# AREAWIDE II Pear Project: All IGR All The Time

Washington State University — World Class. Face to Face.

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## INTRODUCTION

Areawide II (AWII) is a demonstration project evaluating codling moth mating disruption (CMMD) programs in Washington State that replace supplemental organophosphate controls with selective insecticides (e.g. oils, IGRs, particle film, microbials. AWII compares "novel" pest control programs using only selective (SOFT) insect growth regulator insecticides with conventional (CONV) programs that allow for the use of organophosphate (OP) or carbamate insecticides. AWII contrasts the relative efficacy and economic value of the novel programs.

The SOFT program eliminates the use of all OPs, carbamates, and other broad-spectrum neurotoxins. Products available include but are not be limited to Bts (e.g., Deliver , Javelin), methoxyfenozide (Intrepid), spinosad (Entrust, Success), horticultural mineral oil, pyriproxyfen (Esteem), and particle films (Surround). The SOFT program is flexible and can change from year to year as products become available or as pest densities are lowered to the point that the softest alternatives provide sufficient control.

2002, 2003
'All IGR All-the-Time Program'
CONV program vs SOFT (IGR)
SOFT = No chloronicotinyls, no Agri-Mek, no OPs

General Programs

**Pear Psylla**
- Agri-Mek
- Provado
- Actara
- Assail
- Surround
- Esteem
- Dimilin
- Neemix

**Codling moth**
- Guthion
- Imidan
- Mating disruption
- Intrepid
- Esteem
- Dimilin

**Spider mites**
- Both used Acramite

Table 1. Areawide II growers, location, acreage & varieties.

| Orchard | Region | Main Cultivar | Acres |
|---|---|---|---|
| P1 | Moxee | Bosc/Anjou | 15 |
| P2 | Moxee | Red Anjou | 20 |
| P3 | Naches | Bartlett | 16 |
| P4 | Monitor | Bosc | 17 |
| P5 | Dryden | Anjou | 20 |
| P6 | Entiat | Anjou | 16 |

## METHODS

Pest densities were monitored using traps, foliage samples and visual examinations. Monitored pests included CM, leafrollers (LR), pear psylla (PP), spider mites, and grape mealybug (GMB). These are key pests for determining the efficacy of different treatment regimes and the impact of these regimes on natural enemy and secondary pest populations. Impact of pests was evaluated by examining fruit for damage at the end of the first CM generation and again at harvest. Data on cost of programs and crop damage will be analyzed by an economist to determine the overall impact of the programs on grower profitability.

Adult CM were monitored with delta-style sticky traps baited with high-load pheromone lures, one trap per 2-2.5 acres. Both pandemis (PLR) and obliquebanded (OBLR) leafrollers were monitored using traps baited with low load (0.1X for PLR, 0.05X for OBLR) pheromone lures, with one trap in each treatment-block. All traps were checked weekly and the number of moths recorded.

Field monitoring for the amount and location of fruit damage by each of the lepidopteran pests was done at key times in the season (LR—late May and early August, CM—early to mid July, again prior to harvest). Further, fruit were inspected in bins during harvest for damage from lepidopteran pests and other insects.

Every two weeks, the orchards were monitored for pests and natural enemies by limb-tap and foliage sampling—spur (prebloom) and leaf samples (mid-May through August). Leaf samples were brushed using a standard mite-brushing machine and counted at WSU-TFREC. All key pest and beneficial arthropods were counted during the limb-tap and leaf-brush sampling.

Table 2. Pear psylla russet evaluation (bin samples), 2003.

| | Percent fruit injury | |
|---|---|---|
| Orch | SOFT | CONV |
| P1 | 0.20 | 0.28 |
| P2 | 0.00 | 0.12 |
| P3 | 0.40 | 0.24 |
| P4 | 2.52 | 3.60 |
| P5 | 1.32 | 0.67 |
| P6 | 0.00 | 0.00 |
| Avg (SE) | 0.74 (0.41) | 0.82 (0.56) |
| 2002 | 0.36 | 0.23 |

Fruit was considered damaged if the cumulative area of psylla-caused russet exceeded the area of a nickel. On average, psylla damage was moderate across all AWII orchards. No significant difference among programs was noted.

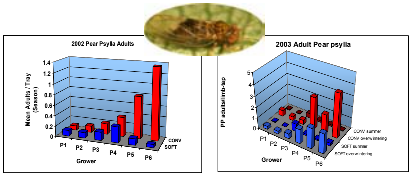
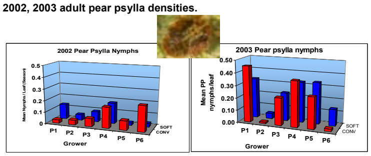



Fig 1. 2002, 2003 adult pear psylla densities.

| 2003 | o.w. | summ. |
|---|---|---|
| SOFT | | |
| Avg | 1 | 0.2 |
| (SE) | (0.3) | (0.1) |
| CONV | o.w. | summ. |
| Avg | 1.7 | 0.1 |
| (SE) | (0.6) | (0.1) |

Slightly more PP pressure in CONV




| 2003 | SOFT | CONV |
|---|---|---|
| Avg (SE) | 0.23 (0.02) | 0.22 (0.03) |

PP nymph samples from upper canopy shoots during the second and third summer generations.

Fig 2. 2002, 2003 pear psylla nymph densities.

Overwintering PP densities were low following prebloom at all orchards, with little or no difference among treatment programs. Psylla densities were uniformly low during the first summer generation with no differences among programs.

While the effects of adulticides are important for PP management, it is the honeydew from summer nymphs that ultimately cause fruit damage. Therefore, nymph samples taken during June and July can be the best predictor of PP damage. Although PP pressure was higher than in 2002, no significant differences in PP nymph densities were noted between SOFT and CONV programs.

Table 3. Codling moth and leafroller damage, 2003.

| | Mid Year Assesment | | Preharvest Evaluation | | Bin Sample Harvest Evaluation | | | |
|---|---|---|---|---|---|---|---|---|
| | % Codling Moth Damage | | | | % Codling Moth Damage | | % Leafroller Damage | |
| Orch | SOFT | CONV | SOFT | CONV | SOFT | CONV | SOFT | CONV |
| P1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 | 0.00 |
| P2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 | 0.00 |
| P3 | 0.0 | 0.0 | 0.5 | 0.2 | 0.32 | 0.16 | 0.00 | 0.00 |
| P4 | 0.0 | 0.0 | 0.0 | 0.6 | 0.08 | 0.24 | 0.04 | 0.08 |
| P5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.00 | 0.04 | 0.17 |
| P6 | 0.0 | 0.0 | 0.0 | 0.2 | 0.04 | 0.04 | 0.00 | 0.48 |
| Avg (SE) | 0.000 (0.000) | 0.000 (0.000) | 0.08 (0.08) | 0.17 (0.10) | 0.07 (0.05) | 0.07 (0.04) | 0.01 (0.01) | 0.12 (0.08) |

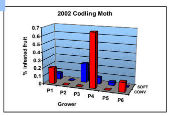



Fig 3. 2002 Codling Moth damage.

On average, codling moth damage was low across the AWII project with no significant difference between programs. However, some damage was detected.

No live leafrollers were detected during the first or second larval sample; however, leafroller damage was noted in harvest bin samples. On average, leafroller damage was higher in the CONV blocks, primarily due to the observations in orchard P6.

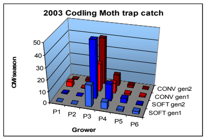



Fig 4. 2003 Codling Moth Pressure.

CM adult captures during the first generation were generally low with the exception of orchard P3. Orchard P4 also had captures that exceeded a treatment threshold of 4 moths/trap. During the 2nd generation, CM captures continued to increase in orchards P3 and P4. These captures did not appear to be associated with treatment regimes, but rather elevated pressure across both blocks. On average, no significant difference was noted between programs.

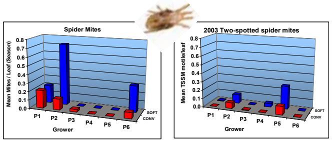



Fig 5. 2002, 2003 Spider mite densities.

| 2003 | SOFT | CONV |
|---|---|---|
| Avg (SE) | 0.07 (0.02) | 0.03 (0.01) |

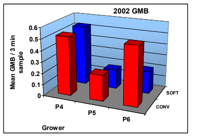



Fig 5. 2002 Grape mealybug densities.

Table 4. Pear harvest fruit injury evaluations (bin samples), 2003.

| | Grape mealybug nymphs | | Pear rust mite | |
|---|---|---|---|---|
| Orch | SOFT | CONV | SOFT | CONV |
| P1 | 0.00 | 0.00 | 0.76 | 0.08 |
| P2 | 0.00 | 0.00 | 0.00 | 0.00 |
| P3 | 0.00 | 0.00 | 0.68 | 0.08 |
| P4 | 12.48 | 2.52 | 0.00 | 0.00 |
| P5 | 1.48 | 1.17 | 0.00 | 0.00 |
| P6 | 1.92 | 9.20 | 0.00 | 0.00 |
| Avg (SE) | 2.65 (2.00) | 2.15 (1.47) | 0.24 (0.15) | 0.03 (0.02) |

All Wenatchee area orchards had some GMB infestation at harvest. In orchard P4 a troublesome infestation was observed in the SOFT block, and in P6 elevated infestation was noted in the CONV block. On average, no difference was noted between programs.

PRM damage was generally very low across the AWII project with a couple of notable exceptions. The SOFT blocks of orchards P1 and P3 each had troublesome levels of damage.

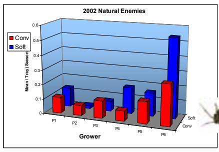
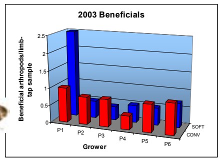



Fig 7a. 2002 Natural enemy densities. No clear pattern for different species, and no significant differences between programs.




| 2003 | SOFT | CONV |
|---|---|---|
| Avg (SE) | 0.9 (0.3) | 0.8 (0.1) |

Fig 7b. Total beneficial arthropods/limb-tap sample, 2003. Again, no significant increases in biocontrol.

Table 5. Cost analysis of insecticide applications, 2003.

| | Soft | | Conv | | |
|---|---|---|---|---|---|
| Orch | # apps | $ / ac | # apps | $ / ac | Soft-Conv |
| P1 | 15 | $347.95 | 11 | $249.76 | $98.19 |
| P2 | 14 | $520.83 | 11 | $290.85 | $229.98 |
| P3 | 15 | $226.74 | 13 | $188.65 | $38.09 |
| P4 | 18 | $525.39 | 18 | $570.42 | -$45.03 |
| P5 | 16 | $460.78 | 16 | $460.78 | $0.00 |
| P6 | 13 | $328.35 | 11 | $371.63 | -$43.28 |
| | | | | | |
| Avg (Range) | 15.2 (13-18) | $401.67 (226.74-525.39) | 13.3 (11-18) | $355.35 (188.65-570.42) | $46.00 |
| | | | | | |
| 2002 | | $355.00 | | $335.00 | $20.00 |

The overall cost of the SOFT treatment regime was higher on average than the CONV, and appeared to be driven by a combination of high CM and high PP pressure in a number of the orchards (Table 10). However, it can be noted that in orchards P4 and P6, the cost of the SOFT treatment regime was substantially less than the CONV and the cost range of the treatment regimes over the entire AWII project was similar.

Table 6. Number of insecticide applications per program, 2003

| | Average applications/acre | | | Total Applications/acre | |
|---|---|---|---|---|---|
| | SOFT | CONV | Total by class | SOFT | CONV |
| Guthion | 0.0 | 0.8 | Organophosphate | 0.0 | 1.0 |
| Lorsban | 0.0 | 0.2 | | | |
| Assail | 0.0 | 0.3 | Chloronicotinyls | 0.0 | 0.8 |
| Actara | 0.0 | 0.5 | | | |
| Provado | 0.0 | 0.0 | | | |
| Thiodan | 0.2 | 0.2 | | | |
| Agrimek | 0.0 | 0.7 | | | |
| Pheromone | 0.3 | 0.3 | | | |
| Dimilin | 0.2 | 0.0 | Growth regulators | 4.7 | 2.0 |
| Intrepid | 0.8 | 0.0 | | | |
| Esteem | 2.0 | 1.0 | | | |
| Azadirachtin | 1.7 | 1.0 | | | |
| Surround | 2.3 | 1.3 | | | |
| Acramite | 0.3 | 0.7 | Miticides | 0.8 | 1.3 |
| Pyramite | 0.0 | 0.3 | | | |
| Vendex | 0.2 | 0.0 | | | |
| Apollo | 0.0 | 0.2 | | | |
| Carzol | 0.3 | 0.2 | | | |
| Sulfur | 0.2 | 0.0 | | | |
| Oil | 5.2 | 5.3 | | | |

## Summary

It is clear that even under conditions of increased codling moth and pear psylla pressure throughout the entire project (as measured by harvest injury evaluations), a SOFT treatment regime based on IGRs and Surround can maintain fruit quality equivalent to a CONV program based on OPs with psyllacides and miticides.

Further, this program was sustainable over the two years of the project. A limiting factor to the full implementation of the SOFT program will be the economic concern of increased pesticide applications and increased cost associated with some of the SOFT insecticides, specifically Surround and azadirachtin. The cost differential between treatment regimes (2001- SOFT $355/a, CONV $335/a; 2002- SOFT $401/a, CONV $355/a) may or may not decrease as biological control agents for PP increase in response to a SOFT program.

One further important limitation of the SOFT treatment regime is a notable lack of suitable insecticides for pear rust mite control.

While there are limitations to the SOFT program that may limit industry-wide implementation, and the SOFT program is arbitrarily limited to specific products, the potential for alternative strategies in pear pest management is being demonstrated. Continued research hopes to determine the effects of the programs on biological control, and determine how important biological control can be.

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