Wenatchee Valley Pear IPM Project (WVPP)
2000 Summary Report

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The Wenatchee Valley Pear IPM Project (WVPP) seeks to demonstrate, in commercial orchards, the increased use of biological control of key pear pests to develop more effective and economical pest control programs. The year 2000 was the second of a three-year project. Funding was provided by several sources: the Washington Tree Fruit Research Commission, the Washington State Commission on Pesticide Registration, the North Central Washington Fieldmen's Association, and the participating growers.

Participants

The same fifteen growers participated in Year 2 of the WVPP, 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. D'Anjou pear was the cultivar sampled in each orchard. The fruit from these blocks went to six different fruit packers.

The blocks vary considerably in their surroundings (native vegetation vs. orchard, narrow canyon vs. extensive farmed area). Their location and proximity to native habitat often has a large bearing on their pest situation, as the native lands serve as both a source many natural enemies as well as some pests (stink bug, box elder bug, green fruitworm).

Sampling Methods and Reporting

Every block was sampled weekly beginning in mid March, before the first sprays were applied, and continuing until the end of August, just prior to D'Anjou harvest. In addition, all blocks were sampled again in 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 associated 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 Torrey Hansen, WVPP IPM technician, did all sampling.

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. A field day was held in August to present information on the WVPP and the USDA cover crop management study.

PEST CONTROL PROGRAMS

The growers managed their pest control programs using the information provided by the WVPP and the advice of their consultant(s). All growers were interested in encouraging the development of more biological control in their orchards and balanced this with the risk of pest-caused fruit damage. Consequently, no two blocks followed the same spray program (Table 2).

Again, the blocks were put into two categories, based on their spray programs:

1) "Hard" blocks (seven sites) used broad-spectrum insecticides before and after bloom for pear psylla control. These materials included a pyrethroid (6 growers), Pyramite (6), AgriMek (7), and Provado (6). Five growers made two applications of Provado.
2) "Soft" blocks (eight sites) used none of the materials above. For psylla control sprays, these growers mostly relied upon a pre-bloom Surround (6 growers), Esteem (3), and foliar oil (8). Three of the eight growers managed their block organically. All of these blocks were under a soft pest management program in 1999 as well.

The terms "hard" and "soft" are convenient but can be misleading. Most hard blocks also used codling moth mating disruption, sprayed no or few organophosphates after bloom, and used Surround in the pre-bloom period. Their use of the psyllicides listed above was a significant difference that affected pest and natural enemy populations. However, the hard blocks also tended to have less border contact with native habitat, which reduced their access to some populations of predators and parasites. Some of the discussion in this report compares the average data from hard and soft blocks. Any general conclusions are limited by the inherent differences among blocks.

The costs of the different programs are summarized in Table 3. The soft blocks generally had less expensive programs than the hard ones (soft average material cost was $394, hard average was $634). Six of the eight cheapest spray programs were

in soft blocks. Six soft blocks reduced spray costs from 1999 levels, as they sprayed less often with less pest pressure in 2000. The one soft block that increased greatly (9904) applied six Confirm sprays for a codling moth problem. Soft blocks tended to be treated more often (an average 10 applications, vs. 7.3 in the hard blocks), due to the use of materials with less toxicity and less residual activity, like spray oil.

Two selective spray materials were used extensively and warrant further comment:

Surround- this particle film spray was used in six of eight soft blocks and six of seven hard blocks. Use was strictly pre-bloom, as foliar sprays in 1999 suppressed most natural enemies (especially predatory bugs and parasitic wasps), aggravated spider mite populations and provided only limited control of pear psylla. Most applications in 2000 were at a rate of 50#/acre, with a few at higher rates (63# to 88#/ac). From one to three applications were made. On average there was a 60% drop in psylla adult numbers with one 50# application (12 sprays, ranging from 30% to 90%). Two 50# sprays resulted in an average drop of 85% (80%-92% range). No greater reductions were noted with higher rates, but there were only six high rate applications to measure. Coverage appeared to be a more important factor than rate. For comparison, the oil/Thiodan sprays over the past two seasons have resulted in 90-98% drops in psylla numbers, with oil/sulfur somewhat less, in the 60-80% range.

"Summer" oil- highly refined mineral oils are being applied more frequently, and at higher rates, over the past two seasons to pear orchards in the Wenatchee Valley. Conventional as well as soft blocks are using them, but in the soft blocks they are often the primary, or only, materials used after bloom for control of pear psylla and mites. In the WVPP at least four different formulations were used in 2000 for foliar applications, at rates of up to 2 gallons per acre and concentrations up to 2%. A limited amount of fruit marking was seen, the result of either too high a rate, too short an interval between sprays and/or the inclusion of calcium chloride in the spray. Phytotoxicity is the most immediate risk, but there are also concerns with the possible weakening of fruit spurs and reduction of tree vigor with multiple oil applications over several years. Ongoing research in the Northwest should help address these concerns.

FRUIT DAMAGE

Savings in spray costs are of little or no value if they are exceeded by the cost of increased fruit damage from pests. Most soft blocks suffered high levels of fruit marking from pear psylla in 1999, causing extensive downgrading and revenue loss. Many of these growers accepted this damage philosophically, as their crop had been reduced and heavily marked by a severe spring frost.

This year, however, seven of eight soft growers saw their psylla marking fall dramatically, from an average of 25% in 1999 to 3% in 2000. The other grower (9903) saw his level of marking remain the same at just over 10%; his use of fish oil instead of mineral oil may have contributed to his higher psylla numbers. Psylla marking in the hard blocks also fell, from 6% in 1999 to 3% this year. (Damage summaries in Tables 4 and 5.) Fruit damage for psylla and mealybug in our evaluations was defined as a cumulative area of russet equal to or greater than a ¾" diameter circle, or, with mealybug, the presence of nymphs on the fruit.

Damage from mealybug, the second most serious pest on average, varied greatly among growers, with six having no marking and two others less than 0.2%. The other growers either saw their damage reduced (9902, 9904, 9906) or remain at a low level (9913, 9915). One soft grower (9905) had extensive marking but developed high numbers of natural enemies this year, after the use of Surround last summer suppressed biological control. His block will be a key test next year of whether natural enemies can bring mealybugs under control. One hard grower (9907) had high marking of his fruit, and used no materials specifically for mealybug control. He has tried to develop natural enemy populations by using a selective program early in the season but they have not responded, probably due to his location in the midst of an orchard area and well away from native habitat.

Damage from other pests was far more sporadic and site specific. Two trends stand out. Leafrollers are causing increasing damage in the soft blocks (over 2.0% of fruit in three blocks); for better control, they need to be targeted with well-timed sprays of Bt and/or insect growth regulators. Stink bugs and box elder bugs caused much more damage this year than last in blocks bordering native habitat. There are no effective selective control measures for these pests, and even frequent, late season broad-spectrum insecticide sprays may provide limited benefits.

THE PESTS

Pear psylla

Pear psylla is the main pest for most Wenatchee Valley pear growers. In 1999, it caused more fruit damage than any other pest for both hard and soft growers. This year, damage by pear psylla was far lower for most growers, with the greatest decline in damage being found in the soft blocks (3.0% psylla marking in 2000 vs. 25.0% in 1999). The amount of marking was equivalent between the two spray programs (3.0% soft vs. 2.7% hard).

The low amount of marking in 2000 is the result of far lower psylla populations (Tables 6 and 7.) Most soft blocks endured high numbers of psylla in July and August of 1999, averaging 4 to 5 nymphs per leaf; these same blocks averaged 0.8 and 1.6 nymphs/leaf, respectively, in July and August of 2000. These declines resulted from the use of selective sprays (primarily oil) combined with the biological control provided by the predators and parasites that established themselves in 1999 and returned in large numbers this year.

A measurement of the impact of psylla predators is shown by the ratio of predators to psylla nymphs (Table 15). The number per tray of the two main predators, deraeocoris and campylomma, is divided by the number of nymphs per leaf for each sample date. (Other, less common, predators can be included; the same trends result, with still higher ratios). In 1999, this ratio dropped to less than 0.1 in July and 0.5 in August, due to the very high psylla numbers in most soft blocks, despite large and increasing numbers of natural enemies. Only 1 of 8 soft blocks had a ratio exceeding 1.0 in 1999. In 2000, 6 of the 8 had ratios above 1.0, with soft block averages of 3.4 (July) and 2.2 (August). The hard blocks averaged 0.01 and 0.1 for those two months; their numbers of psylla nymphs were similar to those in the soft blocks but few natural enemies were found.

Only one of the soft blocks had significant psylla damage. This grower (9903) used a fish oil product for two of his first three post bloom oil sprays. Counts indicated that these sprays were less effective at suppressing psylla nymphs than the mineral oil sprays used by other growers, and later by 9903. Another grower (9905) developed very high predator numbers, especially of campylomma. He had very few natural enemies in 1999 due to frequent post-bloom kaolin sprays. His psylla marking was difficult to distinguish from the marking caused by high numbers of mealybug in his block, and, based on the psylla nymph counts, was probably lower than shown by our fruit checks.

Several growers developed high psylla populations later in the summer, in August and early September, yet suffered little fruit marking. These growers were both hard (9902) and soft (9911, 9913). Pear fruit is more resistant to marking as it approaches harvest, and these growers managed to keep the fruit fairly free of psylla honeydew earlier in the summer.

Grape mealybug

A serious pest for many growers in the Wenatchee Valley, grape mealybug can cause damage that approaches or exceeds that caused by pear psylla. Few other regions have this degree of risk from mealybug, although it is found in their pear orchards. Mealybug control has commonly relied upon multiple applications of several broad-spectrum insecticides that reduce or eliminate natural enemies. A key concern for soft pear IPM programs in the Valley has been whether mealybug control can be achieved without disrupting biological control of psylla and other pests. After two seasons, most soft blocks in the WVPP show a decline in mealybug numbers, but not as consistently or dramatically as with pear psylla.

Mealybug has been found in nine of the WVPP blocks (six soft, three hard) (Table 8). They were first detected in infested blocks in spur samples taken in early April. First finds on tray samples were in early May, with peak numbers on trays found from late May to early July and again from mid August into September. Significant damage only occurred in two blocks (9905, 9907). The amount of damage relates well to both the numbers per tray in August as well as the percent-infested shoots.

Sampling efficiency and reliability is a concern with mealybug. Mealybug populations can have an uneven distribution, requiring a large sample size to accurately sample the population. Shoot samples may be accurate but are very time-consuming. Beating trays take less time but are limited to the lower portions of the trees where mealybug is less abundant. Fruit samples at harvest provide an accurate indication of the presence and relative abundance of mealybug, but are too late to provide information for current season control needs.

Mealybug populations generally declined or remained low in the soft blocks this year, with one exception. In four soft blocks (9903, 9909, 9911, all under organic management, and 9913) mealybug has been found over the past two years, but infrequently and at very low levels, with no population increase observed. In two others (9904, 9906) the mealybug population has declined and very little fruit infestation was found at harvest. Another grower (9915) had a low population that increased slightly in 2000. These last three growers applied Esteem (pyriproxifen) at popcorn and petal fall timings for

psylla control, which may have provided some help with mealybug. The eighth soft block (9905) has had high numbers of mealybug, with 40-45% infested shoots on average in August both years. Few natural enemies were found in this block in 1999 due to multiple summer Surround sprays, but high numbers of predators and parasites developed this year when these sprays were eliminated. He hopes that these natural enemies will be able to reduce the mealybug population next year. Summer oils and an azadirachtin product (Ecozin) were sprayed by 9905 this summer to aid in mealybug control; the effect of these applications was unclear.

Spider mites

This year was warmer than the 1999 growing season, and many growers in the Wenatchee Valley sprayed several times for spider mite control. However, the WVPP soft blocks had generally lower spider mite (twospotted or McDaniel mite) populations and less transpiration burn than the hard blocks, despite applying few or no miticides (Table 9). This mirrors the experience of pear growers in the Okanagan of British Columbia in the early 1990's who found that spider mite populations generally declined below damaging levels, even on the highly susceptible cultivar D'Anjou, with the use of a more selective pear IPM program.

Four of the soft blocks only used summer oil sprays for mite control. Two others applied no oil after mid-May, and still developed no problem mite populations. Two other soft growers included one Savey application. In none of the soft blocks did the average monthly count of spider mites exceed 1 per leaf. Soft blocks averaged 0.6 mites /leaf for the summer (ranging from 0.1 to 0.9); hard blocks averaged 1.6/leaf (range 0.1-3.7). Part of the reason for higher mite numbers in most hard blocks may relate to the use of the insecticide Provado for psylla and mealybug control. Studies have indicated that mites increase egg production when treated with this material. This was supported by a comparison within one soft WVPP block this summer. The section receiving Provado plus oil increased its spider mite numbers from 0.05 to 8.6 mites/leaf within five weeks of application, while the area receiving oil only at the same date remained below 0.5/leaf for the entire period.

Biological control of spider mites is apparently occurring in these soft blocks. However, few predatory mites were found in leaf samples (only 12 counts of Western predatory mites or eggs in 135 samples from the soft blocks), and even fewer of the beetle *Stethorus spp.*, a key mite predator in some areas. Other predators may be having a significant impact, although other than campylomma nymphs we identified no other substantial numbers of possible mite predators.

Pear rust mite

This very small mite can potentially cause extensive fruit damage if not controlled. In British Columbia, it emerged as one of the most serious pests after several years of a selective pest control program with little or no miticide use. It has been easily controlled with AgriMek and several other miticides. In the WVPP soft blocks, there has been no fruit damage found but rust mites were counted in late August leaf samples from four blocks. Two of these were the blocks under organic management for the longest time, and have only sulfur and oil as management tools. Numbers exceeded 30 per leaf for several weeks in one of these blocks (9911). There is a risk of more soft blocks developing damaging pear rust mite populations if miticide use is curtailed. The use of AgriMek at very low rates will be examined in 2001 for its effect on rust mites and natural enemies.

Codling moth

Codling moth is generally well controlled in pears in North Central Washington, but can be locally serious. Following the lead of apple growers, there is an increase in pear acreage treated with mating disruption as part of a codling moth control program; 14 of the 15 WVPP growers did so in 2000. Pheromone traps, at an average density of one per 3 acres, were used to monitor codling moth populations. Ten of the growers had an average catch for the season of less than 5 per trap (Table 10). All growers, but one, had undetectable fruit damage or no more than 0.1% (three growers). The one exception (9904) had his 1999 crop so reduced by frost that he did not pick that year, or spray for codling moth. Codling moth increased on the fruits remaining in one area of the block with a history of codling moth problems. This resulted in increased pressure in 2000, which he attempted to control with mating disruption (400 Isomate C+/acre) and the insect growth regulator Confirm. Despite six sprays of this insecticide, at harvest he had nearly 2% of the D'Anjou fruits with stings or entries.

Leafrollers

Leafroller fruit damage in the soft blocks was three times higher than the previous year, while damage in the hard blocks remained relatively low. Fruit damage was highest on average in the soft blocks (1.3% vs. 0.2% in the hard blocks) and exceeded 2.0% in three soft blocks. Pheromone traps again monitored both obliquebanded (OBLR) and pandemis (PLR) leafrollers. OBLR catch totals were higher in 2000 in all blocks but two, increasing overall nearly 140% (Table 11). PLR catches increased in only five blocks and the total catch of all blocks fell almost 30% (Table 12). The four blocks with the highest OBLR catches had the most fruit damage.

Bacillus thuringiensis (Bt) was the main material used for leafroller control in the soft blocks. Grower 9909 had the highest catch of OBLR (719/trap/yr) and applied three Bts; fruit damage in that block was 0.9%, down from 2.2% the year before. Grower 9905 had the highest PLR catch (707/trap/yr) and also applied three Bts, and no fruit damage was found this year. The three growers with the highest fruit damage from leafrollers had the largest increases in OBLR catch this year and applied no Bt (9903, 9913) or just one Bt (9911).

Stink bug/Box elder bug

Fruit damage by these true bugs was more widespread this year, with bug damage found during harvest in 14 of the 15 blocks. Bug damage overall averaged 0.9% in 2000, up from 0.1% in 1999. The soft blocks suffered more bug damage (1.3% vs. 0.5% in the hard blocks), with one block (9915) having 4% fruit damage. This higher damage probably resulted from the soft blocks having greater border contact with native habitat, as the wild lands serve as the key source of both stink bugs and box elder bugs. For example, the five soft blocks with over 50% of their border contacting native habitat averaged 1.8% bug damage. The three soft blocks with less than 25% contact had 0.5% damage, the same as the two similar hard blocks. The two blocks with no such border contact were both hard and averaged 0.05% bug damage.

Both stink bugs and box elder bugs were found sporadically on beating trays, with little correlation between tray sample numbers and fruit damage. In several cases these bugs were easily found in the bins during harvest, despite no or very low catch on trays several weeks earlier. The predominant stink bug species found was the consperse stink bug (*Euschistus conspersus*); the green stink bug (*Acrosternum hilare*) showed up in several blocks during harvest.

Other pests

Cutworm damage to fruit was found in four blocks, but only in 9913 was it significant (0.6%); no insecticides were applied there after bloom. *Green fruitworm* feeding showed up more in 2000. Fruitworm larvae were found on beating trays, but rarely. Three blocks had damage from this pest, with 1.3% of fruit fed upon in 9908. All three blocks are situated in narrow canyons with extensive contact with native forest habitat containing other hosts of this insect. This pest tends to recur in the same orchards, so control programs in 2001 should take the damage into account. *Lygus bug* damage was found on fruit in several blocks, but at very low levels. Lygus showed up infrequently on beating trays, and never above 0.1/tray.

THE NATURAL ENEMIES

Nineteen different species or groups of predators and parasites were counted in the WVPP in 2000.

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

The soft blocks contained far higher numbers of these natural enemies than the hard blocks. Populations of predators and parasites that had developed on psylla populations in 1999 returned earlier and at higher levels in 2000. There was a late season (August) buildup of natural enemies in only one hard block (8002) that developed a large psylla population, averaging over 3 nymphs per leaf for the month.

Deraeocoris

This true bug, along with campylomma, is the most abundant predator found in Wenatchee Valley pear orchards. Overwintering as adults, they were first found in blocks from mid March to early April, usually the earliest psylla predator to appear in numbers. The first nymphs were found in late May. There are two generations per year, with populations of nymphs peaking in July and late August/September (Table 13).

Derries were higher in all soft blocks in May, June and July of 2000 than in the same months the year previous. Derry counts were generally lower in the late summer this year than in the year before, reflecting the lower amount of food (psylla) in these blocks this year. As in 1999, few derries were counted in hard blocks.

Campylomma

Campies overwinter as eggs deposited under the bark of young limbs in late summer. The first nymphs were found soon after bloom in early May, with the first adults found in early June. Three generations occurred in WVPP orchards, with nymphs peaking in mid May, mid July and late August/early September (Table 14).

Campylomma built up to far higher numbers in the soft blocks in 2000. These blocks averaged nearly 0.5 /tray in the May-August period, compared with less then 0.1/tray in '99. One block (9905) averaged over 2/tray in July and August. Hard blocks averaged 0.01/tray. There is a strong correlation between August '99 counts and numbers of nymphs in the spring '00; all blocks with campylomma in the late summer of '99 had many nymphs the following spring (0.3-1.3/tray in May). Of the nine blocks with no campylomma in August '99, six had no campylomma the next spring and three had less than 0.1/tray in May and June.

Lacewings

Lacewings were the third most common predator found in tray samples. Both brown and green lacewing adults are found in WVPP blocks, but brown lacewings were five times more abundant in 2000. Brown lacewing adults are predaceous and were first caught in mid March. Green lacewings adults were found first in mid May; only some species are predators. All lacewing larvae are predators. We did not distinguish the larvae found between green and brown lacewings, but due to the higher numbers of brown adults I suspect that most were brown lacewing larvae. Larvae were consistently found in some blocks by mid June, with the highest counts occurring in August (exceeding 1/tray in 3 blocks). Most lacewings overwinter as larvae in cocoons. In several blocks we found these cocoons in March in newspaper or cardboard that was left in the orchard through the winter. In two soft blocks, virtually all the larvae were dead, having been parasitized.

Earwigs

These predators are primarily active at night and pass the day in protected locations on the tree trunk and ground. Although occasionally found in beating tray samples, these numbers do not accurately represent earwig populations. We used earwig "condos" to monitor their numbers, rolls of corrugated cardboard placed inside eight-inch long pieces of 1¼" PVC pipe. Earwig numbers were higher in the soft blocks again in 2000, with the soft blocks averaging 11 earwigs/condo and the hard blocks 1.5.

Lady beetles

Lady beetle adults and larvae were generally not found at levels exceeding 0.1/tray. Only at one site (9903) were consistently higher numbers found, with up to 0.3/tray. Highest numbers found were in late August. The main species found were the convergent lady beetle (*Hippodamia convergens*) and the Asian lady beetle (*Harmonia axyridis*).

The small black lady beetles include species that feed both on mites (*Stethorus* spp.) and mealybugs and their relatives (*Scymnus* spp.). These beetles were found more commonly than the larger, more familiar "lady bugs"; close to 20% of the orchard tray counts included these predators, almost all counts in the soft blocks. They first appeared in early May, with the highest numbers, up to 0.2/tray, found in the summer months. The larvae were very rarely found.

Other predators

Other true bug predators were counted but never exceeded 0.1/tray and were found in less than 5% of orchard visits; these bugs include *anthocorids, damsel bugs, bigeyed bugs and stilt bugs.* The *Anthocoris* spp. are considered very good psylla predators but are quite susceptible to pesticides; only four were found this year. *Minute pirate bugs* are more common anthocorids, particularly in several soft blocks, with counts of up to 0.2/tray in August. Other predators found infrequently included *snakeflies, syrphid flies* and *ants.*

Spiders were frequently found in all blocks, beginning in March, but their numbers were consistently higher in the soft blocks. The soft blocks averaged 0.2/tray for the year, with several high counts of 0.8/tray; the hard blocks averaged 0.06, with no count exceeding 0.3/tray. All spiders are predators, although their impact on pear pests is unknown. No attempt was made to distinguish the various families found.

A new predator was found in two soft blocks this year. *Anystis* is a large, rapidly moving and orange-colored predatory mite that was found on beating trays in the summer. These uncommon predators will feed on mites and small soft-bodied insects, and are rare due to their susceptibility to most miticides.

Parasitic wasps

Many small wasps were counted in tray samples, beginning in mid April. They were found in all blocks, but at higher numbers in the soft blocks. The average weekly catch was 0.18/tray in the soft blocks (range of 0.10-0.35), versus 0.08 in the hard blocks (range of 0.05-0.13). We don't know how many, if any, of these wasps parasitized pear pests, but their numbers are another indication of the abundance and diversity of natural enemies.

One wasp that was counted separately is the parasitoid *Trechnites* spp. Trechnites is an obligate parasite of pear psylla, first noted in WVPP blocks in the summer of 1999. In 2000, it was counted in eleven blocks (all eight soft and three hard). In the hard blocks catches never exceeded 0.1/tray. In the soft blocks, most reached 0.5/tray, with a peak catch of 28.6/tray at 9904 in late April! Dr. Tom Unruh dissected a sample of 12 psylla nymphs from this block in early May and 100% were parasitized. The four soft blocks with the most Trechnites in April were those in which the parasite was identified in August of 1999. The other four soft blocks had their peak Trechnites catches in August, and may expect to see greater numbers next spring.

The natural enemy populations that were established in Year 1 of the WVPP are now paying dividends in the control of two of the worst pests that Wenatchee Valley pear growers face. The psylla control in most soft blocks was equivalent to control in the hard blocks and cost less. Spider mites were better controlled in the soft blocks, and also at less cost. The third year of this program, in 2001, should help clarify whether these developments are stable and continuing. Trends in mealybug control are less clear in the soft blocks; next year will be important in establishing whether we can achieve improved biological control of this key pest. Other pests, particularly leafrollers and pear rust mite, could potentially cause serious damage but we have the tools to control them without disrupting biological control of psylla, spider mites and, hopefully, mealybug.

But many limitations remain that prevent wider adoption of soft pear pest management programs:

1) Most blocks suffered high psylla damage during the first year of establishing improved biological control, as the psylla populations increased greatly before natural enemies became established.
2) Close proximity to native habitat appears to be important, as these lands serve as a reservoir for key natural enemies; a successful soft program may not be possible for blocks in the midst of farmed areas.
3) Soft pest management programs require more intensive and regular monitoring of pests and natural enemies than growers have been receiving. They will have to pay extra for this information, and presently there are few people available to provide this degree of service.
4) Soft programs are more risky, as they have not yet been shown to provide reliable pest control over many seasons.
5) Mineral oil is a central part of soft pear pest management programs, particularly applications made after bloom. There remain concerns with oil about both the risk of fruit marking and the long term effects on tree health.

The WVPP is addressing some of these concerns, but also raising new questions. A new project, "Building a multi-tactic pheromone-based pest management system in western orchards", has been funded by the USDA. A consortium of entomologists from the state universities in Washington, Oregon and California, as well as USDA researchers, will soon begin work on this multi-year project and will provide much needed information that should advance pest management in pears and other tree fruits. There will always be pest control needs and new challenges. The WVPP has advanced the understanding of soft pear IPM programs in North Central Washington, and will continue to do so through 2001.

Table 1. WVPP blocks, 2000

Block	Location	Ac.	Cultivar	Surroundings	% border w/ native habitat	Pest control program
9901	Wenatchee	4	D'Anjou	Orchard, bitterbrush; nearby river	<25%	Hard
9902	Monitor	13	D'Anjou	Orchard,bitterbrush	>50%	Hard
9903	Cashmere	13	D'Anjou	Pine, orchard; up narrow canyon	>50%	Soft (organic)
9904	Cashmere	5	D'Anjou	Orchard, pine, bitterbrush	25-50%	Soft
9905	Cashmere	7	D'Anjou	Orchard; very limited contact with bitterbrush	<25%	Soft
9906	Cashmere	9	D'Anjou	Pine; up canyon	>50%	Soft
9907	Dryden	11.5	D'Anjou	Orchard on all sides	0%	Hard
9908	Dryden	12	D'Anjou	Orchard, pine; up canyon	>50%	Hard
9909	Peshastin	18	D'Anjou	Pine; up narrow canyon	>50%	Soft (organic)
9910	Peshastin	12	D'Anjou	Orchard	<25%	Hard
9911	Peshastin	5	D'Anjou	Surrounded by organic orchard	0%	Soft (organic)
9912	Leavenworth	12	D'Anjou	Orchard, river bank	25-50%	Hard
9913	Peshastin	9.5	D'Anjou	Pine, orchard; up canyon	>50%	Soft
9914	Peshastin	5	D'Anjou	Orchard on all sides	0%	Hard
9915	Peshastin	4.5	D'Anjou	Pine, residences	>50%	Soft
		141	total acres			

Table 2. WVPP Spray programs, 2000

9901

Date	Material	Rate/ac	$	Total
3/11	surround	50lbs	$30	$30
3/20	surround	50lbs	$30	$30
3/26	thiodan 3ec	3qts	$29	
	lorsban 4ec	2qts	$18	
	asana	1pt	$17	
	pbo	1pt	$18	
	superior oil	4gal	$11	$93
4/8	Pyramite	11 oz	$104	
	Procure	8 oz	$26	
	SafTSide	.625 gal	$6	$136
4/19	Isomate C+	200/ac	$55	$55
4/24	AgriMek	20 oz	$108	
	SafTSide oil	1.25 gal	$13	$121
6/24	Provado	10 oz	$41	
	SafTSide	1.9 gal	$19	$60
7/15	Provado	10 oz	$41	
	SafTSide	1.9 gal	$19	
	Savey	6 oz.	$72	$132
		2000 spray cost		**$657**
	#sprays(@$15)	*8*	*$120*	*$777*

9902

Date	Material	Rate/ac	$	Total
3/26	Baythroid	1 pt.	$17	
	PBO	3.2 oz	$4	
	Lorsban	2 qt	$18	
	Surround	100#	$60	$99
4/12	Pyramite	11 oz	$105	
	Procure	8 oz	$26	
	Surround	25#	$15	$146
4/21	NoMate	300 disp.	$83	$83
4/24	AgriMek	20 oz	$108	
	Provado	10 oz	$41	
	SafTSide oil	1.25 gal	$13	$162
7/3	Provado	10 oz	$41	
	SafTSide oil	1.25 gal	$13	$54
		2000 spray cost		**$544**
	#sprays(@$15)	*5*	*$75*	*$619*

9904

Date	Material	Rate/ac	$	Total
3/25	Oil, Superior	3.75 gal	$10	
	Microthiol Sulfur	15#	$13	$23
4/10	Stylet oil	1.6 gals	$19	
	Procure	10 oz	$33	
	Esteem	20 oz	$83	
	Dipel	2.5 #	$23	$158
4/22	Isomate C+	400/ac	$110	$110
5/2	Stylet oil	1.6 gals	$19	
	Esteem	20 oz	$83	$102
5/15	Stylet oil	1.6 gals	$19	$19
5/31	Confirm	20 oz	$30	$30
6/17	Confirm	20 oz	$30	$30
7/10	Confirm	20 oz	$30	$30
7/26	Confirm	20 oz	$30	$30
8/7	Confirm	20 oz	$30	$30
9/2	Confirm	20 oz	$30	$30
		2000 spray cost		**$592**
	#sprays(@$15)	*11*	*$165*	*$757*

9905

Date	Material	Rate/ac	$	Total
3/24	Surround	63#	$38	$38
3/27	Surround	63#	$38	$38
4/10	Stylet oil	1.25 gal	$15	$15
4/18	Dipel	2#	$18	$18
4/24	Stylet oil	1.25 gal	$15	
	Dipel	2#	$18	$33
4/25	Isomate C+	200 disp.	$55	$55
5/4	Stylet oil	1.25 gal	$15	$15
5/18	Lacewing eggs/larvae	1250	$6	$6
5/19	Detergent	4#	$1	$1
5/24	Savey	6 oz	$72	
	SafTSide oil	1.5 gal	$15	$87
6/22	SafTSide oil	2 gal	$20	$20
7/10	Superior oil	1.5 gal	$4	
	Dipel	2#	$18	$22
7/24	Superior oil	1.5 gal	$4	
	Ecozin	12 oz	$38	$42
8/1	Superior oil	1.5 gal	$4	
	Ecozin	12 oz	$38	$42
		2000 spray cost		**$432**
	#sprays(@$15)	*14*	*$210*	*$642*

9907

Date	Material	Rate/ac	$	Total
3/23	Surround	50#	$30	$30
4/3	Surround	50#	$30	$30
4/10	Omni Oil	1.25 gal.	$6	
	Esteem	16 oz	$66	
	Procure	8 oz	$26	$98
5/2	Esteem	16 oz	$66	
	SafTSide Oil	1.5 gals	$15	$81
6/19	Savey	6oz	$72	
	Ecozin	10oz	$31	
	Omni Oil	0.6 gal	$3	$106
6/29	AgriMek	20oz	$108	
	Azinphos	2 lbs	$18	
	Superior Oil	0.75 gal	$2	$128
		2000 spray cost		**$473**
	#sprays(@$15)	*6*	*$90*	*$563*

9908

Date	Material	Rate/ac	$	Total
3/30	Endosulfan 3EC	3 qt	$28	
	Chlorpyrifos 4E	2 qt	$18	
	Asana XL	1 pt	$17	
	Butacide 8 EC	0.5 pt	$9	
	Microthiol Sulfur	15 #	$13	
	Volck oil	4 gal	$11	$96
4/11	Pyramite	11 oz.	$105	
	Esteem	16 oz.	$66	
	Superior oil	3 qts.	$2	
	Diazinon WP	4 lbs.	$20	
	Procure	8 oz.	$26	$219
4/21	Isomate C+	275 disp.	$76	$76
5/10	AgriMek	20 oz.	$108	
	Volck Oil	1.25 gal	$3	
	Dithane	8 lbs.	$25	$136
6/27	Provado	10 oz	$41	
	SafTSide oil	1.9 gal	$19	$60
8/4	Provado	10 oz	$41	
	VolckOil	1 gal	$3	$44
		2000 spray cost		**$631**
	#sprays(@$15)	*6*	*$90*	*$721*

Table 2. (cont.)

9903

Date	Material	Rate/ac	$	Total
3/27	Surround	50#	$30	$30
3/28	Lime sulfur	10 gal	$45	
	Oil	5 gal	$13	$58
4/7	Surround	63#	$38	$38
4/10	Checkmate CM	250 disp.	$113	$113
5/11	SafTSide oil	1.5 gals	$15	$15
5/26	Fish oil	1 gal.	$8	$8
6/20	Fish oil	1 gal.	$8	$8
7/20	Omni oil	1.5 gal	$8	$8
7/25	Fish oil	1.5 gal	$12	$12
7/30	Omni oil	1.5 gal	$8	$8
8/8	Omni oil	1.5 gal	$8	$8
		2000 spray cost		**$306**
	No.sprays(@$15)	*11*	*$165*	*$471*

9906

Date	Material	Rate/ac	$	Total
3/28	Surround	50#	$30	$30
4/9	Surround	50#	$30	$30
4/14	Esteem	16 oz.	$66	
	SafTSide	1.25 gal	$13	
	Procure	8 oz.	$25	$104
4/28	NoMate CM	350 disp.	$96	$96
5/4	Esteem	16 oz.	$66	
	SafTSide	1.25 gal	$13	$79
5/17	Esteem	16 oz.	$66	
	SafTSide	1.25 gal	$13	$79
6/2	Confirm	20 oz	$30	
	Savey	6 oz	$72	
	SafTSide oil	0.63 gals	$6	$108
6/20	Confirm	20 oz	$30	$30
7/7	SafTSide oil	1.25 gal	$13	$13
		2000 spray cost		**$569**
	No.sprays(@$15)	*9*	*$135*	*$704*

9909

Date	Material	Rate/ac	$	Total
4/2	Surround	75#	$45	$45
4/9	Surround	75#	$45	$45
4/16	Surround	75#	$45	$45
5/7	SafTSide oil	1.25 gal	$13	
	Dipel	1.5#	$14	$27
5/10	NoMate CM	200 disp.	$55	$55
5/23	SafTSide oil	1.25 gal	$13	$13
6/5	SafTSide oil	1.25 gal	$13	
	Dipel	1.5#	$14	$27
6/20	SafTSide oil	1.25 gal	$13	$13
7/1	SafTSide oil	1.25 gal	$13	
	Dipel	2#	$18	$31
7/15	SafTSide oil	1.25 gal	$13	$13
7/28	SafTSide oil	1.25 gal	$13	$13
8/11	SafTSide oil	1.25 gal	$13	$13
		2000 spray cost		**$340**
	No.sprays(@$15)	*12*	*$180*	*$520*

9910

Date	Material	Rate/ac	$	Total
3/25	Surround	75#	$45	$45
3/31	Oil	4 gal	$11	$106
	Endosulfan 3EC	3 qts	$29	
	Lorsban 4E	2 qts	$18	
	Asana	1 pt	$17	
	PBO	1 pt	$18	
	Sulfur	15#	$13	
4/11	SafTSide oil	0.6 gal	$6	$221
	Surround	75#	$45	
	Procure	8 oz	$26	
	Pyramite	11 oz	$105	
	Imidan 70 WP	5.5 #	$40	
4/22	NoMate CM	250	$63	$63
5/3	AgriMek	20 oz	$108	$162
	Provado	10 oz	$41	
	SafTSide oil	1.25 gal	$13	
5/7	Dithane DF	8#	$25	$25
6/17	Provado	10 oz	$41	$60
	SafTSide oil	1.9 gal	$19	
6/22	Guthion 50W	2#	$18	$18
7/26	Provado	10 oz	$41	$100
	SafTSide oil	1.9 gal	$19	
	Imidan 70 WP	5.5#	$40	
		2000 spray cost		**$800**
	#sprays(@$15)	*9*	*$135*	*$935*

9912

Date	Material	Rate/ac	$	Total
3/20	Surround	50 lbs	$30	$30
4/4	Oil	4 gal	$11	$91
	Lorsban 2 EC	3 qt	$27	
	Thiodan 3 EC	2 qt	$19	
	Asana	1 pt	$17	
	PBO	1 pt.	$18	
4/8	Pyramite	11 oz	$104	$136
	Procure	8 oz	$26	
	SafTSide oil	0.63 gals	$6	
4/22	NoMate CM	250	$63	$63
5/2	AgriMek	20 oz	$108	$154
	Aliette	2.5#	$33	
	SafTSide oil	1.25 gal	$13	
6/25	Provado	10 oz	$41	$60
	SafTSide oil	1.9 gal	$19	
7/14	Provado	10 oz	$41	$156
	SafTSide oil	1.9 gal	$19	
	Savey	8 oz	$96	
7/28	Vendex	2#	$53	$72
	SafTSide oil	1.9 gal	$19	
		2000 spray cost		**$762**
	#sprays(@$15)	*8*	*$120*	*$882*

9914

Date	Material	Rate/ac	$	Total
3/24	Surround	75#	$45	$45
3/29	Oil	4 gal	$11	$105
	Endosulfan 3EC	3 qts	$28	
	Lorsban	2 qts	$18	
	Asana	1 pt	$17	
	PBO	1 pt	$18	
	Sulfur (wettable)	15#	$13	
4/12	Surround	75#	$45	$96
	Procure	8 oz	$26	
	Carzol	0.63 #	$25	
4/22	NoMate CM	210 disp.	$58	$58
5/2	AgriMek	20 oz	$108	$121
	SafTSide oil	1.25 gal	$13	
5/12	Dithane	8#	$25	$25
6/2	Guthion 50W	2#	$18	$18
7/5	Guthion 50W	2#	$18	$37
	SafTSide oil	1.9 gal	$19	
7/27	Guthion 50W	2#	$18	$67
	Provado	12 oz	$49	
		2000 spray cost		**$572**
	#sprays(@$15)	*9*	*$135*	*$707*

Table 2. (cont.)

9911					9913					9915				
Date	Material	Rate/ac	$	Total	Date	Material	Rate/ac	$	Total	Date	Material	Rate/ac	$	Total
3/20	Surround	88#	$53	$53	3/20	Surround	50#	$30	$30	3/27	Superior Oil	4gal	$11	$35
3/28	Surround	88#	$53	$53	3/23	Surround	50#	$30	$30		Thiodan 3 EC	2.6 qts.	$24	
4/2	Supreme oil	4 gal	$11	$24	4/1	Surround	50#	$30	$30	4/10	Omni Oil	1.7 gal	$8	$70
	Wettable Sulfur	15#	$13		4/12	Morestan	5#	$100	$100		Esteem	15 oz	$62	
4/11	SafTSide oil	1.25 gal	$13	$13	4/25	Isomate C+	250	$69	$69	4/17	Isomate C+	200 ties	$55	$55
4/24	NoMate CM	400	$110	$110	5/18	Dithane	8#	$25	$25	4/27	Omni Oil	1.5 gal	$7	$69
5/2	Dipel	2#	$18	$31	8/15	Regulaid	3 qts	$21	$21		Esteem	15 oz	$62	
	SafTSide oil	1.25	$13			(in 800 gpa)				6/1	Confirm	20 oz	$30	$30
6/13	SafTSide oil	1.5 gal	$15	$15						6/19	Omni Oil	2 gal	$10	$10
6/29	SafTSide oil	1.5 gal	$15	$15						7/31	Omni Oil	2 gal	$10	$10
7/24	SafTSide oil	1.5 gal	$15	$15										
		2000 spray cost		$329			2000 spray cost		$305			2000 spray cost		$279
	#sprays(@$15)	9	$135	$464		#sprays(@$15)	7	$105	$410		#sprays(@$15)	7	$105	$384

Table 3. Spray program costs (**hard** and *soft*)

Grower	2000			1999			Difference 2000-1999		Grower	Spray cost
	Sprays	Application	Total	Spray cost	App. Cost	Total	Sprays	Apps		
1	**$657**	**$120**	**$777**	**$744**	**$105**	**$849**	**-$87**	**$15**	*15*	*$279*
2	**$544**	**$75**	**$619**	**$473**	**$60**	**$533**	**$71**	**$15**	*13*	*$305*
3	*$306*	*$165*	*$471*	*$416*	*$180*	*$596*	*-$110*	*-$15*	*3*	*$306*
4	*$592*	*$165*	*$757*	*$369*	*$105*	*$474*	*$223*	*$60*	*11*	*$329*
5	*$432*	*$210*	*$642*	*$625*	*$180*	*$805*	*-$193*	*$30*	*9*	*$340*
6	*$569*	*$135*	*$704*	*$592*	*$150*	*$742*	*-$23*	*-$15*	*5*	*$432*
7	**$473**	**$90**	**$563**	**$572**	**$120**	**$692**	**-$99**	**-$30**	**7**	**$473**
8	**$631**	**$90**	**$721**	**$508**	**$75**	**$583**	**$123**	**$15**	**2**	**$544**
9	*$340*	*$180*	*$520*	*$236*	*$150*	*$386*	*$104*	*$30*	*6*	*$569*
10	**$800**	**$135**	**$935**	**$742**	**$105**	**$847**	**$58**	**$30**	**14**	**$572**
11	*$329*	*$135*	*$464*	*$300*	*$150*	*$450*	*$29*	*-$15*	*4*	*$592*
12	**$762**	**$120**	**$882**	**$665**	**$105**	**$770**	**$97**	**$15**	**8**	**$631**
13	*$305*	*$105*	*$410*	*$425*	*$105*	*$530*	*-$120*	*$0*	**1**	**$657**
14	**$572**	**$135**	**$707**	**$459**	**$165**	**$624**	**$113**	**-$30**	**12**	**$762**
15	*$279*	*$105*	*$384*	*$528*	*$195*	*$723*	*-$249*	*-$90*	**10**	**$800**
AVERAGE										
soft	*$394*	*$150*	*$544*	*$436*	*$152*	*$588*	*-$42*	*-$2*		
hard	**$634**	**$109**	**$743**	**$595**	**$105**	**$700**	**$39**	**$4**		

Table 4. Fruit damage at harvest, 2000

Grower	# of fruit	Pear Psylla	Grape Mealybug	San Jose Scale	Pear rust mite	Codling moth	Leaf-roller	Cut-worm	Lygus	Stink/ Box elder bug	Other
9901	1250	1.6%				0.1%				0.3%	
9902	1250	1.8%	0.9%				0.4%	0.1%	0.2%	0.4%	
9903	1100	**11.6%**					**2.9%**			0.6%	
9904	1000	0.7%	3.2%			**1.9%**	0.6%			0.9%	
9905	1000	**8.6%**	**14.9%**							0.4%	
9906	1000	1.0%	0.9%						0.1%	**1.8%**	0.2% fruitworm
9907	1000	**12.9%**	**34.4%**				0.2%		0.2%	0.1%	
9908	900	0.7%					0.3%			0.6%	**1.3% fruitworm**
9909	1100						0.9%	<0.1%	0.2%	0.9%	0.4% fruitworm
9910	1200	<0.1%	<0.1%	<0.1%		0.1%		<0.1%		0.8%	
9911	1000	0.1%				0.1%	**2.1%**		0.2%	0.3%	
9912	1000	0.8%	0.2%				0.1%		0.1%	**1.1%**	
9913	1250	1.8%	1.0%	<0.1%			**3.6%**	0.6%	0.2%	**1.6%**	
9914	1000	0.8%				0.5%			0.1%		
9915	1000	0.5%	0.9%				0.2%		0.1%	**4.0%**	

Damage Determination

Pear Psylla	cumulative light russet covering 3/4" circle or more
Grape Mealybug	mealybugs found on fruit OR coarse russet >3/4" circle
San Jose Scale	scale or red marks found on fruit
Pear Rust Mite	russeting in calyx end
Codling Moth	stings or entries
Leafroller	feeding damage on fruit
Stink Bug	feeding depressions and white corky area below skin

Table 5. Fruit damage by key pests, 1999-2000

Psylla	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Soft	Hard
1999	0.5%	0.3%	9.4%	-	-	20.1%	-	1.2%	3.4%	15.0%	31.9%	13.8%	47.2%	6.1%	38.0%	25.0%	6.2%
2000	1.6%	1.8%	11.6%	0.7%	8.6%	1.0%	12.9%	0.7%	0.0%	0.1%	0.1%	0.8%	1.8%	0.8%	0.5%	3.0%	2.7%

Mealybug	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Soft	Hard
1999	0.0%	12.9%	0.0%	-	-	6.9%	-	0.4%	0.0%	0.0%	0.0%	0.0%	0.8%	0.0%	0.2%	1.3%	2.2%
2000	0.0%	0.9%	0.0%	3.2%	14.9%	0.9%	34.4%	0.0%	0.0%	0.1%	0.0%	0.2%	1.0%	0.0%	0.9%	2.6%	5.1%

Leafroller	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Soft	Hard
1999	0.0%	0.0%	0.1%	-	-	0.0%	-	0.4%	2.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.1%
2000	0.0%	0.4%	2.9%	0.6%	0.0%	0.0%	0.2%	0.3%	0.9%	0.0%	2.1%	0.1%	3.6%	0.5%	0.2%	1.3%	0.2%

Stink bug	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Soft	Hard
1999	0.0%	0.0%	0.0%	-	-	0.0%	-	0.4%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
2000	0.3%	0.4%	0.6%	0.9%	0.4%	1.8%	0.1%	0.6%	0.9%	0.8%	0.3%	1.1%	1.6%	0.0%	4.0%	1.3%	0.5%

Table 6. Psylla adults per tray, 2000

Week of	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Soft	Hard
13-Mar	**32.9**	14.8	4.8	**29.8**	24.2		**29.1**	10.1		36.3	3.9	**9.4**	7.6	19.6	12.8	10.4	20.5
20-Mar	7.7	10.4	**5.4**	26.4	18.0	8.3	16.6	8.0	5.1	**43.6**	**9.5**	4.1	**14.8**	**24.0**	**17.3**	13.1	16.3
27-Mar	6.4	**16.0**	2.2	17.0	14.5	**12.6**	10.5	**11.6**	**10.7**	13.9	3.2	2.8	4.7	0.9	2.5	8.4	8.6
3-Apr	0.0	1.1	1.5	12.2	0.5	8.7	2.4	0.3	1.5	0.1	0.4	0.0	1.3	0.2	2.4	3.6	0.3
10-Apr	0.1	0.7	0.4	10.0	1.3	1.0	2.7	0.0	0.8	0.0	0.2	0.0	0.8	0.1	1.2	2.0	0.2
17-Apr	0.0	0.0	0.9	6.2	0.4	2.4	1.4	0.0	0.4	0.0	0.0	0.0	0.2	0.0	0.7	1.4	0.0
24-Apr	0.0	0.0	1.2	3.2	0.6	2.6	1.2	0.0	0.1	0.0	0.2	0.0	0.6	0.1	0.2	1.1	0.0
1-May	0.0	0.0	0.2	2.0	0.1	1.1	0.3	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.1	0.5	0.0
8-May	0.0	0.0	0.5	0.7	0.1	1.2	0.0	0.1		0.0	0.0	0.1	0.2	0.0	0.1	0.4	0.0
15-May	0.1	0.0	0.2	0.2	0.4	0.3	0.1	0.0	0.1	1.0	0.1	0.6	0.2	0.8	0.3	0.2	0.4
22-May	0.1	0.5	0.3	0.1	0.6	0.4	0.3	0.0	0.2	0.7	0.2	0.7	0.2	0.6	0.6	0.3	0.4
29-May	0.1	0.8	0.5	0.4	3.0	1.4	2.0	0.1	0.3	0.9	0.2	0.6	0.1	0.1	0.1	0.7	0.4
5-Jun	0.6	0.8	1.1	0.1	1.9	3.0	3.0	0.4	3.5	0.3	0.2	-	-	0.6	0.8	1.5	0.5
12-Jun	1.0	0.9	2.5	3.0	4.9	1.2	1.8	0.8	2.4	0.6	1.0	0.6	5.1	0.9	1.3	2.7	0.8
19-Jun	0.7	0.5	4.0	1.2	1.2	2.6	2.2	0.2	0.9	0.1	0.9	1.1	3.4	0.3	0.4	1.8	0.5
26-Jun	0.1	0.7	3.5	0.8	1.2	1.3	0.6	0.1	0.8	0.1	0.2	0.1	3.5	0.1	0.6	1.5	0.2
3-Jul	0.7	1.7	**5.9**	2.9	**6.8**	3.2	0.5	0.0	1.8	0.6	1.2	0.4	3.2	0.2	0.7	3.2	0.6
10-Jul	0.7	1.7	3.8	0.9	3.0	1.3	0.6	0.1	0.5	0.7	1.3	1.9	1.2	1.0	0.3	1.5	1.0
17-Jul	0.7	3.6	**5.1**	1.4	**8.4**	1.5	0.5	0.4	1.2	1.3	1.8	3.1	2.5	3.3	1.5	2.9	2.1
24-Jul	1.2	**5.8**	**15.7**	3.6	**13.2**	3.1	0.8	0.6	3.5	1.0	2.3	0.9	3.5	0.9	2.3	5.9	1.7
31-Jul	1.6	**6.6**	**12.5**	1.7	**13.8**	1.5	2.8	1.9	3.8	0.6	**7.7**	0.5	**9.5**	1.0	2.9	6.7	2.0
7-Aug	1.2	**7.7**	**19.3**	1.3	**6.4**	**7.0**	1.8	0.1	4.1	0.3	**7.0**	0.1	**36.6**	0.5	3.8	10.7	1.6
14-Aug	2.8	**17.0**	**13.9**	2.2	**8.9**	**8.5**	3.8	0.6	0.9	0.5	**6.8**	0.5	**38.0**	0.4	3.5	10.3	3.6
24-Aug	2.1	**23.5**	**11.7**	1.8	**6.4**	**5.0**	2.7	2.1	1.3	2.4	4.1	0.9	**21.8**	1.3	2.5	6.8	5.4
28-Aug	2.6	**22.0**	**18.5**	2.2	**5.9**	**9.1**	4.9	5.0	2.1	2.1	**12.8**	1.8	**13.3**	3.0	4.1	8.5	6.1
16-Oct	**35.7**	**40.8**	11.0	5.8	10.4	**30.5**	**67.5**	**32.1**	12.0	**52.9**	22.2	13.3	**82.0**	22.1	11.4	23.2	32.8

2000 PPa Summary

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Soft	Hard
March	18.7	13.3	4.1	23.8	20.4	10.5	18.7	9.9	7.9	31.3	5.5	5.4	9.0	14.8	10.9	11.5	15.6
April	0.0	0.5	1.0	7.9	0.7	3.7	1.9	0.1	0.7	0.0	0.2	0.0	0.7	0.1	1.1	2.0	0.1
May	0.1	0.3	0.3	0.7	0.8	0.9	0.6	0.0	0.2	0.5	0.1	0.4	0.2	0.3	0.2	0.4	0.3
June	0.6	0.7	2.8	1.3	2.3	2.0	1.9	0.4	1.9	0.3	0.6	0.4	3.0	0.5	0.8	1.8	0.5
July	1.0	3.9	8.6	2.1	9.0	2.1	1.0	0.6	2.2	0.8	2.9	1.4	4.0	1.3	1.5	4.1	1.5
August	2.2	17.6	15.9	1.9	6.9	7.4	3.3	1.9	2.1	1.3	7.7	0.8	27.4	1.3	3.5	9.1	4.2
October	35.7	40.8	11.0	5.8	10.4	30.5	67.5	32.1	12.0	52.9	22.2	13.3	82.0	22.1	11.4	23.2	32.8

Table 7. Psylla nymphs per leaf, top shoots, 2000

Week of	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Soft	Hard
29-May	0.05	0	0.2	0.05	0.05	0.3	0.05	0	0	0	0	0	0	0	0.05	0.08	0.01
5-Jun	0.1	0.5	0.2	0.05	0.1	0	0.1	0	0	0.2	0	-	-	0.4	0.05	0.06	0.19
12-Jun	0.2	0.9	0.2	0.05	0.3	0.2	0.4	0.01	0.05	0.5	0	0.3	0.05	0.7	0	0.11	0.43
19-Jun	0.6	0.6	0.3	0.05	0.2	0.3	0.1	0.05	0.05	0.5	0.3	0.4	0.2	0.8	0.1	0.19	0.44
26-Jun	0.6	**1.1**	**1.1**	0.2	0.7	0.5	0.6	0.05	0.1	0.8	0.05	0.2	0.6	0.7	0.2	0.43	0.58
3-Jul	0.2	0.6	**2.1**	0.6	0.6	0.5	0.8	0.1	0.4	0.5	0.1	0.2	0.9	0.6	0.2	0.68	0.43
10-Jul	0.5	0.2	**3.9**	0.4	0.7	0.8	0.6	0.05	0.5	**1**	0.4	0.5	**1.4**	**1.4**	0.4	1.06	0.61
17-Jul	0.2	0.3	**3.2**	0.3	0.5	0.4	0.4	0.05	0.3	0.3	0.2	0.2	**1.2**	0.6	0.5	0.83	0.29
24-Jul	0.7	0.4	**3.9**	0.2	0.5	0.2	0.8	0.3	0.3	0.7	0.3	0.6	**1.2**	0.3	0.6	0.90	0.54
31-Jul	0.3	**3.2**	**2.6**	0.3	0.4	0.3	**1.8**	0.9	0.05	**1**	0.4	0.8	**1.7**	0.7	0.3	0.76	1.24
7-Aug	0.1	**4**	**2.1**	0.2	0.4	0.4	**2.4**	0.4	0.2	0.3	0.3	0.5	0.7	0.3	0.3	0.58	1.14
14-Aug	0.1	**2.8**	**3**	0.4	0.4	0.6	**4.2**	0.4	0.2	0.2	**1**	0.2	**5.6**	0.7	0.3	1.44	1.23
21-Aug	0.5	**3.6**	**2.1**	0.2	0.5	**1.6**	**2.9**	0.2	0.3	0.7	**1**	0.2	**8.8**	0.7	**1.5**	2.00	1.26
28-Aug	0.6	**3.2**	**4.5**	0.4	0.7	**1.9**	**2.5**	0.5	0.5	**2.2**	**2.1**	0.8	**9.3**	**1.2**	0.4	2.48	1.57

2000 PPn Summary

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Soft	Hard
June	0.4	0.8	0.5	0.1	0.3	0.3	0.3	0.0	0.1	0.5	0.1	0.2	0.2	0.7	0.1	0.19	0.41
July	0.4	0.9	3.1	0.4	0.5	0.4	0.9	0.3	0.3	0.7	0.3	0.5	1.3	0.7	0.4	0.84	0.62
August	0.3	3.4	2.9	0.3	0.5	1.1	3.0	0.4	0.3	0.9	1.1	0.4	6.1	0.7	0.6	1.62	1.30

Table 8. Grape mealybug, 2000

Week of	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(% infested spurs)															
3-Apr					10%		14%					3%			6%
10-Apr				10%	20%		9%		3%						3%
17-Apr				10%	16%		3%		3%			6%			7%
24-Apr				3%			3%		3%			3%			
1-May					10%										
(per Tray)															
1-May					0.05										0.05
8-May					0.4		0.1								0.05
15-May					0.4		0.05								
22-May					0.3		0.3								0.2
29-May				0.2	0.3	0.05	0.4								0.3
5-Jun					0.1		0.2								0.2
12-Jun				0.1	0.5				0.05						0.1
19-Jun				0.05	0.3		0.3								
26-Jun					0.2		0.3								
3-Jul					0.4	0.1	0.5					0.05			0.05
10-Jul					0.4		0.5					0.05			
(% inf. top shoots)															
3-Jul				10%			5%								
10-Jul				5%	5%		40%								20%
17-Jul				30%	**100%**	10%	**100%**					10%			50%
24-Jul		5%			**70%**		**90%**					5%			20%
31-Jul		20%		30%	**70%**	20%	**95%**					5%			40%
07-Aug				10%	50%		**80%**								20%
14-Aug				20%			**70%**								20%
21-Aug				10%	30%		**80%**								5%
28-Aug				20%	40%		**60%**								
2000 GMB Summary															
July	0%	5%	0%	15%	49%	6%	66%	0%	0%	0%	0%	4%	0%	0%	26%
August	0%	0%	0%	15%	30%	0%	73%	0%	0%	0%	0%	0%	0%	0%	11%

Table 9. Twospotted spider mites per leaf, 2000 (blanks are zeroes)

Week of	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Soft	Hard
1-May																	
8-May					0.9		0.5										
15-May			0.05		0.4	0.05	0.15										
22-May			0.05	0.05	0.1	0.1	0.8		0.15								
29-May			0.05		0	0.9	**2**		0.05		0.05						
5-Jun			0.05		0.1		**6.8**				0.4				0.05	0.1	1.0
12-Jun			0.05	0.2	0.4		**14.5**				0.1				0.2	0.1	2.1
19-Jun			0.1		0.05	0.3	**23.1**				0.05		0.1		0.4	0.1	3.3
26-Jun			0.2		0.3	0.3	**2.8**		**1.5**			0.4	0.2		0.4	0.4	0.5
3-Jul				0.3	0.3	0.1	0		**2**				0.5	0.6	0.2	0.4	0.1
10-Jul						0.3			**1.1**		**1.1**	**2.1**	0.4	0.4	0.4	0.4	0.4
17-Jul		0.1	0.2		0.2	0.2			0.5	0.2	1	**3.9**	0.2		0.3	0.3	0.6
24-Jul	0.2	0.9	0.1	0.5	0.4	0.8	0.4		0.6	**4.8**	0.3	**3.1**	0.1	**5.4**	0.2	0.4	2.1
31-Jul		0.9	0.05	0.8	0.7	0.05	0.05		0.4	**1.6**	0.05	**6.5**	0.3	**6.9**	**1.8**	0.5	2.3
7-Aug		0.3			0.2	0.05	0.2	0.05	0.5	**1.8**	0.7	**5.4**	**2.2**	**6.7**	0.3	0.5	2.1
14-Aug	0.05	0.6		**2.9**		**1.7**	0.1	0.3	0.4	**12.1**		**2.5**	**1.1**	**4.5**	**1.3**	0.9	2.9
21-Aug	0.5		0.05	**1.7**	0.5	0.4	0.5	0.6	0.1	**10.1**	0.8	**2**	**1.3**	**4.1**	0.3	0.6	2.5
28-Aug	0.3	**1.5**	0.2	0.6	0.9	**4.2**	0.9	**1.9**	0.6	0.8	**3.2**	0.3	0.5	**4.4**	**1.5**	1.5	1.4

2000 TSSM summary

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Soft	Hard
June	0.0	0.0	0.1	0.1	0.2	0.2	11.8	0.0	0.4	0.0	0.1	0.1	0.1	0.0	0.3	0.2	1.7
July	0.0	0.4	0.1	0.3	0.3	0.3	0.1	0.0	0.9	1.3	0.5	3.1	0.3	2.7	0.6	0.4	1.1
August	0.2	0.6	0.1	1.3	0.4	1.6	0.4	0.7	0.4	6.2	1.2	2.6	1.3	4.9	0.9	0.9	2.2

Table 10. Codling moth trap catches, 2000

Week of	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1-May				1		1	1								
8-May						16	2								
15-May	1			14		19	7		3				3	4	1
22-May			4	32		113	9				1		2	8	1
29-May			2	13		45	6			1				1	
5-Jun		1	1	27		8	8			1				1	
12-Jun			1	13		1	5			1		1	3	2	
19-Jun		1		32		11	8	1		1		2		13	5
26-Jun				5			1			4		2	2	35	
3-Jul				36		2	8			8			1	25	
10-Jul				45		3	2			23	2		2	15	
17-Jul			1	17		4	1			11	2		3	17	2
24-Jul				2		2	1			2			1	16	
31-Jul			1			3	6								
YTD total	*1*	*2*	*10*	*237*	*0*	*228*	*63*	*1*	*3*	*52*	*5*	*5*	*17*	*137*	*9*
00 per trap	*1*	*1*	*3*	*79*	*0*	*76*	*16*	*0*	*1*	*13*	*3*	*1*	*6*	*46*	*5*
99 per trap	2	0	15	45	0	241	14	1	0	11	1	3	50	17	4
99 Total	3	0	46	90	0	722	57	3	0	45	1	11	149	34	7

NOTE: bubble lures were not replaced in August '00; later counts tailed off, so are not included

Table 11. Pandemis leafroller trap catches, 2000

Week of	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
5/29	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/7	56	4	0	0	3	0	0	0	0	0	0	0	0	0	0
6/13	7	1	0	4	14	1	1	0	0	0	1	0	0	0	1
6/19	34	0	9	31	52	4	4	0	0	1	0	0	0	0	28
6/26	13	4	19	29	97	1	1	3	3	0	2	1	1	0	36
7/4	5	0	6	14	64	0	0	4	3	0	1	0	1	0	8
7/10	9	5	2	12	50	0	0	8	1	0	3	0	0	0	8
7/17	7	1	2	19	96	0	10	3	0	1	3	0	0	0	13
24-Jul	2	6	6	29	118	6	67	2	1	1	1	2	0	2	20
31-Jul	3	1	7	7	64	7	31	11	1	0	4	3	0	1	16
7-Aug	1	2	21	1	21	0	6	8	2	0	7	3	1	1	11
14-Aug	17	10	12	1	16	0	1	20	2	0	9	9	0	0	2
21-Aug	30	15	0	6	61	1	6	13	0	2	4	9	1	1	1
28-Aug	85	25	0	20	51	5	14	2	0	0	3	2	1	0	2
00 Total	271	74	84	173	707	25	141	74	13	5	38	29	5	5	146
99 Total	**143**	**85**	**141**	**708**	**863**	**32**	**130**	49	22	3	10	33	14	20	**71**

Table 12. Obliquebanded leafroller trap catches, 2000

Week of	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
5/29	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0
6/7	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
6/13	1	1	0	0	2	0	0	0	1	0	1	2	0	0	0
6/19	0	1	34	1	1	2	0	0	4	0	32	15	20	0	8
6/26	1	0	31	6	6	2	1	12	89	0	32	57	77	1	12
7/4	6	2	58	1	2	6	1	7	114	0	92	2	10	0	8
7/10	5	7	39	1	2	11	1	20	137	0	120	30	36	0	30
7/17	0	6	37	1	8	33	2	40	120	0	120	29	27	1	38
24-Jul	1	5	13	3	1	9	0	23	155	0	4	4	15	3	18
31-Jul	1	5	20	1	0	8	0	11	69	0	1	1	4	0	2
7-Aug	9	2	24	1	0	0	0	0	14	0	1	1	2	0	0
14-Aug	6	3	5	1	3	1	1	0	5	0	1	2	0	0	0
21-Aug	2	7		0	2	1	0	2	1	0	1	6	0	0	1
28-Aug	8	0	3	0	3	3	1	0	2	0	0	4	3	0	0
00 Total	40	39	264	16	30	76	7	115	719	0	405	153	194	5	117
99 Total	53	22	5	1	5	33	1	9	472	0	221	0	37	2	1

Table 13. Deraeocoris per tray, 2000

Week of	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
13-Mar								0.05							
20-Mar								0.05							0.1
27-Mar															
3-Apr				0.1					0.05						0.1
10-Apr			0.05	0.1											0.2
17-Apr			0.05	0.2											0.1
24-Apr			0.15	0.1											0.1
1-May			0.05	0.1		0.05									0.05
8-May			0.1												0.1
15-May			0.1			0.05	0.03			0.05	0.05				0.05
22-May			0.05	0.2					0.05						0.2
29-May			0.1	0.3		0.1									0.2
5-Jun			0.1	0.1	0.05	0.1									0.2
12-Jun			0.1	**0.6**											0.2
19-Jun			0.2	0.2	0.15	0.1	0.05		0.05		0.05		0.05		0.1
26-Jun			0.2	**0.6**	0.3	0.4	0.1		0.05		0.1		0.1		0.3
3-Jul			0.5	**0.9**	0.2	**0.9**	0.05		0.05		0.3				0.4
10-Jul			**0.6**	**0.6**	0.2	**1.3**			0.3		**0.9**		0.3		0.4
17-Jul			**1.5**	**0.5**	**0.7**	**1.7**	0.05		**0.5**		**0.6**		0.3		**0.6**
24-Jul			**2.6**	**0.8**	**0.7**	**2.1**			**0.7**		**0.6**		0.2		**0.7**
31-Jul			**1.6**	**0.8**	**0.5**	**0.5**			0.4		**0.8**		0.4	0.05	**0.8**
7-Aug		0.05	**1.2**	0.4	0.2	**1**			0.3		**0.7**		**0.8**		**1**
14-Aug		0.1	**0.7**	**0.6**	0.4	**0.5**			0.2		**0.6**		**0.7**		**0.9**
21-Aug		0.1	**1.2**	0.2	0.4	**0.8**	0.05		0.2		0.4		**0.8**		**1.1**
28-Aug		0.2	**1**	**0.6**	**1.3**	**0.6**			0.2		**0.5**		**0.7**		**1**
16-Oct		**0.1**	0.3	0.2	**0.5**	**0.3**			0.1		0.1		0.2		0.4

2000 Derry Summary

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Soft	Hard
April	0.00	0.00	**0.06**	**0.13**	0.00	0.00	0.00	0.00	**0.01**	0.00	0.00	0.00	0.00	0.00	**0.13**	0.04	0.00
May	0.00	0.00	**0.08**	**0.12**	0.00	**0.04**	**0.01**	0.00	**0.01**	0.01	**0.01**	0.00	0.00	0.00	**0.12**	0.05	0.00
June	0.00	0.00	**0.15**	**0.38**	**0.13**	**0.15**	**0.04**	0.00	**0.03**	0.00	**0.04**	0.00	**0.04**	0.00	**0.20**	0.14	0.01
July	0.00	0.00	1.36	0.72	0.46	1.30	0.02	0.00	0.39	0.00	0.64	0.00	0.24	0.01	0.58	0.71	0.00
August	0.00	0.11	1.03	0.43	0.58	0.73	0.01	0.00	0.23	0.00	0.55	0.00	0.75	0.00	1.00	0.66	0.02
October	0.00	0.10	0.30	0.20	0.50	0.30	0.00	0.00	0.10	0.00	0.10	0.00	0.20	0.00	0.40	0.26	0.01

Table 14. Campylomma per tray, 2000

Week of	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
17-Apr															
24-Apr															
1-May				0.04		0.2			0.3		**0.8**		**1.1**		**0.9**
8-May	0.04			**0.7**	**1.5**								**1.6**		**0.7**
15-May				**0.8**	**1.6**				0.3		0.2		**1.3**		**0.6**
22-May	0.08			**1.4**	**0.9**				**0.5**		**0.9**		0.6		**0.7**
29-May	0.08			**0.8**	**1.7**	**0.5**	0.05		**0.5**		0.4		**1.2**		**0.5**
5-Jun				0.4	**0.9**		0.1		**0.5**		0.2		-		0.3
12-Jun				0.4	**0.8**				0.2		0.3		0.3		0.05
19-Jun					0.2	0.1			0.4				0.3		
26-Jun					0.05				0.05		0.1		0.1		
3-Jul				0.1	**0.7**				0.3		0.1				
10-Jul				0.05	**1.9**				0.1		0.05		0.05		
17-Jul				**1**	**3.1**	0.1			0.4		**0.7**		0.4		0.1
24-Jul				**0.7**	**3.1**	0.3			**0.6**		**0.9**		**0.5**		0.1
31-Jul				0.1	**2.2**	0.2			**0.9**		**0.7**		**0.5**		0.2
7-Aug	0.1			0.05	**1.6**	**0.7**			0.4		**1**		0.3	0.05	0.05
14-Aug	0.1	0.1		0.4	**2.6**	0.3			0.05		0.4		0.4		0.2
21-Aug		0.3		**0.5**	**3**	0.1			0.1		0.1		0.1		0.4
28-Aug	0.05	0.2	0.1	**0.6**	**2.8**	**0.7**			0.1		0.2		0.3	0.2	0.4
16-Oct	0.1	0.1		0.2	**1.1**	**0.3**	0.1			0.1	0.3				0.2

2000 Campy Summary

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Soft	Hard
April	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00
May	0.0	0.0	0.0	0.7	1.1	0.1	0.0	0.0	0.3	0.0	0.5	0.0	1.2	0.0	0.7	0.58	0.01
June	0.0	0.0	0.0	0.2	0.5	0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.2	0.0	0.1	0.18	0.00
July	0.0	0.0	0.0	0.4	2.2	0.1	0.0	0.0	0.5	0.0	0.5	0.0	0.3	0.0	0.1	0.50	0.00
August	0.1	0.2	0.0	0.4	2.5	0.5	0.0	0.0	0.2	0.0	0.4	0.0	0.3	0.1	0.3	0.56	0.04
October	0.1	0.1	0.0	0.2	1.1	0.3	0.1	0.0	0.0	0.1	0.3	0.0	0.0	0.0	0.2	0.26	0.05

Table 15. Natural enemy (Derry + campy):psylla nymph ratio, 2000

Week of	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
5-Jun	0.0	0.1	0.1	0.0	0.1		0.0			0.0				0.0	0.0
12-Jun	0.0	0.0	0.5	20.0	2.7	0.0	0.0	0.0	4.0	0.0		0.0	6.0	0.0	
19-Jun	0.0	0.0	0.7	4.0	1.8	0.7	0.5	0.0	9.0	0.0	0.2	0.0	1.8	0.0	1.0
26-Jun	0.0	0.0	0.2	3.0	0.5	0.8	0.2	0.0	1.0	0.0	4.0	0.0	0.3	0.0	1.5
3-Jul	0.0	0.0	0.2	1.7	1.5	1.8	0.1	0.0	0.9	0.0	4.0	0.0	0.0	0.0	2.0
10-Jul	0.0	0.0	0.2	1.6	3.0	1.6	0.0	0.0	0.8	0.0	2.4	0.0	0.3	0.0	1.0
17-Jul	0.0	0.0	0.5	5.0	7.6	4.5	0.1	0.0	3.0	0.0	6.5	0.0	0.6	0.0	1.4
24-Jul	0.0	0.0	0.7	7.5	7.6	12.0	0.0	0.0	4.3	0.0	5.0	0.0	0.6	0.0	1.3
31-Jul	0.0	0.0	0.6	3.0	6.8	2.3	0.0	0.0	26.0	0.0	3.8	0.0	0.5	0.1	3.3
7-Aug	1.0	0.0	0.6	2.3	4.5	4.3	0.0	0.0	3.5	0.0	5.7	0.0	1.6	0.2	3.5
14-Aug	1.0	0.1	0.2	2.3	7.5	1.3	0.0	0.0	1.3	0.0	1.0	0.0	0.2	0.0	3.7
21-Aug	0.0	0.1	0.6	3.5	6.8	0.6	0.0	0.0	1.0	0.0	0.5	0.0	0.1	0.0	1.0
28-Aug	0.1	0.1	0.2	3.0	5.9	0.7	0.0	0.0	0.6	0.0	0.3	0.0	0.1	0.2	3.5

2000	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Soft	Hard
June	0.0	0.0	0.4	6.8	1.2	0.4	0.2	0.0	3.5	0.0	1.0	0.0	2.0	0.0	0.6	1.99	0.03
July	0.0	0.0	0.4	3.8	5.3	4.5	0.0	0.0	7.0	0.0	4.3	0.0	0.4	0.0	1.8	3.43	0.01
August	0.5	0.1	0.4	2.8	6.2	1.7	0.0	0.0	1.6	0.0	1.9	0.0	0.5	0.1	2.9	2.24	0.10

1999	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Soft	Hard
June	0.0	0.0	1.3	0.0	0.1	0.2	0.0	0.0	1.0	0.4	0.0	0.0	10.4	0.0	0.0	1.63	0.06
July	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.2	0.1	0.0	0.0	0.1	0.0	0.1	0.08	0.01
August	0.0	0.0	0.2	0.2	0.0	0.3	0.0	0.0	0.3	0.0	1.5	0.0	0.3	0.1	1.2	0.49	0.02