Okanagan Kootenay

Cherry Growers Association

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A Review of 2006 NW Cherry Research

By Michael Beulah

Reported below are some of the more significant research results presented at the **NW Cherry Research Review** in Richland, Washington in November 2006.

A lot of work has been done by Gary Grove and others on **Powdery Mildew**. It seems that they find that the Summerland varieties are more susceptible than their standard of Bing. They find that Staccato and SweetHeart are most susceptible with Lapin being a little less so. I know that I try to keep on top of this disease because once it gets going it can cause great losses in production by increasing cullage.

These are some of Gary Groves Significant findings

- Investigations on the temperature and humidity *ranges* over which the cherry mildew fungus colonizes (grows on) cherry foliage were completed in 2006. Disease developed at 10 (50 F) -28 C (82.4 F) but did not develop at 7.5 (45.5 F) and 28.5-35 C (86-95 F). The effect of relative humidity (between 80% and 100%) alone was insignificant but there were significant temperature/humidity interactions (equation 1). Multiple regression analyses indicated that disease development on cherry foliage was best described by the equation:

Disease severity = 38.9 + 1.3 T + -0.052 T^2*RH + 0.008 T^3*RH (equation 1)

where T = temperature and RH = relative humidity. The equation accounted for about 82% of the variability in the raw data (R^2 = 0. 82). The most significant aspects of these findings are the identification of the temperatures above and below which the fungus does not actively colonize cherry foliage. The temperature algorithm for the secondary infection risk index was partially derived from this equation and previously published information on the latent period. The optimum temperature for colonization was 20.5 C (68.9 F).

- The results of our controlled-environment studies on spore production commenced in 2005 and were completed in 2006 (Figure 1). Sporulation occurred at 12.5 C (54.5 F) -

27.5 C (81.5 F) at relative humidities of 80-100% Multiple regression analyses of the raw data indicated that sporulation on cherry foliage was described by the equation:

(log) $Y = -0.003 + 0.05T + 0.09\ T*RH + 0.0001\ T^2 + -0.0004T^3RH$ (equation 2)

with an R^2 of 0.74. The optimum temperature for sporulation was 21.5 C (70.7 F).

- Studies to ascertain the effects of high temperature on the viability of powdery mildew spores were initiated in 2006. It was found that 24 hours of exposure at 40 C was required to kill spores. Exposure times of 0, 4, 8, and 24 hours at 40 C (104 F) resulted in germination levels of 28.1%, 20.9%, 17.0%, and 0%, respectively. Temperatures of 30-39 C (86-102 F) were not lethal regardless of incubation time.

Jill Calabro found in each of the three cultivars(Bing, Lapins and SweetHearts), fruit remained susceptible to PM throughout the growing season. Fruit infection declined somewhat near the point at which fruit reached 15 °Brix, about 1 ½ weeks before harvest. Perhaps some slight resistance is gained once 15 °Brix is reached, but these studies show evidence to the contrary of this theory. Powdery mildew incidence was statistically the same in the weeks before and after 15 °Brix was reached consistently.

Jill also studied PM resistance to DMI fungicides. DMI fungicides have a single mode of action and target only one gene to control fungi. Resistance develops much more quickly in single mode of action fungicides, because a simple mutation in the fungus can decrease the effectiveness of the fungicide. The life cycle of PM ensures great genetic variability among this group of fungi, so that resistance to DMI's is a valid concern. These results confirm that resistance to DMI's does exist among populations of cherry PM in the PNW. However, this study was not thorough enough to determine the prevalence of these isolates in orchards. A great effort should be made to educate growers about the importance of engaging strategies to preserve the effectiveness of the DMI's currently available, such as using the maximum labeled rate and rotating DMI's with fungicides from other classes.

Also in her research studying the relationship of PM infection and pitting. She found with both Bing and Sweetheart, pitting was related to the temperature at which the injury occurred; the impact delivered at 1 °C resulted in significantly greater pitting than those at 20 °C. and also in each of the three years, cultivar Sweetheart had the greatest injury due to pitting, suggesting a possible cultivar effect. Storage temperature had no effect on pitting.

Jill also studied tree management styles and the incidence of PM. In both years, PM incidence was significantly greatest in trees trained with the Spanish bush system. Spanish bush pruning strategies promote heavy branching and dense foliage that would diminish air movement through the canopy, thereby creating a more favorable environment for PM. Both central and steep leader are more conducive to encouraging air flow through the canopy. With rootstocks, Mazzard consistently had the significantly highest PM incidence and Edabriz the least. This is also likely related to air flow in the canopy, as trees with Mazzard rootstock have a much larger, denser canopy. Edabriz is a more dwarfing rootstock, which enables greater air circulation.

In Washington's newly resurrected Cherry Variety Breeding Program, Jim Olmstead is making PM resistance one of the top priorities. . In addition to conventional control methods, genetic resistance to PM is likely to be an important trait for sustainable cherry production, providing another tool for growers to use in disease and resistance management programs.
Because of this, development of PM resistant cultivars is a primary goal for the WSU Sweet Cherry Breeding Program. Fortunately, five cultivars have been determined to possess foliar resistance to PM ('PMR-1', 'Chelan', 'Venus', 'Moreau', and 'Hedelfingen') (Olmstead et al., 2001; Olmstead and Lang 2002a). Additionally PM resistance in all five cultivars was shown to be controlled by a single dominant gene (Olmstead and Lang 2002a,b).

- Jim also determined that varieties with foliar resistance to PM also had fruit resistance. Fruit from cultivars exhibiting foliar PM resistance were also resistant to the disease.

- Although PM growth progressed as far as hyphae growth, no spore producing structures (conidiophores) were produced on resistant cultivars.

For the cultivars examined, resistance was primarily exhibited as a lack of secondary spore production. However, differences in initial disease infection and growth on 'PMR-1' and 'DD' compared to the other resistant cultivars are promising given that both carry the same resistance gene. If 'Chelan', 'Moreau', and 'Venus' carry at least one different resistance gene, the two genes can be pyramided together in future breeding selections for more durable PM resistance. Fruit from the cultivars examined were also resistant to PM, an important finding given that fruit, not foliar, infection is economically important for PNW growers.

With all the recent heat, water may become an issue again this year. The Public is being informed that farmers use 85-90% of the local water. Now in Summerland most orchards are on water meters. So the next project maybe of interest to some. Drip irrigation for cherries, this project was done in Oregon in the Dalles by Xinhua Yin.

Significant Findings
- Drip irrigation saves 79% of irrigation water compared with micro sprinkler irrigation.
- Fruit yield under drip irrigation is similar to that under micro sprinkler. However, there is a trend of yield increase with straw mulch and fabric covers.
- Fruit quality including fruit sugar content, firmness, and size does not differ regardless of irrigation and ground cover system.
- Drip irrigation significantly increases the percentage of marketable fruits by reducing cherry surface pitting and bruising compared with micro sprinkler. Black fabric may also increase the percentage of marketable fruits.
- Fabric cover over the row area of young sweet cherry significantly improves tree N uptake and leaf N content.
- Application of organic fertilizers directly on the top of fabric cover is equally effective as the application of these fertilizers to the beneath of fabric cover.

Split nitrogen fertigation systems produce competitive cherries with more flexibility for N fertilizer applications

Results

Drip irrigation had significantly higher nitrogen (N) and manganese (Mn), but lower potassium (K) concentrations in leaf than micro sprinkler in August, about one month after harvest . The concentrations of other nutrients were statistically similar between these two irrigation systems. The above results suggest that the uptake of all these nutrients except K by roots is not reduced due to the switch from micro sprinkler to drip irrigation in the second year. The four ground cover systems had similar leaf nutrient concentrations except Cu. The biggest benefit with drip irrigation was water saving. During the entire season from May to September, drip irrigation saved as much as 79% of irrigation water relative to micro sprinklers. Compared with no cover, straw mulch reduced seasonal water consumption by less then 1%, and black fabric and white fabric had a 3 to 5% increase in water use. Fruit yield with drip irrigation was similar to that under micro sprinkler averaged over the four ground cover systems. There was a trend of yield increase with straw mulch and fabric covers, relative to no cover, although these yield increments were statistically insignificant. Fruit quality including fruit firmness, size, and color did not differ regardless of irrigation or ground cover system ; but sugar content was greater with drip irrigation than micro sprinkler. Drip irrigation increased marketable fruits (excellent + slightly pitted) by over four percent (absolute value) via reducing cherry surface pitting compared with micro sprinkler . It seemed there is a benefit with black fabric in reducing fruit pitting and bruising relative to no cover.

On the Cherry Fruit Fly Front, Tim Smith has been testing a number of products(not available) for possible control of CFF as well as some materials to replace Dimethoate(for post harvest clean up) which will cause yellowing of leaves on some of the new varieties. These are some of his interesting results:

Products included in this project during the 2006 trials included Assail, Provado, Rynaxypyr (an “anthranilic diamide,” a new class of insecticide), Entrust, GF-120NF Bait, XDE-175 (a new synthetic spinosin), Pyganic, Rimon (an IGR, applied as a spray and as a bait), and another numbered product. Most of the products had never been tested in the field for effect on cherry fruit fly when first included in this project. At least two promising new-chemistry products will be included in 2007.
Most tested products controlled CFF very well at moderate or full rates applied at 10 day intervals. As in past trials, effective products became less effective when applied at 14 day intervals, even with full standard rates.
The table below summarizes the results.

Table 1. Details of 2006 Trials:

Treatment	Trees / Sites	Days Interval Spray	Flies / Trap 2006	Fruit Sample Number	Larvae Found in Fruit
“Standard” Control. **Provado 1.6F, 6 oz/A** 1st. Treatment, Carbaryl 4 pints/A 2nd, Provado 6 oz/A 3rd treatment, Success 4 oz/A 4th treatment + GF-120 BAIT weekly during and after harvest.	2/2	10	289 13	1000 1000	0 0

Untreated Check Trees	3/3	na	846 605 275	1000 1000 1000	263 428 131
Rynaxypyr 2 oz/a + silicone wetter @ 2 fl.oz./100 gal.	4/4	10	57 289 13 515	1000 1000 1000 1000	0 0 0 0
Rynaxypyr 3 oz/a + silicone wetter @ 2 fl.oz./100 gal.	3/3	10	48 15 515	1000 1000 1000	0 0 0
Table 1, Continued. **Treatment**	**Trees / Sites**	**Days Interval Spray**	**Flies / Trap 2006**	**Fruit Sample Number**	**Larvae Found in Fruit**
Rynaxypyr 4 oz/a + silicone wetter @ 2 fl.oz./100 gal.	4/4	10	57 289 13 515	1000 1000 1000 1000	0 3* 0 0
Rynaxypyr 2 oz/a, NO wetter	4/4	10	21 535 60 13	1000 1000 1000 1000	0 1* 0 0
Rimon 32 fl.oz/a (An Insect Growth Regulator)	3/3	10	20 2 14	1000 1000 1000	0 0 2
Rimon /Bait 2 fl. oz. Rimon per 20 fl.oz NuLur Bait / Acre. 0.2 fl.oz. Bait mix per tree	3/3	7	62 55 55	1000 1000 1000	0 0 0
Assail 30SG, 5 oz / A 10 day spray + interval	3/3	10	21 289 535	1000 1000 1000	0 0 0
Assail 30SG, 5 oz / A 14 day spray interval	4/4	**14**	19 19 19 19	1000 1000 1000 1000	3 11 0 2
Provado 1.6F 6 fl oz /a	3/3	10	21 289 13	1000 1000 1000	0 1* 0
Provado Pro 192 NT 4 fl oz/a	4/4	10	21 15 535 13	1000 1000 1000 1000	0 0 0 0

Provado Pro 192 NT 6 fl oz/A	4/4	10	21 289 13 515	1000 1000 1000 1000	0 0 0 0
XDE-175 (GF-1640) **4.5 oz. /a**	4/4	10	21 6 214 535	1000 1000 1000 1000	0 0 0 0
Table 1, Continued. **Treatment**	**Trees / Sites**	**Days Interval Spray**	**Flies / Trap 2006**	**Fruit Sample Number**	**Larvae Found in Fruit**
XDE-175 (GF-1640) **3.0 oz. /a**	3/3	10	21 214 535	1000 1000 1000	0 0 0
Entrust **1.9 oz./a**	4/4	10	21 535 6 214	1000 1000 1000 1000	0 0 0 0
Numbered Product Z **Moderate rate**	4/4	10	289 60 214 515	1000 1000 1000 1000	0 0 0 0
Numbered Product Z **Higher rate**	4/4	10	48 535 214 515	1000 1000 1000 1000	0 0 0 0
Pyganic 5 (5% pyrethrum) 12 fl.oz./a **with buffer**	4/4	7	53 53 53 11	1000 1000 1000 1000	0 1 2 2
Pyganic 5 (5% pyrethrum) 12 fl.oz./a **NO buffer**	2/2	7	18 75	1000 1000	3 2
GF-120NF Bait **20 fl.oz./a, 1:3 dilution** **0.20 oz product / tree**	18/14	7	see details in text	14,000	0

*The test tree with this light infestation was adjacent to a tree where control failed. Female CFF were free to fly from the infested tree to the nearby test tree with fully mature eggs. This might explain the control

breakdown, as the other three replicates treated with this product and rate were free of larvae, despite high pressure.

Three materials were demonstrated as effective for control of cherry fruit fly larvae inside the fruit, as possible alternatives for post-harvest dimethoate. The dimethoate data has been submitted to the EPA by Northwest Hort Council. See the post-harvest section and table 4 for details.

Provado, Assail and Calypso controlled black cherry aphid (Myzus cerasi) when used at rates and application timings intended for cherry fruit fly control.

Provado, Assail and Calypso applied to severely infested fruit on a tree prevented all or most subsequent larval emergence. As in the 2005 post-harvest trial, Calypso was effective to a practical degree, but did not completely control larva inside the fruit. The lowest effective rate for Provado has not yet been determined. The currently recommended rate of Dimethoate (1.33 lb. ai / a, or 4 pints of the 2.67 lb/gal. formulation) was also effective. The lesser rate of Dimethoate, (1.0 lb./ai/A, or three pints of the 2.67), recently proposed by the EPA as the high legal rate during the re-registration process, was not as effective. This research was submitted to the EPA by the Northwest Hort Council and WSU in an effort to persuade them to reconsider the rate reduction.

Table 2. Post harvest "Clean-up" Spray Options:

Product	Rate	Fruit Sample	Larvae Emerged
Dimethoate 267	64 oz./300 gal./A 1.33 lb. ai/Acre	250	0
Dimethoate 267	48 oz./300 gal./A 1.0 lb. ai/Acre	250	9
Provado 1.6F	8 oz./300 gal./A	250	0
Provado 1.6F	6 oz./300 gal./A	250	0
Calypso SC 480	8 oz./300 gal./A	250	3
Assail 30 SG	8 oz./300 gal./A	250	1
Untreated	0	250	76

Are we ready for Apogee on cherries?

This is work done by S. Guak, M. Beulah and N. Looney at the Pacific Agri-Food Centre in Summerland, B.C. over 3 seasons (1998-2000) and reported in the

proceeding of the Fourth International Cherry Symposium in 2001. Apogee (BASF Corp USA) is prohexadione-ca a new gibberellin biosynthesis inhibitor with short residual effect in the tree. The main reason to use this product is growth control. I see this being important in the future for many reasons. With most cherry plantings in B.C. being more than 300 trees to the acre and yet planted on Mazzard rootstock, crowding and low light conditions can result pretty quickly. Creating a need for summer pruning early in the season when there is lots of other jobs to be doing. The other benefit would be better spray penetration and therefore better disease control.

In these experiments sprays were applied to Lapins at three shoot lengths (15, 30 and 55cms) and two rates of apogee(0, 125 and 250ppm) were tried. Also 2 applications were tried (one at 15cm and again at 30 cms). The most effective treatment was 250 ppm applied at 30 cms growth. This resulted in a 25% decrease in shoot length compared to control trees at the end of the season. 150 ppm also provided some growth control (8%) at 30 cm growth however when applied earlier when shoots were 15 cms the shoots slowed growth for a few weeks then resumed growth. In the U.S. Don Elfving has found it hard to control the growth of cherries with apogee for the same reason the shoots resume growth. However it seems that it is our favour that our growing season is a bit shorter so when 250 ppm is applied at about 30 cm growth, the shoot slows growth and sets a terminal and normally doesn't start regrowing. As mentioned this work was with Lapins and may be more effective on this variety as it seems to me that Sweethearts and Staccato do grow later in the season.

Effects on fruit quality showed that it had no effects on fruitset , fruit soluble solids, titratible acids or yield. However it did increase fruit size and when GA wasn't used it increased fruit firmness. Fruit size was increased from 13.2 gms in the control to 13.9 gms for 250 ppm apogee applied at 30 cms growth. Fruit firmness was increased from 72 durometer units to 74 durometer units with250 ppm apogee. However the year when GA was used increased fruit firmness to 82 durometer units.

The last benefit measured in these experiments was a 27% reduction in time of dormant pruning. And there was no effects on return bloom.

I think this product has a place in our farm practices. Apogee is registered for use in Apples in Canada. Greg Norton went to the Minor Use Spray meeting in Ottawa and the company is cautious but interested. Let OKGCA know if you think this chemical would benefit you?

Bees

We all heard about beehive collapse in early spring. I was lucky and got the best beehives I've ever had this year. Here is a web site to learn more about beehive collapse (http://en.wikipedia.org/wiki/Colony_Collapse_Disorder).