applications will drive TSSM up into the pear trees; many growers try to limit herbicide application to the fall, and some have included a miticide in summer herbicide sprays (careful with label restrictions in the US!)

Grape mealybug

This is a very serious pest for an increasing number of growers in the Wenatchee Valley. Control has been based upon repeated applications of several broad-spectrum insecticides, the use of which eliminates the possibility of biological control of mealybug or pear psylla. There are many blocks that remain free of this pest and others in which it remains present at low, non-damaging levels. Biological control of mealybug has been observed in the area but can be difficult to develop. Serious fruit damage, beyond what many growers will tolerate, can occur for one or more years while the natural enemy populations increase and become established. Selective materials are needed to suppress mealybug without seriously harming mealybug predators and parasites.

Mealybug was monitored by cluster examinations in the weeks before and after bloom, by shoot exams in late May through August, and by fruit exams during harvest. Moderate to high populations were found in five WVPP blocks. Two hard blocks (9902, 9907) with mealybug had shoot infestations reach 50% and 75% respectively in mid summer. Treatment with Provado and Imidan or a high rate of Provado alone reduced the shoot infestation.

Infested fruit was common in 9902 (13%); no fruit sample was taken in 9907. Two soft blocks developed high mealybug populations, with 80-90% shoot infestation in 9904 and 55-75% infestation in 9905. No summer treatment was applied to either block and mealybug numbers declined in late August. Fruit exams were not done due to lack of fruit. 9906 had shoot infestations remain between 5% and 15% from late July to early September; no treatment was applied, and 7% of fruit was infested at harvest. Two other soft blocks had low levels of mealybug detected in cluster or fruit exams, and applied no treatment for this pest. In the soft blocks, with mealybug populations in 1999 and where few or no disruptive pesticides are applied, we will see whether natural enemies can reduce mealybug numbers and keep them at low levels. We will also investigate the use of selective pesticides to suppress mealybug without disrupting biological control.

<u>Pear rust mite</u>
Pear rust mite can be a serious pest where miticide use is eliminated. For many British Columbia pear growers using soft or organic pest management programs it has become a more serious pest than pear psylla or spider mites. In the WVPP blocks we examined flower spurs pre-bloom and fruitlets post-bloom for rust mite presence. We found rust mites only in the two organic blocks. In 9909, only one infested fruit was found in the last sample in early July. In 9911, under organic management for 6 years, fruit infestation increased from 10% to 50% in samples during June. No fruit damage from rust mite was noted at harvest. Rust mite may become more common in other soft blocks in Year 2 and beyond when miticide use is curtailed.

<u>Codling moth</u>
All blocks were monitored with pheromone traps at a density of one trap per 2 to 3 acres. Eleven of 16 blocks used mating disruption in 1999. One of the mating disruption blocks (9915) applied one half-rate Imidan spray for codling moth; the other blocks applied no codling moth sprays. Two of the non-mating disruption blocks (9906, 9913) applied Imidan for codling moth. Eight of the 16 blocks had very low codling moth catch in traps, with seasonal totals of 0 to 4 per trap (Table 8). Three blocks had high numbers of codling moth: 9904 (45/trap), 9906 (241/trap) and 9913 (50/trap). There was no fruit damage at harvest by codling moth in most blocks; 9906 had the only significant damage at 0.5%. Several blocks had limited hot spots of damage that were not detected by the pheromone traps or the harvest samples. This points out the importance of field observations of damage by codling moth and other pests to supplement sample data from pheromone traps and other methods.

<u>Leafrollers</u>
Each block had a pheromone trap for both pandemis (PLR) and obliquebanded leafroller (OBLR). PLR were trapped in all blocks and catches were higher in the lower Valley (Table 9). The highest catches occurred in 9905 (863/trap/season) and 9904 (708/trap). Ten of the 15 blocks had seasonal total catches below 100/trap, with three blocks below 20/trap. OBLR numbers were generally lower than those for PLR; 12 of 15 blocks had total catches below 100/trap, with nine blocks below 20/trap (Table 10). The two organic blocks, 9909 and 9911, stood out as having high OBLR catches, with 472/trap in 9909 and 221/trap in 9911. 9909 was the only block in which significant fruit damage from leafroller was found at harvest (2.2%); however, there was no fruit for harvest samples in the two highest PLR blocks (9904, 9905).

Pheromone traps for leafrollers are not as reliable indicators of damage potential as they are for codling moth. The trap information does indicate wide differences in populations and areas that should be closely monitored next year and/or treated with a Bt product next season, targeting the overwintering population shortly after bloom.

<u>Other pests</u>
True bug pests, including stink bugs, lygus bugs and box elder bugs, were found sporadically throughout the season in tray samples. These are highly mobile insects and no consistent catches were made. Harvest time fruit samples detected no damage from these bugs in all blocks except two. In these two blocks (9908 and 9909) damage was light (0.4%); both blocks are in narrow canyons and are bordered by extensive native habitat, where there is greater risk of damage from stink bugs and box elder bugs.

San Jose scale was not found in any blocks, despite a history in several of them. The insecticide Esteem was used in 9 WVPP blocks and is effective in controlling San Jose scale. San Jose scale and several true bugs are among several pests, including pear sawfly, pear slug, lesser appleworm and fruitworms, that may appear and become more serious problems in pear blocks as broad spectrum insecticide use is limited or eliminated.

Natural Enemies

Natural enemies include both predators and parasitoids that feed upon pest species. Fifteen different species or types of natural enemies were identified and counted in the WVPP in 1999:

Deraeocoris (*Deraeocoris brevis)*
Campylomma *(Campylomma verbasci)*
Anthocorids (including *Orius tristicolor* and Anthocoris spp.)
Damsel bugs (*Nabis* spp.)
Bigeyed bugs (*Geocoris* spp.)
Stilt bugs (Berytidae)
Green lacewings (Chrysopidae)
Brown lacewings (Hemerobiidae)
Snakeflies (Raphidiidae)
Earwigs (Forficulidae)
Lady beetles (Coccinellidae)
Black lady beetles or Stethorus (*Stethorus* spp. and others)
Syrphid flies (Syrphidae)
Spiders
Ants
Parasitic wasps

The most commonly found natural enemies in tray samples were Deraeocoris, campylomma, green lacewings, spiders and parasitic wasps.

Deraeocoris: Derries were the most frequently found psylla predator, and are among the most effective in controlling psylla. They overwinter as adults and were first found in the orchards in low numbers in mid to late April. Six of 16 blocks had derries present before bloom, increasing to seven blocks in June, eight in July and ten by the post harvest sample. In each case, all but one of the blocks was using a soft program. The average count of derries per tray in the late May to early September period was 0.34 in the soft blocks, and 0.004 in the hard blocks; the post-harvest average was 0.65 (soft) versus 0.03 (hard) (Table 5). Five soft blocks had counts exceed 1.0 per tray on two or more dates. In British Columbia derries are one of the top psylla predators, together with campylomma, anthocorids and earwigs. BC consultants have determined that derry counts of 0.5/tray and above indicate this predator is making a significant impact; counts above 1.0/tray often lead to sharp declines in psylla populations.

Campylomma: Campies are effective psylla predators that overwinter as eggs under the bark of twigs. Nymphs were first detected in WVPP pear blocks in mid to late May. Second generation nymphs were present mid July through August. They were absent from most blocks, being found in significant numbers (>0.2/tray for two or more weeks) in only four blocks, all soft (Table 5). Summer campylomma counts averaged 0.07/tray in soft blocks and 0.00/tray in hard blocks. The highest first generation counts occurred in two blocks that followed soft programs in 1998. Campies were found in only three blocks in post harvest counts.

Anthocorids: This group of true bug predators includes several species of *Anthocoris* and the minute pirate bug, *Orius tristicolor*. The anthocorids are effective psylla predators and more closely linked to psylla population development than perhaps any other predators. They may also be more sensitive to many pesticides than other predators. They were very rare in WVPP blocks in 1999 (only two finds!); their numbers may increase in the second and subsequent years of soft pest management programs.

Earwigs: These insects are the main summer psylla predators in many BC pear orchards, and feed on grape mealybug as well. They are active searchers and omnivorous but do not damage pear fruit. Earwigs were found in traps in 13 of the 15 WVPP pear blocks. None were trapped in two of the six hard blocks. In two August checks, the soft blocks averaged 28 per trap, and the hard blocks 8 per trap (Table 7). The long-term organic block averaged 100/trap in this period. Earwigs overwinter as females and eggs in the soil; the first generation nymphs move up into trees in the spring. The first earwig catches in the trees in WVPP blocks were made in early to mid June.

Lacewings: Lacewings, both green and brown, were found as adults and larvae in most blocks, with the numbers picking up considerably in late summer in several soft blocks. Most of the summer lacewing counts averaged little more than 0.1/tray, but several soft blocks had counts of 0.4-0.6/tray in mid-August and later. The first lacewings were detected in tray samples until three to four weeks after bloom. Snakeflies are lacewing relatives; they were never found in high numbers, typically 0.1/tray or less, but did appear in some orchards pre-bloom.

Lady beetles: These readily recognized predators were found infrequently in the pear blocks, but counts picked up in mid to late August in several soft blocks, particularly when psylla were abundant. They are not particularly effective psylla predators, being better adapted for feeding upon aphids. All species of lady beetles were grouped in our counts except for the Stethorus, or small black lady beetles, which were counted separately. Stethorus larvae were found in two blocks with high spider mite populations.

Spiders: All species of spiders were grouped together in our counts. Their impact upon pear pests, specifically psylla and mealybug, is unknown. They were counted because all spiders are predators and their abundance is an indication of the diversity within the orchard. Counts were higher in the soft blocks, but were generally 0.1 per tray or less through the season.

Parasitic wasps: These small parasitoids were also lumped together in our counts, and it is unknown if the majority of those found have an impact upon any of the key pear pests. The one exception is the tiny parasitoid *Trechnites*, which became very numerous in several blocks in August. The long-term organic block (9911) had counts of 1 to 2 per tray for many weeks, and 9904, which developed a very high psylla population after it was frosted out, had 8 to 12 *Trechnites* per tray for weeks in August. Parasitized psylla mummies were easily found on the shoots. Wasps were found in most post-bloom samples in the soft blocks, from <0.1 to 0.5/tray.

The diversity of natural enemies found in beating tray samples may indicate the potential for and extent of biological control taking place (Table 6). The average number of natural enemy types found, from the above list of 16 types, was 2.8/tray for soft blocks and 1.4/tray for hard blocks. The two organic blocks were higher still, averaging 4.0/tray in samples taken from late May to early September. The post-harvest counts were even more divergent, with 4.0 for all soft blocks and 1.5 in the hard blocks.

1999 is the first year of this multi-year project to develop more extensive use of biological control in Wenatchee Valley pear orchards. Natural enemy populations were increased in most soft blocks in 1999; in 2000, we need to determine whether they will persist and provide expanded control of pear pests. The BC pear pest management experience demonstrated that one to two years of transition were needed until biological control was well established, with pear orchards adjacent to native habitat developing natural enemy populations faster than those in the midst of farmed areas.

The complex of natural enemies will generally not be able to provide adequate pest control in pear orchards without help from other control methods. Likewise, selective pesticides, such as oil, soap and Surround, will often not control pear pests enough without help from predators and parasites. Creating this new, integrated approach to pest control may require more frequent and intensive orchard monitoring.

Each season, and each block, provides new and different challenges and opportunities for pest management. This program will be truly successful when it can demonstrate, in many blocks over several years, improved biological control resulting in clean fruit at less cost than the "conventional" alternative. Our work is cut out for us.

Table 1. 1999 WVPP pear blocks

Block	Location	Ac.	Cultivar	Surroundings	1998 Program	1998 AgriMek?	1998 CMMD?	1999 Program	1999 AgriMek?	1999 CMMD?
*9901-C	Wenatchee	4.0	D'Anjou	Orchard, bitterbrush; nearby river	Conventional	Yes	No	Conventional	Yes	Yes
*9901-S		1.0							No	Yes
9902	Monitor	13.0	D'Anjou	Orchard,bitterbrush	Conventional	Yes	No	Conventional	Yes	No
9903	Cashmere	12.0	D'Anjou	Pine, orchard; up narrow canyon	Conventional	Yes	No	Conventional	No	No
9904	Cashmere	5.0	D'Anjou	Orchard, pine, bitterbrush.	Conventional	(Yes- Pyramite)	No	Conventional	No	Yes
9905	Cashmere	7.0	D'Anjou	Orchard; very limited contact with bitterbrush	Conventional	(Yes- Pyramite)	Yes	Conventional	No	Yes
9906	Cashmere	9.0	D'Anjou	Pine; up canyon	Conventional	Yes	No	Conventional	No	No
9907	Dryden	11.5	D'Anjou	Orchard on all sides	Conventional	Yes	No	Conventional	Yes	No
9908	Dryden	12.0	D'Anjou	Orchard, pine; up canyon	Conventional	Yes	No	Conventional	Yes	Yes
9909	Peshastin	18.0	D'Anjou	Pine; up narrow canyon	Organic	No	Yes	Organic	No	Yes
9910	Peshastin	12.0	D'Anjou	Orchard	Conventional	Yes	No	Conventional	Yes	Yes
9911	Peshastin	5.0	D'Anjou	Surrounded by organic orchard	Organic	No	Yes	Organic	No	Yes
9912	Leavenworth	12.0	D'Anjou	Orchard, river bank	Conventional	Yes	No	Conventional	Yes	Yes
9913	Peshastin	9.0	D'Anjou	Pine, orchard; up canyon	Conventional	No	No	Conventional	No	No
9914	Peshastin	5.0	D'Anjou	Orchard	Conventional	Yes	No	Conventional	No	Yes
9915	Peshastin	5.0	D'Anjou	Pine, residences	Conventional	Yes	No	Conventional	No	Yes
		140.5 total				12 of 15	3 of 15		6 of 16	11 of 16

*9901-C = Conventional
9901-S = Surround use

Table 2. Spray programs for WVPP blocks, 1999

9901-Surround

Date	Material	Rate/ac	$	Total
3/8	Surround	50#	$30	*$30*
3/9	Surround	50#	$30	*$30*
3/14	Thiodan	3 qt	$28	
	Lorsban	2 qt	$18	
	Superior Oil	4 gal	$10	*$56*
3/20	Surround	50#	$30	*$30*
4/14	Surround	50#	$30	*$30*
4/28	Isomate C+	200 ties	$55	*$55*
5/10	Savey	8 oz	$88	
	Saf-T-Side oil	1.25 gal	$14	*$102*
6/23	Surround	50#	$30	*$30*
7/5	Surround	50#	$30	*$30*
8/9	Savey	6 oz	$66	
	SafTSide	1.9 gal	$23	*$89*
		1999 spray cost		***$482***
	No.sprays(@$15)	10	*$150*	*$632*

9901-Conv.

Date	Material	Rate/ac	$	Total
3/14	Lorsban	2 qts	$18	
	Thiodan	3 qts	$28	
	Esteem	1 Pint	$81	
	Superior Oil	4 Gals	$10	*$137*
4/14	Dimilin	3#	$96	
	Dithane	8#	$27	
	Imidan	5.5#	$39	
	Procure	8 oz	$27	*$189*
4/28	Isomate C+	200 ties	$55	*$55*
5/5	AgriMek	20 oz	$108	
	Saf-T-Side oil	1.25 gal	$14	
	NP 24	12 #	$18	
	Saf-T-Side	1.9 gal	$23	*$163*
6/23	Provado	10 oz	$41	
	Saf-T-Side	1.9 gal	$23	*$64*
7/8	Provado	10 oz	$41	
	Saf-T-Side	2.5 gal	$29	*$70*
8/9	Savey	6 oz	$66	
	SafTSide	1.9 gal	$23	*$89*
		1999 spray cost		***$767***
	No.sprays(@$15)	7	*$105*	*$872*

9902

Date	Material	Rate/ac	$	Total
3/19	Thiodan	3 qt	$28	
	Sulfur	15#	$13	
	Oil	4 gal	$10	*$51*
4/20	Dimilin	2.5#	$80	
	Surround	50#	$30	
	Procure	8 oz	$27	*$137*
5/24	AgriMek	20 oz	$108	
	Oil	1 gal	$3	*$111*
8/1	Imidan	7 #	$50	
	Provado	10 oz	$41	
	SafTSide	2.5 gals.	$29	
	MVP II	2 qts.	$17	
	NP 24	25#	$37	*$174*
		1999 spray cost		***$473***
	No.sprays(@$15)	*$4*	*$60*	*$533*

9903

Date	Material	Rate/ac	$	Total
3/30	Oil	5 gal	$12	
	Lime Sulfur	10 gal	$45	*$57*
4/8	Oil	2.5 gal	$6	
	Sulfur	12#	$10	*$16*
4/24	Dimilin	2.5#	$80	
	Oil	1 qt	$1	*$81*
5/19	Dithane	8#	$27	
	Nutra Phos 24	12.5#	$19	*$46*
6/14	Diatomac. Earth		$20	$20
6/21	Surround	50#	$30	$30
6/28	Surround	50#	$30	$30
7/12	Surround	50#	$30	$30
7/23	Surround	50#	$30	$30
7/30	Surround	50#	$30	$30
8/10	SafTSide	2 gal	$23	$23
8/18	SafTSide	2 gal	$23	$23
		1999 spray cost		***$416***
	No.sprays(@$15)	12	*$180*	*$596*

9904

Date	Material	Rate/ac	$	Total
3/29	Microthiol Sulfur	15#	$13	
	Oil	4.5 gal	$11	
	Esteem	1 pint	$81	*$105*
4/17	Dimilin 25W	2.5#	$80	
	Procure	8 oz.	$27	
	Dithane	8#	$27	*$134*
5/4	Isomate C+	200 ties	$55	*$55*
5/10	Dithane 25W	8#	$27	
	Sulfur	11#	$9	*$36*
5/21	Saf-T-Side oil	1.25 gal	$14	*$14*
7/26	Laundry deterg.	5#	$2	*$2*
7/27	SafTSide oil	2 gpa	$23	*$23*
		1999 spray cost		***$369***
	No.sprays(@$15)	7	*$105*	*$474*

9905

Date	Material	Rate/ac	$	Total
3/30	Oil	5 gal	$12	
	Esteem	1 pt	$81	
	Thiodan	3 qt	$28	
	Microthiol sulfur	15 lbs	$13	*$134*
4/21	Procure	8 oz	$27	
	Dithane	8#	$27	
	Dimilin	2.5#	$80	
	Imidan	5.5#	$39	*$173*
5/5	Isomate C+	200 ties	$55	*$55*
5/11	Imidan	5.5#	$39	
	Safe T Side Oil	1.25 gal	$14	*$53*
6/2	Surround	50#	$30	$30
6/9	Surround	50#	$30	$30
6/17	Surround	50#	$30	$30
6/28	Surround	50#	$30	$30
7/8	Surround	50#	$30	$30
7/27	Surround	50#	$30	
	Dipel	1.5#	$15	*$45*
8/13	Laundry deterg.	3#	$1	*$1*
8/16	Saf-T-Side oil	1.25 gal	*$14*	$14
		1999 spray cost		***$625***
	No.sprays(@$15)	12	*$180*	*$805*

9906

Date	Material	Rate/ac	$	Total
4/4	Oil	4.5 gals	$11	
	Esteem	16 oz	$81	
	Microthiol sulfur	15 lbs	$13	*$105*
4/24	Dimilin	2.5#	$80	
	Dithane	8#	$27	
	Procure	8 oz	$27	*$134*
5/23	Dithane	8#	$27	
	Nutra Phos 24	10#	$15	*$42*
6/15	Surround	90#	$54	*$54*
6/27	Surround	90#	$54	*$54*
7/10	Surround	90#	$54	*$54*
7/23	Surround	75#	$45	*$45*
8/5	Surround	75#	$45	*$45*
8/20	SafTSide oil	2 gals	$23	*$23*
8/28	SafTSide oil	1.5 gals	$18	
	Guthion	2#	$18	*$36*
		1999 spray cost		**$592**
	No.sprays(@$15)	*10*	*$150*	*$742*

9907

Date	Material	Rate/ac	$	Total
3/31	Esteem	16 oz	$81	
	Sulfur	15#	$13	
	Supreme oil	5 gals	$12	*$106*
4/22	Dimilin 25w	2.5lbs	$80	
	Procure 50WS	8oz	$27	
	Dithane DF	8lbs	$27	*$134*
5/19	Dithane DF	8lbs	$27	
	Nutra Phos 24	12.5 lbs	$19	*$46*
6/2	Saf-T-Side oil	1.25 gals	$14	*$14*
6/16	Surround	50#	$30	*$30*
6/27	Surround	50#	$30	*$30*
7/12	AgriMek	20 oz	$108	
	SafTSide oil	1.25 gals	$14	*$122*
8/11	Provado	20 oz	$82	
	Omni Oil	1.25 gal	$8	*$90*
		1999 spray cost		**$572**
	No.sprays(@$15)	*8*	*$120*	*$692*

9908

Date	Material	Rate/ac	$	Total
4/1	Oil	4 gals	$10	
	Thiodan 3 EC	3 qts	$28	
	Lorsban	2 qts	$18	
	Thiolux sulfur	12.5 lbs	$11	*$67*
4-21	Dimilin	2.5#	$80	
	Diazinon	3.75#	$19	
	Carzol	4 oz	$10	
	Oil	1 qt	$1	
	Procure	8 oz	$27	*$137*
4/30	Isomate C+	200	$55	*$55*
5/22	Agrimek	20 oz	$108	
	Dithane	3#	$10	
	Nutra Phos 24	12.5#	$19	
	Oil	3 qt	$2	*$139*
7/9	Agrimek	20 oz	$108	
	Oil	1 gal	$2	*$110*
		1999 spray cost		**$508**
	No.sprays(@$15)	*5*	*$75*	*$583*

9909

Date	Material	Rate/ac	$	Total
4/7	Oil	3 gal	$7	
	Sulfur	15 #	$13	*$20*
4/18	Oil	2 gal	$5	
	Sulfur	15 #	$13	*$18*
5/1	Surround	50#	$30	
	sulfur	6#	$5	*$35*
5/5	Isomate C+	200 ties	$55	*$55*
5/7	Saf-T-Side	1.25 gal	$14	$14
6/4	Saf-T-Side	1.25 gal	$14	$14
6/15	Saf-T-Side	1.25 gal	$14	$14
6/27	Saf-T-Side	1.9 gal	$22	$22
7/23	Saf-T-Side	1.9 gal	$22	$22
7/30	Saf-T-Side	1.9 gal	$22	$22
		1999 spray cost		**$236**
	No.sprays(@$15)	*10*	*$150*	*$386*

9910

Date	Material	Rate/ac	$	Total
4/3	Oil	4 gals	$10	
	Esteem	16 oz	$81	
	Thiodan 3 EC	3 qts	$28	
	Lorsban 4 EC	2 qts	$18	
	Microthiol Sulfur	10 lbs	$9	*$146*
4-19	Dimilin	2.5#	$80	
	Dithane	8#	$27	
	Carzol	1#	$40	
	Procure	8 oz	$27	*$174*
5/1	Isomate C+	200 ties	$55	*$55*
5/12	Dithane	8#	$27	
	Nutra Phos 24	12#	$18	*$45*
5/23	Agrimek	20 oz	$108	
	Saf-T-Side	1.25 gal	$14	*$122*
6/28	Provado	10 oz	$41	
	Saf-T-Side	1.9 gal	$22	*$63*
7/29	AgriMek	20 oz	$108	
	Saf-T-Side	2.5 gal	$29	*$137*
		1999 spray cost		**$742**
	No.sprays(@$15)	*7*	*$105*	*$847*

9911

Date	Material	Rate/ac	$	Total
3/26	Supreme oil	2 gal	$5	
	Sulfur	15#	$13	*$18*
4/7	Supreme oil	2 gal	$5	
	Sulfur	15#	$13	*$18*
4/20	Surround	50#	$30	$30
5/2	Isomate C+	200 ties	$55	*$55*
6/15	Saf-T-Side	2 gal	$23	$23
6/30	Surround	100#	$60	$60
7/14	Surround	75#	$45	$45
7/29	Saf-T-Side	1.5 gal	$17	$17
8/7	Saf-T-Side	1.5 gal	$17	$17
8/16	Saf-T-Side	1.5 gal	$17	$17
		1999 spray cost		**$300**
	No.sprays(@$15)	*10*	*$150*	*$450*

9912

Date	Material	Rate/ac	$	Total
4/4	Thiodan	3 qts	$28	
	Lorsban 4EC	2 qts	$18	
	Esteem	1 pt	$81	
	Supreme Oil	4 gal	$10	$137
4/18	Procure	8 oz	$27	
	Dithane	8#	$27	
	Carzol	1#	$40	$94
5/1	Isomate C+	200	$55	$55
5/10	Agrimek	20 oz	$108	
	Saf-T-Side oil	1.25 gal	$14	$122
7/2	Provado	10 oz	$41	
	Saf-T-Side oil	1.9 gal	$22	$63
8/18	Provado	13 oz	$53	
	SafTSide oil	2.5 gal	$29	$82
		1999 spray cost		$653
	No.sprays(@$15)	6	$90	$643

9913

Date	Material	Rate/ac	$	Total
4/1	Lime sulfur	7 gal	$32	
	oil	3 gal	$8	$40
4/20	Morestan	4#	$84	$84
5/20	Dithane	10#	$33	$33
6/15	Imidan	5#	$36	
	Dithane	10#	$33	$69
7/20	Regulaid	1.5 gal	$42	$42
7/23	SafTSide	5 gal	$58	$58
8/6	Regulaid	1 gal	$28	$28
8/9	SafTSide	2.5 gal	$29	$29
8/26	Regulaid	1.5 gal	$42	$42
		1999 spray cost		$425
	No.sprays(@$15)	7	$105	$530

9914

Date	Material	Rate/ac	$	Total
4/1	Thiodan	3 quarts	$28	
	Lorsban	2 quarts	$18	
	Esteem	1 pint	$81	
	Microthiol Sulfur	15#	$13	
	Oil	3.75 gal	$9	$149
4/23	Dithane	8#	$27	
	Procure	8 oz	$27	
	Carzol	8 oz	$20	$74
5/1	Isomate C+	200 ties	$55	$55
5/14	Dithane	9#	$30	
	Nutra Phos 24	12.5#	$19	
	Procure	8oz.	$27	$76
5/24	SafTSide	1.25 gal	$14	$14
6/11	SafTSide	1.25 gal	$14	$14
6/23	Laundry deterg.	4.5#	$1	$1
7/5	SafTSide	1.5 gal	$17	$17
7/14	Laundry deterg.	4.5#	$1	$1
7/16	SafTSide	2.5 gal	$29	$29
7/31	SafTSide	2.5 gal	$29	$29
		1999 spray cost		$459
	No.sprays(@$15)	11	$165	$624

9915

Date	Material	Rate/ac	$	Total
4/1	Volck oil	5 gals	$12	
	Thiodan 3EC	2.5 qts	$23	
	Microthiol sulfur	15 lbs	$13	
	Esteem	16 oz	$81	$129
4/20	Dimilin	2.5#	$80	
	Procure	8 oz	$27	
	Volck Oil	1 qt	$1	$108
5/1	Isomate C+	200 ties	$55	$55
5/20	Dithane	9#	$30	
	Nutra Phos 24	12.5#	$19	$49
6/14	Imidan 70W	2.75#	$20	
	Apollo	4 oz.	$44	
	Vendex	1.25 #	$33	$97
6/19	Laundry deterg.	4#	$1	$1
6/24	Laundry deterg.	4#	$1	$1
6/29	Laundry deterg.	4#	$1	$1
7/6	Saf-T-Side oil	1.5 gal	$17	$17
7/27	Saf-T-Side oil	1.5 gal	$17	$17
8/2	Laundry deterg.	4#	$1	$1
8/3	Saf-T-Side oil	2.25 gal	$26	$26
8/10	Saf-T-Side oil	2.25 gal	$26	$26
		1999 spray cost		$528
	No.sprays(@$15)	13	$195	$723

Table 3. Spray program costs and number of sprays

Hard spray program blocks in BOLD (6 blocks)
Soft spray program blocks in ITALICS (10 blocks)

GROWER	Spray cost	Applications	App. Cost (No. apps*$15)	*Total*
9901-S	*$482*	*10*	*$150*	*$632*
9901-C	**$767**	**7**	**$105**	**$872**
9902	**$473**	**4**	**$60**	**$533**
9903	*$416*	*12*	*$180*	*$596*
9904	*$369*	*7*	*$105*	*$474*
9905	*$625*	*12*	*$180*	*$805*
9906	*$592*	*7*	*$150*	*$742*
9907	**$572**	**8**	**$120**	**$692**
9908	**$508**	**5**	**$75**	**$583**
9909	*$236*	*10*	*$150*	*$386*
9910	**$742**	**7**	**$105**	**$847**
9911	*$300*	*10*	*$150*	*$450*
9912	**$553**	**6**	**$90**	**$643**
9913	*$425*	*7*	*$105*	*$530*
9914	*$459*	*11*	*$165*	*$624*
9915	*$528*	*13*	*$195*	*$723*
Average	$503	8.5	$130	$633

	Avg. cost	Avg. no. apps.	Avg. app. cost	Avg. total cost
Soft	$443	10.2	$153	$596
Hard	$603	6.2	$93	$695

GROWER	Spray cost
9909	*$236*
9911	*$300*
9913	*$345*
9904	*$369*
9903	*$416*
9914	*$459*
9902	**$473**
9901-S	*$482*
9908	**$508**
9915	*$528*
9912	**$553**
9907	**$572**
9906	*$592*
9905	*$625*
9910	**$742**
9901-C	**$767**

GROWER	Applications
9902	**4**
9908	**5**
9912	**6**
9901-C	**7**
9904	*7*
9910	**7**
9913	*7*
9907	**8**
9906	*10*
9901-S	*10*
9909	*10*
9911	*10*
9914	*11*
9903	*12*
9905	*12*
9915	*13*

Table 4. Fruit damage at harvest

		% Damage							
GROWER	Fruit	PP	GMB	SJS	PRM	CM	LR	SB	Comment
9901-S	250	0.0%							
9901-C	400	0.5%							
9902	2400	0.3%	12.9%						CM- 3 stings N hillside border
9903	2350	9.4%				0.1%	0.1%		CM - more damage across the creek
9904	0								No assessment - too few fruit due to spring frost
9905	0								No assessment - too few fruit due to spring frost
9906	1600	20.1%	6.9%			0.5%			OW TSSM found on fruits
9907	0								No samples taken - failed to get to block during harvest
9908	250	1.2%	0.4%				0.4%	0.4%	
9909	1000	3.4%					2.2%	0.4%	
9910	1800	15.0%				0.2%			CM - hot spot right below ditch in center
9911	700	31.9%							
9912	1200	13.8%							
9913	250	47.2%	0.8%						Sampled only West end of block; other end less psylla
9914	700	6.1%				0.01%			CM near ctr. of block and along road
9915	600	38.0%	0.2%						
Soft		19.5%							
Hard		5.1%							

		Damage Determination
PP	Pear Psylla	cumulative light russet covering 3/4" circle or more
GMB	Grape Mealybug	mealybugs found on fruit
SJS	San Jose Scale	scale or red marks found on fruit
PRM	Pear Rust Mite	russeting in calyx end
CM	Codling Moth	stings or entries
LR	Leafroller	feeding damge on fruit
SB	Stink Bug	feeding depressions and white corky area below skin

Table 5. Deraeocoris and campylomma

	Avg. Der./tray (5/31-9/6)	Der./tray post harvest	Der./tray High count		Avg. Camp./tray (5/31-9/6)	Camp./tray post harvest	Camp./tray High count
9901-S	0.00	0.1	0.0	*9901-S*	0.00		0
9901-C	0.00	0.0	0.0	**9901-C**	0.00		0
9902	0.00	0.0	0.0	**9902**	0.00		0.03
9903	0.47	0.8	1.3	*9903*	0.00		0
9904	0.90	1.2	5.6	*9904*	0.05		0.4
9905	0.01	0.0	0.0	*9905*	0.01	0.6	0.2
9906	0.40	0.7	1.4	*9906*	0.00		0.04
9907	0.00	0.0	0.0	**9907**	0.00		0
9908	0.00	0.2	0.0	**9908**	0.00		0
9909	0.14	0.4	0.4	*9909*	0.11		0.7
9910	0.02	0.0	0.2	**9910**	0.00		0.04
9911	0.35	1.1	1.8	*9911*	0.03		0.2
9912	0.00	0.0	0.0	**9912**	0.00		0
9913	0.13	0.0	0.6	*9913*	0.46	0.2	1.1
9914	0.08	0.4	0.3	*9914*	0.00		0.04
9915	0.94	1.8	4.0	*9915*	0.07	1.1	0.2
Average				Average			
Soft	*0.34*	*0.65*	*1.54*	*Soft*	*0.07*	*0.19*	*0.29*
Hard	**0.004**	**0.03**	**0.05**	**Hard**	**0.000**	**0.00**	**0.01**

Table 6. Natural enemy diversity

	Natural enemy types per tray (5/31-9/6)	post harvest	High count
9901-S	1.4	5	3
9901-C	1.6	3	4
9902	1.6	1	3
9903	3.7	4	7
9904	3.5	3	6
9905	0.9	4	3
9906	2.1	2	5
9907	1.4	1	3
9908	1.5	3	4
9909	4.1	5	6
9910	1.4	0	3
9911	3.8	5	6
9912	0.7	1	2
9913	3.4	4	6
9914	2.3	3	4
9915	3.2	5	5
Average			
Soft	*2.84*	*4.00*	*5.10*
Hard	**1.38**	**1.50**	**3.17**

Natural enemy types:

Deraeocoris	Damsel bug
Campylomma	Berytid
Anthocorid	Parasitic wasp
Lady beetle	Ant
Stethorus	Spider
Green lacewing	Earwig
Brown lacewing	Syrphid
Snakefly	

Table 7. Earwigs

Block	Avg./trap
9901-C	0
9902	3
9903	3
9904	19
9905	20
9906	9
9907	35
9908	0
9909	5
9910	3
9911	100
9912	4
9913	42
9914	26
9915	30
	Avg.
Soft	28
Hard	8

Crumpled newspaper placed in tree crotch, 4 trees per block.

Began monitoring 5 blocks mid May; first earwigs in paper mid June.
For above data, examined papers 8/2, 8/17.

Table 7. Codling moth catches

Week of	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
03-May	0		0		0										
10-May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17-May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24-May	0	0	7	9	0	127	12	0	0	2	0	1	25	0	0
31-May	1	0	10	9	0	86	3	0	0	1	1	1	34	2	1
07-Jun	0	0	0	4	0	21	3	0	0	2	0	0	11	0	0
14-Jun	0	0	1	1	0	30	6	2	0	5	0	2	15	0	1
21-Jun	1	0	4	6	0	26	14	0	0	4	0	5	3	4	0
28-Jun	1	0	0	27	0	11	1	0	0	11	0	0	1	7	0
05-Jul	0	0	0	14	0	13	5	0	0	6	0	1	7	9	2
12-Jul	0	0	0	8	0	18	5	1	0	10	0	0	13	7	1
19-Jul	0	0	2	8	0	17	2	0	0	1	0	0	19	2	2
26-Jul	0	0	0	1	0	14	0	0	0	1	0	0	2	1	0
02-Aug	0	0	0	0	0	49	2	0	0	0	0	0	7	0	0
09-Aug	0	0	2	0	0	111	3	0	0	2	0	1	3	1	0
16-Aug	0	0	5	1	0	121	0	0	0	0	0	0	5	0	0
23-Aug	0	0	10	2	0	63	1	0	0	0	0	0	4	0	0
30-Aug			3	0	0	15	0	0	0	0	0	0	0	0	0
06-Sep			2	0				0	0	0	0	0	0	1	0
Total	3	0	46	90	0	722	57	3	0	45	1	11	149	34	7
# of traps	2	3	3	2	3	3	4	4	4	4	2	4	3	2	2
Avg./trap	2	0	15	45	0	241	14	1	0	11	1	3	50	17	4
MD	*Y*	*N*	*N*	*Y*	*Y*	*N*	*N*	*Y*	*Y*	*Y*	*Y*	*Y*	*N*	*Y*	*Y*

Table 9. Pandemis leafroller catches

Week of	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
07-Jun	0	0	0	0	0	0	0	0		0	0	0	0	0	0
14-Jun	18	22	0	46	7	0	14	0	0	0	0	0	0	0	2
21-Jun	9	5	1	104	24	0	40	0	0	0	0	0	0	0	0
28-Jun	8	2	6	94	94	7	30	0	10	0	0	1	1	0	1
05-Jul	4	2	3	94	74	3	22	0	2	0	1	0	7	1	2
12-Jul	1	0	4	25	116	0	1	0	1	0	0	0	0	0	2
19-Jul	3	3	3	64	93	0	1	0	0	0	0	0	0	0	6
26-Jul	3	4	3	62	94	1	2	3	1	1	0	1	0	3	3
02-Aug	4	5	13	31	87	9	3	4	1	0	0	3	1	4	8
09-Aug	6	0	23	14	85	5	7	6	1	0	0	4	1	0	4
16-Aug	18	6	14	2	107	2	0	18	2	0	1	11	0	1	8
23-Aug	15	5	31	34	46	4	2	8	3	0	4	5	1	0	3
30-Aug	54	31	31	90	36	1	8	10	0	0	3	8	3	4	13
06-Sep			9	48					1	2	1		0	7	19
Total	143	85	141	708	863	32	130	49	22	3	10	33	14	20	71

Table 10. Obliquebanded leafroller catches

Week of	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
07-Jun	0	0	0	0	0	0	0	0		0	0	*0*	0	0	0
14-Jun	1	1	0	0	0	1	0	0	0	0	46	*0*	0	0	0
21-Jun	0	0	0	0	0	0	0	0	0	0	24	*0*	0	0	0
28-Jun	0	0	0	0	1	0	0	0	0	0	47	*0*	0	0	0
05-Jul	3	0	0	0	1	3	1	6	66	0	29	*0*	0	2	0
12-Jul	0	0	0	0	0	0	0	0	30	0	18	*0*	1	0	1
19-Jul	1	6	2	0	2	6	0	0	65	0	13	*0*	9	0	0
26-Jul	1	5	0	0	1	1	0	0	127	0	0	*0*	11	0	0
02-Aug	5	9	2	0	0	19	0	2	69	0	0	*0*	10	0	0
09-Aug	10	0	1	0	0	0	0	0	88	0	0	*0*	1	0	0
16-Aug	12	1	0	0	0	0	0	0	21	0	1	*0*	0	0	0
23-Aug	11	0	0	0	0	1	0	0	2	0	0	*0*	1	0	0
30-Aug	9	0	0	1	0	2	0	1	2	0	6	0	4	0	0
06-Sep			0	0	0				2	0	6	0	0	0	0
Total	53	22	5	1	5	33	1	9	472	0	221	0	37	2	1

Table 11. Pear psylla adults per tray

	1-con.	1-Sur.	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Week of	Ppa	Ppa	Ppa	Ppa	Ppa	Ppa	Ppa	Ppa	Ppa	Ppa	Ppa	Ppa	Ppa	Ppa	Ppa	Ppa
10-May	0.1	0.0	1.5	1.6	1.6	0.4	**1.7**	0.8	0.4	**1.7**	0.1	0.0	0.1	0.6	0.2	0.1
17-May	0.1	0.0	0.7	1.2	1.7	0.3	**1.8**	0.3	0.2	1.1	0.3	0.1	0.1	0.6	0.3	0.3
24-May	0.1	0.1	0.8	0.2	2.6	5.3	0.9	5.1	0.0	0.2	1.5	3.2	6.7	0.0	0.6	1.3
31-May	0.8	0.5	1.3	5.3	**17.1**	9.6	**21.5**	**16.5**	1.7	4.1	4.8	4.8	6.6	1.3	6.5	4.0
07-Jun	1.0	1.0	1.5	**17.1**	**17.3**	7.7	**22.4**	9.8	2.2	8.1	6.2	3.1	3.7	3.4	3.4	2.3
14-Jun	0.4	0.4	0.7	2.7		2.4	**15.4**	11.2	0.2	7.9	3.8	3.4	2.3	3.9	2.7	2.1
21-Jun	0.5	0.9	1.8	**19.6**	11.7	2.1	**38.7**	12.4	1.1	10.5	5.8	10.0	4.4	**24.2**	1.4	3.6
28-Jun	0.1	0.2	2.9	**27.7**	**41**	1.3	**30.2**		1.3	14.4	8.6	11.7	5.5	**19.2**	2.2	6.2
05-Jul	0.3	0.0	0.4	8.1	14.2	8.1	**21.6**	3.2	0.3	8.0	0.1	4.3	0.0	13.0	1.1	2.8
12-Jul	0.0	0.5	0.4	5.3	**25.1**	4.2	**18.8**	3.1	0.0	5.2	2.0	10.8	0.5	**16.3**	1.3	10.2
19-Jul	0.5	0.3	1.6	**15.6**	**144.4**	7.1	**40.4**	3.7	0.2	10.3	3.4	**35.7**	4.6	11.0	12.1	7.8
26-Jul	0.4	0.3	2.8	7.7	**62.6**	14.0	**32.1**	1.6	0.3	7.7	14.0	11.9	1.2	**26.9**	4.0	13.5
02-Aug	0.1	0.1	2.0	7.2	**65.0**	14.8	**29.6**	2.9	0.1	11.3	9.3	**16.9**	2.7	**18.6**	5.1	**25.0**
09-Aug	0.4	0.1	0.1	**21.1**	**76.8**	10.3	**16.9**	0.1	0.5	8.8	6.0	**38.5**	3.7	**38.4**	6.5	**16.2**
16-Aug	0.5	0.4	0.1	**18.9**	**86.4**	7.4	**16.5**	0.2	0.6		1.0	9.8	0.1	**23.5**	1.6	10.8
23-Aug	1.0	0.4	0.5	7.9	**67.0**	**15.2**	14.4	0.2	0.0	7.9	0.8	3.0	0.0	**17.2**	1.8	11.3
30-Aug	2.0	0.2	0.8	2.6	**43.6**	**29.4**	4.9	0.5	0.8	3.6	1.3	1.5	0.0	8.8	2.0	8.2
6-Sep				1.5	**50.4**		2.3			4.1		0.7		7.3	1.6	13.7
4-Oct	*6.2*	*1.9*	*1.0*	*1.0*	*8.3*	***20.7***	*4.0*	*8.6*	*8.3*	*2.5*	***30.8***	*1.4*	*4.4*	***11.0***	***18.8***	***24.8***

Table 12. Deraeocoris per tray (note: blanks are zeroes)

	1-con.	1-Sur.	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Week of	Der.	Der.	Der.	Der.	Der.	Der.	Der.	Der.	Der.	Der.	Der.	Der.	Der.	Der.	Der.	Der.
10-May				0.10				0.05								0.08
17-May											0.04					
24-May										0.03						0.04
31-May				0.10	0.04		0.04			0.03						
07-Jun				0.06		0.04	0.08									
14-Jun																
21-Jun				0.10	0.08					0.02						
28-Jun			0.03	0.03	0.40		0.50			0.10				0.14		0.10
05-Jul				0.10	0.12		0.12			0.20	0.20			0.08		0.08
12-Jul				**1.30**	0.20		**0.60**			0.10	0.08			0.20		0.20
19-Jul				**0.90**	0.40	0.04	0.20	0.04		0.15		**0.60**			0.20	0.10
26-Jul				**0.60**			0.30			0.10		0.20		0.04	0.10	0.20
02-Aug				0.40	**0.80**		0.40			0.09		0.30				**1.50**
09-Aug				**0.60**	0.30		0.30			0.20		0.10		0.04	0.04	0.30
16-Aug				0.40	0.40		**1.30**					0.40		0.30	0.30	**4.00**
23-Aug				**0.60**	**1.20**		**1.40**			0.40		0.40		0.30	0.20	**2.40**
30-Aug				**0.80**	**3.90**		0.40			0.40		**1.40**		**0.60**	0.20	**2.70**
06-Sep				**1.10**	**5.60**		0.30			0.30		**1.80**		0.30	0.10	**2.50**
4-Oct		*0.1*		***0.8***	***1.2***		***0.7***		*0.2*	*0.4*		***1.1***		*0.0*	*0.4*	***1.8***

Table 13. Campylomma per tray (note: blanks are zeroes)

	1-con.	1-Sur.	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Week of	Camp.	Camp.	Camp.	Camp.	Camp.	Camp.	Camp.	Camp.	Camp.	Camp.	Camp.	Camp.	Camp.	Camp.	Camp.	Camp.
10-May																
17-May																
24-May											0.04					
31-May										0.20	0.04			0.80		0.04
07-Jun										0.30				0.10		0.04
14-Jun							0.04			0.09				0.50		
21-Jun														0.04		
28-Jun														0.08		
05-Jul																
12-Jul																
19-Jul										0.70		0.04		0.20		0.08
26-Jul					0.07									1.10		0.10
02-Aug										0.06				1.10		0.10
09-Aug												0.20		0.80		0.08
16-Aug												0.04		1.10		0.20
23-Aug														0.50		0.20
30-Aug			0.03		0.30	0.20				0.20		0.04		0.40		0.10
06-Sep					0.40					0.10		0.10		0.20	0.04	0.10
4-Oct						*0.6*								*0.2*		*1.1*

Table 14. Twospotted spider mites (motile forms) per leaf (note: blanks are zeroes)

	1-con.	1-Sur.	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Week of	TSMm	TSMm	TSMm	TSMm	TSMm	TSMm	TSMm	TSMm	TSMm	TSMm	TSMm	TSMm	TSMm	TSMm	TSMm	TSMm
03-May	0.0	0.0	0.0		1.6	0.08	0.08			0.08		0.00	0.08	0.08	0.3	0.1
10-May					1.2	0.04			0.00		0.04		0.08	0.1	0.2	0.1
17-May					0.9		0.04	0.04						0.04	0.9	0.08
24-May				0.04	0.9		0.1								0.04	0.04
31-May					0.04	0.06	0.4								0.04	0.08
07-Jun				0.04	0.2		0.3	0.08		0.04					1	0.04
14-Jun					0.04										0.2	0.04
21-Jun						0.04	0.4	0.2						0.3	0.1	0.04
28-Jun						0.12	0.2	0.04		0.3					1.6	
05-Jul				0.04		0.3	0.4	0.08		0.2	0.04			0.04	2.4	
12-Jul				0.08		0.4	0.3	0.2		0.1					3.6	
19-Jul				0.9	0.04	2.2	3.2			0.04			0.04		1	
26-Jul		0.20		1.80	0.04	1.80	2.50	0.20		0.60			1.10		2.20	
02-Aug	0.04	0.40		2.60		0.55	2.90	0.08		0.40			0.20		0.20	
09-Aug		0.30		5.00		8.50	13.80			0.04					0.60	
16-Aug		0.50		1.30	0.04	3.20	10.80					0.20	0.04	0.08	0.60	
23-Aug		0.08		3.50	0.04	8.10	16.40	0.10		0.04	0.04			0.30		
30-Aug		0.04		2.70		12.00	4.40		0.04			0.70		0.04	0.10	
06-Sep				1.10	0.08		4.80			0.08		0.20			0.20	

Table 15. Twospotted spider mite eggs per leaf (note: blanks are zeroes)

	1-con.	1-Sur.	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Week of	TSMe	TSMe	TSMe	TSMe	TSMe	TSMe	TSMe	TSMe	TSMe	TSMe	TSMe	TSMe	TSMe	TSMe	TSMe	TSMe
03-May	0.00	0.00		0.1	13.6	1.5	0.1		0.00	0.2	0.2	0.00	0.3	0.2	1.7	0.5
10-May			0.1		10.7	0.4	0.4		0.50	0.04	0.2		0.4	1.6	2.8	0.4
17-May					3.5	0.2	0.7	0.08		0.1	0.08		0.1	0.3	5.5	1.2
24-May			0.2		1.1		0.1			0.2	0.04				0.04	0.1
31-May					0.6		1.2									0.3
07-Jun					0.3		0.5	0.2							1.1	0.2
14-Jun					0.08			0.1							0.3	
21-Jun														0.04	0.3	
28-Jun										0.3					1.4	
05-Jul										0.04				0.04	2.8	
12-Jul				0.12		0.04				0.6			0.04		6	
19-Jul				0.48		1.8	1.6			0.04					1.3	
26-Jul				0.10		0.50	0.90			0.20			0.20		**3.60**	
02-Aug		0.10		0.10	0.04	0.40	0.40			0.60			0.10		0.30	
09-Aug		0.20		1.40		**6.20**	**3.90**		0.04	0.08					1.00	
16-Aug	0.04	0.20		0.50		1.20	**9.60**					0.08	0.04		0.70	
23-Aug		0.20		1.00		**3.20**	**2.20**					0.04		0.04	0.08	
30-Aug				0.90		**2.40**	**1.00**					0.40			0.10	0.04
06-Sep				0.80	0.04		**3.30**					0.10		0.20	0.10	

Table 16. Western predatory mites per leaf (note: blanks are zeroes)

	1-con.	1-Sur.	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Week of	WPM	WPM	WPM	WPM	WPM	WPM	WPM	WPM	WPM	WPM	WPM	WPM	WPM	WPM	WPM	WPM
03-May																
10-May					**0.20**		0.04									0.04
17-May					**0.20**									0.04		
24-May					0.04											
31-May					0.04										0.04	
07-Jun					0.04											
14-Jun					0.04										0.08	
21-Jun								0.04				0.04				
28-Jun															0.04	
05-Jul															0.04	
12-Jul																
19-Jul																
26-Jul				0.04											**0.20**	
02-Aug							0.04								0.04	
09-Aug						**0.20**	0.08									
16-Aug							**0.30**									
23-Aug		0.04				0.08										
30-Aug							0.04					0.04			0.04	
06-Sep							0.04								0.04	

Table 17. Pear psylla - % infested shoots

Week of	1-con. % inf.	1-Sur. % inf.	2 % inf.	3 % inf.	4 % inf.	5 % inf.	6 % inf.	7 % inf.	8 % inf.	9 % inf.	10 % inf.	11 % inf.	12 % inf.	13 % inf.	14 % inf.	15 % inf.
31-May	10%	5%	10%	20%	40%	50%	25%	30%	0%	15%	8%	15%	30%	25%	20%	10%
07-Jun	0%	10%	15%	40%	65%	40%	65%	70%	10%	15%	50%	50%	80%	15%	35%	40%
14-Jun	20%	0%	50%	60%	85%	90%	20%	100%	20%	50%	80%	80%	90%	25%	40%	55%
21-Jun	10%	20%	55%	100%	100%	50%	100%	100%	50%	100%	100%	100%	100%	85%	100%	80%
28-Jun	10%	0%	75%	100%	100%	50%	100%	100%	45%	95%	95%	100%	100%	100%	100%	90%
05-Jul	0%	5%	50%	100%	100%	55%	100%	100%	30%	100%	95%	95%	65%	100%	95%	100%
12-Jul	10%	20%	90%	95%	100%	80%	100%	100%	15%	100%	85%	100%	80%	100%	90%	95%
19-Jul	20%	0%	95%	100%	100%	90%	100%	40%	0%	95%	75%	95%	80%	100%	90%	95%
26-Jul	5%	5%	90%	100%	100%	90%	90%	40%	12%	80%	90%	100%	100%	100%	95%	100%
02-Aug	50%	15%	50%	100%	100%	100%	100%	75%	15%	70%	95%	100%	100%	100%	90%	100%
09-Aug	30%	15%	50%	70%	100%	95%	90%	50%	40%	90%	100%	95%	90%	100%	100%	100%
16-Aug	15%	20%	40%	60%	100%	60%	70%	30%	40%		100%	80%	50%	100%	60%	95%
23-Aug	50%	15%	40%	80%	100%	90%	95%	40%	30%	40%	100%	65%	30%	75%	45%	90%
30-Aug	30%	0%	40%	55%	100%	95%	95%	80%	40%	90%	90%	30%	20%	100%	80%	90%
06-Sep				40%	100%		75%			70%		35%		75%	75%	90%

Table 18. Pear psylla – eggs per leaf, top shoots

Week of	1-con. Ppe	1-Sur. Ppe	2 Ppe	3 Ppe	4 Ppe	5 Ppe	6 Ppe	7 Ppe	8 Ppe	9 Ppe	10 Ppe	11 Ppe	12 Ppe	13 Ppe	14 Ppe	15 Ppe
31-May	0.13	0.18	0.03	0.08	0.4	0.6	0.2	0.6	0	0	0.1	0.1	0.3	0.1	0.07	0.2
07-Jun	0	0	0.01	1.13	1.1	0.8	2.2	**3.1**	0.03	0.02	0.6	0.6	**3.9**	0.1	0.4	0.6
14-Jun	0.02	0	0.6	1.8	**5.3**	**2.8**	**3.7**	**7.9**	0.1	0.7	**2.7**	1.9	**2.6**	0.2	0.7	1.5
21-Jun	0	0.02	0.5	**3.8**	**2.8**	1.4	**9**	**4.4**	0.4	**5.0**	**3.6**	1.7	1	2.4	1.3	0.9
28-Jun	0.05	0	0.2	**9.8**	**4.2**	0.1	**5.9**	**2.9**	0.1	**4.2**	0.6	**3.8**	1.6	**3.7**	2.1	2.4
05-Jul	0	0	0.6	**10.4**	**5.8**	0.3	**6.7**	1.8	0.04	**3.3**	0.2	1.7	0.7	**6.9**	1.2	1.9
12-Jul	0	0	0.2	2	1.9	0.06	**4.8**	**4.1**	0.08	**3.6**	0	1.5	0.03	**8.7**	0.08	0.6
19-Jul	0.3	0	0.5	**4.1**	**12.3**	**3.7**	**3.6**	0.05	0	1.5	0.4	**2.7**	0.4	**5.2**	1.1	2.1
26-Jul	0.02	0	0.4	1.7	**8.4**	2.4	1.6	0.4	0	0.8	**3.6**	2.4	1.3	**3.4**	1.2	**5.2**
02-Aug	0	0.1	0.5	0.8	**9.7**	**4.2**	**5.2**	2.2	0.07	1.2	**5.1**	1.9	1.4	**3.1**	1.8	**5.8**
09-Aug	0.1	0.2	0.2	**5.4**	**12**	1.4	0.9	1	0.5	**3.5**	**4.3**	2.4	0.7	**5.4**	1	1
16-Aug	0.01	0.2	0.1	**8.2**	**16.2**	**2.9**	**3.8**	0.3	0.08		0.8	2.2	0.05	**7.2**	1	**3**
23-Aug	0.6	0.03	0.3	**5**	**16.6**	0.7	**3.7**	0.3	0	0.3	0.6	0	0.06	2.2	0.08	1.8
30-Aug	0.03	0	0.3	2	**5.1**	2.2	4.3	0.05	0.2	1	0.2	0.07	0	0.9	0.8	0.2
06-Sep				0.3	**10**		1.1			1.6		0		0.8	0.4	0.6

Table 19. Pear psylla – I-II instar nymphs per leaf, top shoots

Week of	1-con. PP1-2	1-Sur. PP1-2	2 PP1-2	3 PP1-2	4 PP1-2	5 PP1-2	6 PP1-2	7 PP1-2	8 PP1-2	9 PP1-2	10 PP1-2	11 PP1-2	12 PP1-2	13 PP1-2	14 PP1-2	15 PP1-2
31-May	0	0	0.02	0.1	0	0.02	0	0.05	0	0	0.01	0	0.03	0.03	0.15	0
07-Jun	0	0.03	0.08	0.01	0.08	0.06	0.1	0	0.01	0.15	0	0	0	0	0	0
14-Jun	0.1	0	0.2	0.01	0.4	0.3	0.6	1.5	0	0.03	0.2	0.06	0.2	0.02	0.4	0.3
21-Jun	0.1	0.2	0.3	0.7	1.1	0.6	1.7	**2.2**	0.5	0.4	**2.8**	0.8	0.5	0.7	1.3	0.6
28-Jun	0.02	0	0.3	**2.5**	**2.9**	0.4	1.7	**3.4**	0.2	1.6	**2**	0.9	1.8	1.3	**2.8**	0.9
05-Jul	0	0.03	0.3	**3.5**	**3.3**	0.9	**2.5**	**3.7**	0.1	**2.3**	1.1	1.6	0.3	**3.5**	**2**	1.3
12-Jul	0.03	0.06	1.2	0.8	**8**	0.6	1.5	1.7	0.04	**4.8**	0.5	**3.6**	0.9	**7.5**	1.6	1.5
19-Jul	0.04	0	0.5	**7.5**	**12.1**	0.7	**5.5**	1	0	1.3	0.5	**2.3**	0.3	**5.7**	1.6	**2.3**
26-Jul	0	0.03	0.9	**10**	**5.9**	**2.6**	**2.3**	0.1	0.03	1.5	**2.5**	**2.2**	1.4	**5.4**	1	**2.4**
02-Aug	0.4	0.5	0.3	**2.4**	**4.6**	**2.1**	**5.3**	1	0.1	0.3	**3.3**	1.9	1.3	**7.9**	1.7	**2.4**
09-Aug	0.1	0	0.3	1.6	**12.9**	**2.9**	**2.2**	0.09	0.1	1.9	**7.2**	**2.4**	1.6	**3**	1	**2**
16-Aug	0.06	0.2	0.08	1.8	**5.3**	**2**	0.7	0.2	0.1		**2.1**	0.9	0.3	**2.3**	0.9	1.5
23-Aug	0.05	0	0.01	**7.9**	**9.4**	0.3	**2.4**	0.6	0.1	0.6	**3.2**	0.5	0.1	**2.1**	1	1.1
30-Aug	0.1	0	0.2	**2.9**	1.6	0.9	**6.6**	0.5	0.1	1.6	0.8	0.02	0.04	**2.5**	1.2	0.7
06-Sep				0.3	**7.7**		**4.3**			1		0.1		0.4	1.3	0.5

Table 20. Pear psylla – III-V instar nymphs per leaf, top shoots

	1-con.	1-Sur.	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Week of	PP3-5	PP3-5	PP3-5	PP3-5	PP3-5	PP3-5	PP3-5	PP3-5	PP3-5	PP3-5	PP3-5	PP3-5	PP3-5	PP3-5	PP3-5	PP3-5
31-May	0	0	0	0.07	0	0.02	0.2	0.03	0	0.1	0.01	0	0.03	0	0.05	0
07-Jun	0	0	0	0	0.02	0	0.05	0	0.01	0.02	0.04	0	0.01	0	0	0
14-Jun	0	0	0	0.1	0.05	0	0.03	0.01	0	0.1	0.01	0.08	0	0	0	0
21-Jun	0	0	0	0.2	0.2	0.5	0.1	0.5	0	0.03	0.3	0.1	0.1	0.02	0.03	0.1
28-Jun	0	0	0.08	0.2	**2.8**	0.5	0.5	1.1	0.1	0	0.03	0.2	0.3	0.2	0.4	0.3
05-Jul	0	0	0.2	0.5	1.4	0.6	0.9	**2.3**	0.05	0.1	0.4	1.4	0.1	0.4	0.3	0.2
12-Jul	0.01	0.05	0.5	**1.6**	**4.3**	0.7	**1.7**	0.8	0.01	0.4	0.5	0.9	0.2	0.7	0.3	0.6
19-Jul	0	0	0.8	**2.1**	**5.8**	0.4	**3.3**	0.2	0	0.2	0.4	**2**	0.1	**1.6**	1	**1.7**
26-Jul	0	0	0.7	**4.1**	**5.7**	0.5	**2.6**	0.06	0.01	0.3	0.7	**2.2**	0.2	1.2	0.2	**1.7**
02-Aug	0.03	0.03	0.3	**4.9**	7.9	**2.2**	**2**	0.1	0	0.06	0.4	**1.6**	0.2	**3.2**	0.1	1.1
09-Aug	0	0.03	0	0.6	**5**	**2.2**	**1.7**	0.03	0.03	0.07	1.2	0.3	0.1	1.3	0.03	0.7
16-Aug	0.01	0.03	0.04	0.05	**3.7**	**2**	0.9	0.09	0.1		0.8	1.1	0.1	**1.6**	0.6	1
23-Aug	0.1	0.03	0.06	0.2	**3.8**	**1.7**	0.6	0.09	0.04	0.06	0.5	0.7	0.05	0.6	0.1	0.9
30-Aug	0.1	0	0.04	1	**2.6**	1.1	**1.6**	0.5	0.2	0.2	0.8	0.2	0.02	0.8	0.4	0.4
06-Sep				0.04	**5**		**3.6**			0.2		0.2		0.4	0.4	0.9

Table 21. Pear psylla – total nymphs per leaf, top shoots

	1-con.	1-Sur.	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Week of	PP1-5	PP1-5	PP1-5	PP1-5	PP1-5	PP1-5	PP1-5	PP1-5	PP1-5	PP1-5	PP1-5	PP1-5	PP1-5	PP1-5	PP1-5	PP1-5
31-May	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.2	0.0
07-Jun	0.0	0.0	0.1	0.0	0.1	0.1	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
14-Jun	0.1	0.0	0.2	0.1	0.5	0.3	0.6	1.5	0.0	0.1	0.2	0.1	0.2	0.0	0.4	0.3
21-Jun	0.1	0.2	0.3	0.9	1.3	1.1	1.8	**2.7**	0.5	0.4	**3.1**	0.9	0.6	0.7	1.3	0.7
28-Jun	0.0	0.0	0.4	2.7	**5.7**	0.9	2.2	**4.6**	0.3	1.6	2.0	1.1	2.1	1.5	**3.2**	1.2
05-Jul	0.0	0.0	0.5	**4.0**	**4.7**	1.5	**3.4**	**6.0**	0.2	2.4	1.5	**3.0**	0.4	**3.9**	2.3	1.5
12-Jul	0.0	0.1	1.7	2.3	**12.3**	1.3	**3.2**	**2.6**	0.1	**5.2**	1.0	**4.6**	1.1	**8.2**	1.9	2.1
19-Jul	0.0	0.0	1.3	**9.6**	**17.9**	1.1	**8.8**	1.2	0.0	1.5	0.9	**4.3**	0.4	**7.3**	**2.6**	**4.0**
26-Jul	0.0	0.0	1.6	**14.1**	**11.6**	**3.1**	**4.9**	0.2	0.0	1.8	**3.2**	**4.4**	1.6	**6.6**	1.2	**4.1**
02-Aug	0.4	0.5	0.6	**7.3**	**12.6**	**4.3**	**7.3**	1.1	0.1	0.4	**3.7**	**3.6**	1.5	**11.1**	1.8	**3.6**
09-Aug	0.1	0.0	0.3	2.2	**17.9**	**5.1**	**3.9**	0.1	0.1	2.0	**8.4**	**2.7**	1.7	**4.3**	1.0	**2.7**
16-Aug	0.1	0.2	0.1	1.9	**9.0**	**4.0**	1.6	0.3	0.2		**2.9**	2.0	0.4	**3.8**	1.5	**2.6**
23-Aug	0.2	0.0	0.1	**8.1**	**13.2**	2.0	**3.0**	0.7	0.1	0.7	**3.7**	1.2	0.2	**2.7**	1.1	2.0
30-Aug	0.2	0.0	0.2	**3.9**	**4.1**	2.0	**7.2**	1.0	0.3	1.8	1.6	0.2	0.1	**3.3**	1.6	1.1
06-Sep				0.3	**12.7**		**7.8**			1.2		0.3		0.8	1.7	1.4

Table 21. Grape mealybug - % infested shoots (note: blanks are zeroes)

	1-con.	1-Sur.	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Week of	%MB	%MB	%MB	%MB	%MB	%MB	%MB	%MB	%MB	%MB	%MB	%MB	%MB	%MB	%MB	%MB
31-May								8%								
07-Jun					5%			4%								
14-Jun			10%		5%	10%		4%								
21-Jun						5%		4%								
28-Jun			4%		5%	4%		10%								
05-Jul			8%		10%											
12-Jul					10%			8%								
19-Jul			30%		10%	40%		35%								
26-Jul			50%		50%	75%	15%	70%								
02-Aug			25%		50%	15%	15%	75%								
09-Aug			35%		80%	65%	5%	20%	10%		10%					
16-Aug			30%		70%	55%		60%								
23-Aug			10%		90%	65%	10%	60%								
30-Aug			10%		20%	15%		30%								
06-Sep					10%		5%									