

WTFRC Project # CH-03-301

Project title: Eliminating Cherry Leafroll Disease from Pacific Northwest Orchards

PI: Michael Bush
Organization: Washington State Univ., Coop. Extension, Yakima County
128 N. 2nd Street, Room 233, Yakima, WA 98901
(509) 574-1600
bushm@wsu.edu

Co-PI(s) and affiliation(s): Ken Eastwell, Assoc. Plant Pathologist, WSU-IAREC, Prosser
Bill Howell, Manager NRSP-5, WSU-Prosser

Cooperator(s): Karen Lewis, WSU Coop. Extension, Grant County
Jack Watson, WSU Coop. Extension, Benton/Franklin Co.
Tim Smith, WSU Coop. Extension, Douglas/Chelan Co.
Matt Whiting, Assist. Horticulturist, WSU-IAREC, Prosser

Introduction & Justification

Cherry leaf roll virus (CLRV) is a cherry tree pathogen that is new to the Pacific Northwest. CLRV causes cherry production losses and tree mortality when present in trees that are also infected with other endemic viruses that are known occur at high frequencies in mature cherry orchards. Extensive cherry production losses and tree mortality can be expected if CLRV is allowed spread.

Often producers and fieldmen characterize the symptoms expressed by cherry trees infected with CLRV as a generic tree decline. Some of these symptoms associated with CLRV include delayed bloom and fruit ripening, small cherry size, lack of terminal growth, and premature leaf drop prior to harvest, excessive gumming, shoot tip dieback, loss of fruit-bearing wood, upright leaf growth, leaf enations, and enlarged leaf midribs. Eastwell and Howell have developed an ELISA test and a sampling protocol that allows the WSU ELISA laboratory to screen and detect CLRV in tissue samples of cherry budwood, leaves and fruit.

In previous studies, researchers have observed that within a season or two, CLRV can spread from infected trees to nearby trees through root grafts. They have also found CLRV-infected trees in orchard blocks far removed from known infected sites. The sooner CLRV-infected trees are diagnosed and removed, the less likely the virus will spread to adjacent trees. Previous assessments indicated that CLRV is restricted to a relatively few trees in cherry production areas in Washington. This project intends to contain the virus before it spreads and threatens a larger portion of the PNW cherry industry and evaluate the feasibility of an eradication program.

Objectives:

The objectives of this project are to:

1. Identify and eliminate cherry trees infected with the Cherry leaf roll virus (CLRV) from cherry production areas in the Pacific Northwest.
2. Survey key cherry growing areas in Washington to establish the distribution of CLRV.

Methods:

The leading activities during the winter months of 2003 and 2004 were educational programs to introduce CLRV to cherry producers, agricultural consultants and cherry fieldmen throughout the Pacific Northwest. The goals of these activities were to 1) alert the industry to the threat that this virus poses to cherry production, 2) provide the audience with a “searching image” of the symptoms

associated with cherry trees infected with CLRV, and 3) encourage growers and others to submit samples from suspect cherry trees. Interviews and articles on CLRV were given to the Good Fruit Grower, Basin Business Journal, Western Fruit Grower and other trade magazines that target fruit growers in the Pacific Northwest (estimated circulation of 35,000). Many of these presentations and printed articles focused on the impact of several cherry viruses on cherry production. The articles characterized CLRV as highly debilitating disease whose distribution in the Western USA is not fully delineated. Oral presentations were made by project investigators and cooperators at several local grower meetings including the Washington Horticultural Association, the Oregon State Horticultural Association, the Cherry Institute, the Columbia Basin Tree Fruit Spring Meeting, the Sweet Cherry Short Course and other gatherings. These presentations reached an estimated 3,000 to 3,500 meeting participants. Speakers made it clear that CLRV can negatively impact production and that prompt identification and removal of these infected cherry trees will reduce the risk of the disease spreading to adjacent trees, blocks and cherry producing regions in the Pacific Northwest. Field tours were held in CLRV-infected blocks in Prosser and in Kennewick. At these field days, the visual symptoms of CLRV-infected trees, the impact of the disease on tree productivity and the ability of the virus to spread to adjacent trees were demonstrated. Roughly 100 local producers and fieldmen attended these field tours.

The key expenditure during the first quarter of this project was to hire an agricultural consultant to serve as an Industrial Liaison between the project researchers and the cherry industry. The primary role of the liaison is to arrange meetings with representatives from cherry packinghouses and agrichemical supply companies to discuss CLRV, provide their fieldmen with educational material on CLRV and recruit these fieldmen to scout and sample cherry blocks for CLRV-infected trees. The liaison also gave several presentations on CLRV to fieldmen audiences, made field calls to diagnose unhealthy cherry trees, collected cherry samples for fieldmen and transported samples to the WSU ELISA laboratory. Denny Jones was hired for the role and served in this capacity throughout the duration of the project.

Another key activity of this project was to design and assemble educational material on CLRV to distribute among members of the cherry industry in the Pacific Northwest. In the winter months of 2003, the project's investigators and cooperators designed and printed laminated flashcards to provide growers, fieldmen and consultants with color images of the visual symptoms associated with tree infected with CLRV. Approximately 3,700 flashcards were printed and to industry members throughout the Yakima Valley, Columbia Basin, Wenatchee Valley and Hood River Valley in Oregon. In addition, the written material on the flashcards was translated into Spanish and 400 copies were printed and distributed. Information and pictures of CLRV and recommended tree removal procedure were posted on a County Extension websites as well as at <http://www.nrsp5.prosser.wsu.edu> >. Informational notebooks of CLRV were designed and distributed to cherry packinghouses and agrichemical fieldmen. This notebook was to serve to educate these fieldmen about the CLRV threat, provide them with color images of the symptoms associated with CLRV-infected trees and a protocol for taking budwood, leaf or fruit samples to screen for CLRV. The goal of this notebook was to recruit fieldmen to assist in or facilitate the identification and sampling of diseased cherry trees. Roughly 200 notebooks were assembled and distributed.

During the first year of this project we focused our sampling efforts towards the cherry industry along the Yakima Valley and Columbia Basin that we suspected was the "hotspot" for CLRV-infected trees. During the second year, cherry consultants and fieldmen associated with the cherry industry from the Wenatchee Valley and Hood River Valley in Oregon were encouraged to, and did, bring in samples of suspect trees from these areas.

We intend to follow up with fieldmen and growers regarding samples that tested positive in 2004. This will give us another opportunity to promote CLRV eradication, remind fieldmen about the potential of CLRV to spread to adjacent trees or blocks and further assess the distribution of CLRV.

Significant findings:

- CLRV was identified in 460 of the 1,300 cherry samples submitted to the WSU ELISA laboratory. This represents roughly 105 CLRV-infected cherry blocks.
- Nearly all cherry trees that tested positive for CLRV were from Yakima, Benton and Franklin Counties. Twenty-seven percent of all positive samples came from Yakima County (n= 509) and originated from Selah to Grandview. Over 51% of the positive samples were taken in Benton County from Grandview to Richland (n= 457). Another 19% of all positive samples came from Franklin County from Pasco to Basin City (n = 307).
- One positive site (2 samples) was collected near Wenatchee in 2003, but no further samples were collected in 2004 (16 samples in total).
- All samples (45) received from Grant County, Spokane County, Klickitat County, Oregon and Idaho were negative for CLRV.

Results and discussion:

The WSU ELISA laboratory screened over 1,300 cherry tissue samples for CLRV. Many of these samples were taken from unhealthy trees that showed signs of cherry decline, reduced productivity or from trees displayed the symptoms that this program trained fieldmen to associate with CLRV. Nearly 35% of these 1,300 samples tested positive for CLRV. It is important to note that incidence of CLRV in these carefully selected and biased subset of all cherry trees is not a reflection of the actual incidence of CLRV in the field.

Typically multiple tissue samples were submitted by a fieldman to the laboratory to be screened at once; on average five to ten samples originated from each orchard block sampled. We estimate that the number of orchards with at least one tree infected with CLRV rose from 40 orchards in 2002 to 105 orchards in 2004. Nearly all these orchards are found Yakima, Benton or Franklin Counties. We estimate that nearly 35% of the cherry samples that tested positive for CLRV came from the area around Grandview including samples from Yakima County and Benton County. In Yakima County, CLRV infected orchards were scattered from Sunnyside, Wapato, Zillah and Selah. In Benton County, most of the CLRV-infected trees were found between Grandview and Prosser with a few finds around Benton City and Richland/Kennewick area. In the 2003 season, we focused our educational and sampling efforts in this area. We hosted field tours of two cherry blocks with a high incidence of CLRV to demonstrate the impact the CLRV can have on an orchard operation. The fieldmen who attended these tours were some of our best cooperators in this project.

During the 2003 and 2004 field season, Franklin County Horticultural Pest and Disease Board hired summer interns to walk cherry blocks in the county in search of trees with CLRV symptoms. This agency's proactive response to eradicating CLRV from Franklin County was greatly appreciated and the most successful approach to dealing with CLRV. Over the two years interns covered an estimated 2,500 acres of orchard searching for cherry trees in decline. The Board sent nearly 275 samples to the WSU ELISA laboratory for testing. Over 76 samples representing 21 blocks tested positive for CLRV in Franklin County. All cherry trees that tested positive for CLRV were removed by early 2004 and in most blocks, the stumps were either treated with glyphosate or the stumps were completely removed. In 2004, all orchards that had a positive find in 2003 were resurveyed. Of the 19 blocks with positive finds in 2003, only five blocks were found to still have CLRV-infected trees. In 2004, only two additional sites in Franklin County were found to contain CLRV-infected trees. Representatives from the Franklin County Board were encouraged that they could eradicate CLRV

from their County. Their experience has shown that it will take more than one season to accomplish this even in orchards that have already been sampled.

In 2003, two samples from one orchard taken from the Wenatchee Valley tested positive for CLRV. The follow-up survey revealed that this orchard is no longer in existence. Despite efforts to intensify our educational efforts in this area in 2004, few samples came from the area. All samples (25) taken in Chelan/Douglas Counties during the 2004 tested negative for CLRV. While this could be linked to our difficulty in reaching this audience with our educational efforts, fieldmen familiar with this CLRV program and with the symptoms of trees infected with CLRV were confident that CLRV did not exist in their orchard blocks that they routinely monitored.

Throughout this program, our educational efforts were directed towards the cherry grower and towards cherry fieldmen. Both audiences responded well. An estimated 26% of the samples submitted to the WSU ELISA laboratory came from fieldmen and 22% from cherry growers. Roughly 25% of all samples came from Horticultural Pest & Disease Boards, 10% from agrichemical fieldmen and 8% from crop consultants. We did encounter several growers and fieldmen who desired anonymity regarding the location of positive finds. The assistance of our Industrial Liaison as a go-between did recruit samples that we would not have received otherwise.

One major setback to the success of the project is growers who refused to remove trees that the project has screened and diagnosed as positive for CLRV. Often these were small-scale farmers who did not rely on cherries to provide their main means of income. Efforts to convince the grower to remove these trees through adjacent grower peer pressure and Horticultural Pest & Disease Boards did not seem to work outside of Franklin County. We estimate that nearly 10% of the CLRV-infected cherry trees have not been pulled. At the other extreme, we had a few growers either completely remove their orchard blocks badly-infected with CLRV or remove every tree that tested positive for CLRV (accounting for 35% of our positive samples).

Throughout the Yakima Valley, a number of fieldmen did comment that the function of the Industrial Liaison greatly improved their awareness of CLRV and willingness to cooperate with this program. The laminated flashcards that depicted symptoms of trees infected with CLRV were frequently mentioned as another product that was appreciated by fieldmen and we experienced a demand for those flashcards in Spanish that exceeded our supply. The notebook with the sampling kits provided a good reminder and incentive for fieldmen to submit samples to the ELISA lab. When asked about the cost of the ELISA test, many fieldmen did not feel that the cost would deter them from submitting samples in the future. There were some growers and fieldmen that felt comfortable with recognizing symptoms of trees infected with CLRV and indicated that they would only submit a few samples each season to periodically confirm their diagnosis.

We estimate that over 600 cherry trees have been removed as a result of this project. Four orchards alone accounted for nearly 200 of those trees removed. Not all these trees were tested positive for CLRV, but some showed signs of tree decline and were located in orchards where other trees tested positive. Some growers expressed doubts about receiving mixed results (multiple samples where some samples tested positive and some negative for CLRV) from the ELISA labs and removed all trees in decline regardless of test results. We attribute the removal of these trees to our educational program that convinced growers that CLRV is a highly virulent disease that will significantly impact tree productivity and spread to adjacent trees if the infected tree is not removed immediately. These actions should be interpreted as a positive step towards the containment and even eradication of CLRV in the PNW.

Budget:

Project title: Eliminating Cherry Leafroll Disease from Pacific Northwest Orchards
PI's: Bush, Eastwell & Howell

Project duration: 2003-2005
Current year: 2005
Project total (2 years): \$123,000
Current year request: \$0

Current year breakdown

Item	Year 1 (2003)	Year 2 (2004)	Year 3 (2005)	T
Salaries ¹	35,000	35,000	0	70,000
Benefits (17%%)	5,950	5,950	0	11,900
Wages				
Benefits (%)				
Equipment				
Supplies ²	4,000	3,000	0	7,000
Travel	9,125	9,125	0	18,250
Miscellaneous ³	6,340	9,510	0	15,850
Total	60,415	62,585	0	123,000

¹ Industry liaison—was hired through WTFRC and was the equivalent of one full-time position.

² The supplies requested are primarily for addition notebooks, flashcards and sample bags.

³ Screening samples for CLRV at the WSU ELISA Laboratory (~1,500 samples @ \$6.34/sample).