Final Project Report

Project Title: Powdery Mildew Workshop

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Budget: **Year 1**: $10,000

Justification

Cherry powdery mildew (CPM) is a significant problem for cherry producers, despite development and implementation of new chemical controls and IPM programs in the past decade. The disease received the highest ranking at the 2009 WA-OR cherry priority-setting session and the 2009 crop season highlighted the threat this disease poses, as cherry acreage expands, new cultivars are planted, and market demands for fruit quality escalate. The potential for pathogen resistance to common chemical controls exacerbates the situation. The disease was also identified as a high priority at the 2010 priority session.

The time is right for the PNW cherry industry to work more effectively towards permanently mitigating the impact of this disease. We can no longer rely so strongly on chemical controls, but should expand our efforts to used a more systems-oriented approach, including genetic, chemical, biological, engineering and informational approaches. Extension efforts must be integrated throughout these efforts rather than utilized simply to disseminate information.

We propose to organize a strategic workshop with selected researcher, extension, and industry participants to develop a visionary strategy that includes both short- and long-term goals. We expect to initiate the process with an evening session on Thu 12 Nov at the 2009 OR-WA Cherry Research Review in Yakima to better define specific issues from the industry perspective. We will then organize a one-day workshop, tentatively scheduled for 14 Jan in Yakima, the day before the 2010 Cherry Institute. While the focus will be on CPM, we will attempt to include other crops that also face pressures from PM (apple, grape, hops). This workshop will include significant stakeholder participation, with an emphasis on the development of a strategic roadmap to guide further research and extension activities. Requested funds will be used to conduct the meeting, defray expenses for invited participants, and kick start the new strategic approaches. Funding will also be sought from private sector technology providers.

Objectives

1) Initiate a process to create a visionary strategy to permanently mitigate the impact of powdery mildew on cherries in the PNW

2) Develop a strategic roadmap that:
   a) defines desired outcomes
   b) sets specific research and extension goals
   c) develops performance benchmarks and priorities
   d) explores opportunities for leveraged funding

Methods

The workshop was both educational and strategic, with cherry industry representatives and research and extension scientists from the U.S. In a participatory and facilitated context we:

1) provided fresh perspectives on mildew management by featuring innovative insights on the management of powdery mildews across relevant specialty crops

2) identified cost-effective tools and techniques that could with further research and extension mitigate powdery mildew impacts

3) identified priority areas of research and extension and sources of short- and long-term funding

Morning session: Formal presentations on cherry production in the Western United States provided background on the economic impact of cherry powdery mildew throughout the supply chain. Technical experts reviewed our current understanding of the epidemiology and management of CPM and presented the latest research on powdery mildews of perennial specialty crops. Particular emphasis was placed on the approaches and economics of genetic, cultural, chemical and biological components of disease management across crops. We examined the commercialization of control tactics and technologies, including outreach and implementation of science-based programs, registration of new fungicides, regulatory issues affecting domestic and export markets, and economic parameters.

Afternoon session: The afternoon session featured structured discussion to identify major knowledge gaps, proposed potential research and extension goals, and identified potential sources of funding for further efforts.

Plenary Session: Participants developed a consensus framework for subsequent research and extension activities. A team was formed to ensure effective follow-up.

Participant List
Workshop Organizers:
Gary Grove, WSU Prosser
Jim McFerson, Manager, Washington Tree Fruit Research Commission

Tree Fruit Industry
Denny Hayden, Chair, WTFRC Cherry Committee
Tim Dahle, Chair, OR Sweet Cherry Commission
Brent Milne, WTFRC
Other industry representatives

Grape Industry
Rick Hamman, Mercer Ranches

Hop Industry
Ann George, WA Hops Commission

Plant Pathologists
Gary Grove, WSU Prosser
Disease history, status of current knowledge of CPM epidemiology and management
David Gent, USDA-ARS, Corvallis
Epidemiology of Hop Powdery Mildew
Chang-Lin Xiao, WSU-Wenatchee
Apple powdery mildew
Wayne Wilcox, Cornell University, Geneva
GPM management from the eastern perspective; fungicide resistance
Jim Adaskaveg, University of California Riverside
Powdery mildew of soft fruits

Genetic and Physiology
Markus Keller, WSU-Prosser
viticulture and disease management
Nnadozie Oraguzie, WSU-Prosser
breeding, genetics, and genomics
Todd Einhorn, OSU-Hood River

Extension
Karen Lewis, WSU Extension
Gwen Hoheisel, WSU Extension
Gary Grove, WSU Prosser
Lynn Long, OSU Extension
Clive Kaiser, OSU Extension

Fungicide development, regulations, and usage
Deborah Carter, NHC

Engineering and diagnostics
Qin Zhang, WSU-Prosser

Table 1. Workshop agenda.

Time	Section	Topic	Speaker
9:00	Welcome & Intro		Jim McFerson
9:05	PM Overview		Gary Grove
9:15	**Tree Fruit**/cherry	Cherry industry perspective	Denny Hayden
9:20		Cherry PM state of knowledge/management	Gary Grove
9:40	**Tree Fruit**/soft fruit	California PM perspective (soft fruit)	Jim Adaskaveg
10:00	**Tree Fruit**/apples	Apple industry perspective	Brent Milne
10:05		Apple PM state of knowledge/management	Chang-Lin Xiao
10:20	Discussion	Tree fruit section	
10:30	Break		
10:45	**Grape**	Grape industry perspective	Rick Hamman
10:50		Grape PM state of knowledge/management	Wayne Wilcox
11:20		Viticulture and PM	Markus Keller
	Discussion	Grape section	
11:40	**Hop**	Hop industry perspective	Ann George
11:45		Hop PM state of knowledge/management	Dave Gent
12:15	Discussion	Hop section	
12:30	**Lunch**		
1:15	**Discussion sessions**	Research and extension strategic priorities	
		Cultural practices	
		cropping (training)systems	
		mechanization and sensing	
		irrigation	
		Biological *(epidemiology)*	
		Genetic	
		Economic	
		Chemical	
		current programs	
		chemical pipeline	
		resistance management	
		MRLs	
3:15	**Break**		
3:30	**Plenary session**		
5:00	**Social hour**		

Future Plans. In order to further the effort envisioned at the workshop, the pathology group met at the University of Washington in late May. A table of research priorities was developed (Table 2). The pathology team decided to develop two parallel Specialty Crop Research Initiative (SCRI) proposals, one focusing on mitigating the powdery mildew of grapevines and the second on those of apples, cherries, and hops. Our original plans were to developed a Research and Extension Planning Project but the decision was recently made to develop a Coordinated Agricultural Project (CAP). As of 10/15 the CO-PDs are completing the narrative component for distribution to the entire team by November 1.

Table 2. Research and outreach priorities developed at the Seattle meeting of the pathology team.

	Cherry Mildew	**Hop Mildew**	**Apple Mildew**
Life cycle	chasmothecia	bud perennation	bud perennation (role of chasmothecia poorly understood)
Model	Yes*	Yes*	No*
Automation/Spray Technology	Needs improvement	Needs improvement	Needs improvement
Environmental			
Humidity	Limited	Limited	Limited
Light	No	No	No
Heat / cold	Limited	Limited	Limited
Cultural			
Irrigation	Limited	No	No
Light penetration	No	No	No
Air movement	No	No	No
Intervention**	No	No	No
Molecular detection	Yes	Yes	No (some work in Canada)
Fungicide Resistance	Underway	No	No
Outreach	Needs improvement and modernization	Needs improvement and modernization	Needs improvement and modernization

*** = improvement needed ** = life cycle interruption, "fooling the pathogen", etc.**

Several conference calls have been held since the Seattle meeting and a transdisciplinary team has been formed, stakeholder meetings scheduled, and the proposal preparation process initiated. Current team members are presented in Table 2.

Table 3. Current composition of PM SCRI CAP team.

Person	**Role**	**Organization**	**Expertise/Area**	**Specialty Crops**
Gary Grove	Project leader	WSU	Epidemiology	Cherries, hops
David Gent	CO-PI	USDA-ARS	Epidemiology	Hops
Chang-Lin Xiao	Co-PI	WSU	Epidemiology	Apples
Matt Whiting	Cooperator	WSU	Horticulture	Cherries
Todd Einhorn	Cooperator	OSU	Horticulture/irrigation	Cherries
Clark Seavert	Cooperator	OSU	Economics	
Marcia Ostrom	Cooperator	WSU	Rural Sociology	
Thomas Piento-Nielson	Cooperator	Sierra Nevada Brewing	Sensory analyses	
Clive Kaiser	Cooperator	OSU	Extension/outreach	
Lynn Long	Cooperator	OSU	Extension/outreach	
Gwen Hoheisel	Cooperator	WSU	Extension/outreach	

Executive Summary

Powdery mildew (PM) diseases are problematic on perennial specialty crops (apples, cherries, grapes, hops, and soft fruit) grown in the Western US and in many cases drive the crop-specific IPM systems. Research and outreach groups have historically focused on the disease of specific crops with limited interaction with crop teams. The cherry and hop PM epidemics of 2009, and period problems with PM of apples and grapes, prompted the reevaluation of our research and outreach approaches and presented the opportunity for the formation of a trans disciplinary teams to focus upon the mitigation of these problematic on perennial specialty crops. WTFRC, OSCC, and WSU funded a 1-day powdery mildew workshop that was held in Yakima, WA on January 14, 2010. Industry representatives who put the diseases in historical and economic perspectives developed the workshop focus and discussion frameworks. The morning session also featured presentations by PM experts on specific crops. Presentations included summaries of the current knowledge base and recommendations on areas of future research and outreach. The afternoon session featured structured discussions designed to establish strategic research and outreach priorities related to cultural practices, epidemiology, genetics/breeding, economics, and fungicide resistance and development. The workshop concluded with a plenary session. Workshop pathologists met for a second time in Seattle in late May in order to further develop areas of research and outreach and to plan the development of Specialty Crop Research Initiative Proposals. Participants concluded that the knowledge base on grapevine PM was much further advanced than those on other specialty crops and that the priority SCRI effort should focus on apples, cherries, and hops. A trans disciplinary team was subsequently formed and in a recent conference call decided to develop an SCRI Coordinated Agricultural Project (CAP) instead of a Research and Extension Planning Project. The pathology group is currently developing the project narrative for distribution to the full team by November 1. The first of a series of stakeholder meetings is scheduled for late October.