Wine Advisory Committee
Fiscal Year 2009 Approved Projects at WSU

The WAC reviews research proposals and recommends funding to WSU based on priorities and available funding. The funds are dedicated to viticulture and enology research from an excise tax on all liquor sold in Washington state (1/4 cent /litre) and from a WSU line-item in the budget passed by the Washington State Legislature. This year's total came to $441,917. It should be noted that WSU provides for the overhead, staffing and facility costs of each researcher therefore providing an approximate seven fold increase to these funds.

Fruit Quality and Ripening Characteristics as Affected by Berry Size and Berry Shrivel
By Bhaskar Bondada, with Markus Keller and Jim Harbertson
WAC Funding: $20,000

This proposal addresses two issues that have real and practical consequences for the grape and wine industries. The first one deals with a strange ripening phenomenon known as Berry Shrivel, a widely spread serious fruit quality problem in the world of grape production. Dealing with this problem is critical, although it is not easy as we do not know what precisely causes it. Secondly, berry size is considered by many to be an important factor in red wine quality, i.e. smaller berries contribute to better wine quality. Smaller berry size can be achieved by various management practices. However, it is not known how smaller berry size from different cultural practices affects fruit quality, a crucial information for improving wine quality and making different styles of wine.

Winegrape Nutrition: Deficiency Symptoms and Micronutrient Response
By Joan R. Davenport and Mercy Olmstead
WAC Funding: $13,347

The first line of assessment of problems in the vineyard is an assessment of visual symptoms. However, there are few printed or published resources available for the industry with which to assess nutrient deficiencies. Nutritional deficiencies often appear as leaf discoloration, but can also appear as misshapen clusters, fruit, or discoloration of other tissues. As an added complexity, insect damage can often mimic certain nutrient deficiency symptoms. Without knowledge of the cause of the damage, preventative applications of certain chemicals might be applied to reduce the impact on fruit quality. These applications can lead to resistance of certain insects and diseases to the applied chemical. Thus, it is imperative that growers have complete knowledge of nutrient and pest damage symptoms before inappropriate chemicals are applied to the vineyard.

Work to develop low end critical nutrient standards has been based on either field trials with specific nutrient levels or on tissue survey projects. As a result, the absolute low end of nutrient concentration in wine grape petioles and leaves is not based on induced deficiencies and may not fully represent truly deficient conditions. With this project, we propose to establish these low end levels under controlled conditions and will analyze all tissues to determine if fruit vs. leaf (blade or petiole) vs. some other tissue type would best reflect the status of a particular nutrient.

Microbiology and Chemistry of Washington Wines.
By C.G. Edwards with N. Arneborg, J.K. Fellman, P.R. Grbin, C.F. Ross, G. Unlu in addition with A. Dubé Morneau and N.G. Umiker and S.L. Jensen
WAC Funding: $29,015

Brettanomyces spoilage is considered to be a concern if not a major threat to red wine quality. The proposed research area addresses "*Brettanomyces* for nutrient requirements and

growth characteristics" as well as "fermentation management: microbiology undesirable organisms."

Improvement, Distribution, and Implementation of Model- and Detection-Based Management Programs for Grapevine Powdery Mildew

By Gary G. Grove with Walt Mahaffee
WAC Funding: $20,000

The mission of this research is to reduce fungicide usage and contribute to sustainability through the implementation and improvement of weather- and sampling-based disease management. In this implementation phase of the project we propose to:

1. Assess the improved the PCR-based [*qualitative*] sampling-driven disease management approach in high- and low- pressure commercial vineyards
2. Develop a *quantitative* component for the PCR-based air sampling technique
3. Determine the most appropriate fungicide classes for use during critical epidemiological periods identified by the *qualitative* air sampling/PCR technique
4. Maintain air-sampling stations in all Washington appellations in order to make web- and email-based powdery mildew forecasts more robust and geographically comprehensive
5. Develop a web-based program that integrates weather data from AgWeatherNet with the powdery mildew model and provides management recommendations along with a simplified online database for pesticide recommendations
6. Develop a web-based means to train stakeholders in use and implementation of the powdery mildew and other disease forecasting models

Grape Secondary Metabolism: Impact of Vineyard Location and Viticulture Techniques on Cabernet Sauvignon and Riesling Grape and Wine Phenolic Compounds; and Expansion of Analysis Capability to Include Volatile Aroma Compounds, Gene Expression and Total Antioxidant Activity

By James F. Harbertson and Kerry Ringer with Markus Keller and Russell Smithyman
WAC Funding: $112,500

To date, little research has been conducted to understand the impact of vineyard location (climate and topography) and current viticulture techniques in Washington on phenolic composition, volatile aroma composition, total antioxidant activity, and gene expression of wine grapes and research wines.

Biology and Integrated Management of Insect and Mite Pests of Wine Grapes

By David G. James with V. Hebert and P.J. Landolt in addition with L.C. Wright, T. Grasswitz, V. Reyna, D. Brooks, O. Garcia
WAC Funding: $64,500

Washington is home to a number of arthropod pests that can seriously affect wine grape production. Historically, Washington wine grape production has relied upon the use of chemical-based control strategies although integrated pest management strategies, particularly pest scouting and the use of thresholds, are commonly used and help to minimize pesticide inputs. However, there is a need to develop ecologically-based IPM strategies that enhance natural controls, further reducing pesticide and cost inputs in wine grape production. Detailed knowledge of pest biology and ecology is a prerequisite for development of advanced IPM systems and much of this information is still lacking for Washington wine grape pests and their natural enemies. Pesticides remain an important part of vineyard arthropod management and evaluating their impact on pests and beneficials is a fundamental part of our research. This project provides a solid foundation of basic and applied knowledge necessary for the development of advanced IPM systems in Washington wine grapes.

Our recent discovery at WSU of the potential of using synthetic versions of chemicals released by plants when attacked by pests, as effective attractants for predators and parasitoids, has provided a new and exciting focus and has attracted worldwide attention. Research is now being conducted on HIPPOs in Australian and New Zealand vineyards as well as in other crops like vegetables and ornamentals. Washington vineyards are providing the proving grounds for this new pest management technology which has the potential to greatly enhance biological control strategies and reduce pesticide inputs in grape production.

This is the second year of a three year plan initiated in 2007 which focuses on HIPPO, rust/bud mites and cutworms.

Rootstock, Cultivar, and Environmental Effects on Grape Yield Components and Quality

By Markus Keller and Bhaskar R. Bondada with Jim F. Harbertson, Mercy A. Olmstead, Joan R. Davenport

WAC Funding: $75,450

Rootstock evaluation is a critical industry priority in Washington; the berry shrivel syndrome can pose a serious threat to high-quality grape production, but its causes and possible remedies are unknown; establishment of a new wine grape research vineyard is essential for the success of the WSU Viticulture and Enology program.

Effects of Vine Spacing and Selected Rootstocks on Certain Wine Grape Cultivars

By Carol A. Miles and Gary A. Moulton with Tom Thornton, Brent Charnley, Chuck Jackson, Karen Pierolo, Randy Bonaventura

WAC Funding: $9,000

Control of vine vigor for optimum quality wine grape production can be difficult in the cool maritime climate of western Washington, especially for vines established on soils that have a high water holding capacity. These soils tend to contain large amounts of organic matter which release nitrogen as the heat levels increase during the growing season. Close plant spacing common in vineyards does not always provide root competition to reduce too-vigorous vine growth where soils are deep or heavy. Work in California and Australia has indicated that wider spacing between vines reduced vine vigor and increased the fruit yield per vine, which brought vines more into balance. A trial of different row spacings is needed to determine the effectiveness of this method in western Washington climate conditions.

Selecting the right grape rootstock for soil and climate conditions is also important for plant health, vigor control, and earlier ripening. Previous rootstock trials at WSU Mount Vernon NWREC demonstrated the effect of certain rootstocks in promoting earlier ripening in the cultivar Pinot Noir 2A. Preliminary observations indicate that these rootstocks have similar effect on other wine grape cultivars commonly grown in western Washington vineyards. Work is still needed to establish this definitively.

Finally, there is still a need to screen new cultivars in western Washington. Screening new cultivars is an on-going process based on input of new cultivars from national and international sources. Because cultivars perform differently in different regions, specific studies are needed to determine which are best suited for area conditions.

Evaluating Quality of Hard Ciders and Perries

By Carol Ann Miles and Gary A. Moulton with Drew Zimmerman, Peter Mitchell, Northwest Cider Society (Ron Irvine, President)

WAC Funding: $4,000

Growers in both eastern and western Washington are interested in establishing cider apple and perry pear plots, either by converting existing orchard acreage to cider or perry cultivars or by planting new orchards. Cider apples and perry pears can be used to augment and improve ciders and perries that are made with common dessert apples and pears, in natural

blending processes resulting in high quality value-added cider and perry products. The addition of cider and perry cultivars by existing orchardists would result in crop diversification and the potential to produce a high value product. The selection of suitable cultivars and the implementation of correct blending and fermentation methods are factors that affect the profitability of commercial hard cider and perry production.

Weed Management in Establishing an Organic Wine Grape Vineyard

By Carol A. Miles, Gary A. Moulton, Timothy W. Miller with Brent Charnley, Mercy A. Olmstead
WAC Funding: $13,000

More than 40 new wine grape vineyards are being planted in the region and interest in organic wine production is high. Weed management in newly planted vineyards is a critical factor in promoting good vine growth. For organic growers, hand weeding is labor intensive and costly. Organically sound, sustainable weed management methods suited to local soil and climate conditions are the first step needed to establish viable organic vineyards in the region.

Attraction and Retention of Beneficial Insect Populations through Enhanced Biodiversity in Irrigated Vineyards (*Vitis vinifera* L.)

By Mercy Olmstead, David James, Tessa Grasswitz with Derek Way and Ron Dragoo
WAC Funding: $4,000

Cover crops can confer a number of benefits on vineyard systems, including the attraction and retention of beneficial insects. The latter in turn can help reduce pest populations and hence the number of pesticide applications needed each season. Such approaches are becoming increasingly important in the light of rising production costs and increasing consumer demand for wines produced using sustainable or organic practices. However, until recently, most of the research on this topic has been conducted in areas with substantial annual rainfall, with little or no work having been done in arid regions. This project was therefore initiated two years ago to investigate the value of this approach in the irrigated vineyards characteristic of the inland areas of the Pacific Northwest.

Epidemiology of Grapevine Leafroll Disease in Washington State

By Naidu A. Rayapati with Joan Davenport, Eileen Perry, Fran Pierce, Doug Walsh
WAC Funding: $69,113

Grapevine leafroll disease (GLD) is a major threat to the sustainability of the wine grape industry. GLD was previously thought to affect about 10% of the combined acreage of wine and juice grapes. However, an increase in the spread of GLD in many vineyards has been observed in recent years. The delieterious effects of GLD on *Vitis vinifera* include reduced vigor and yield, delayed ripening, lower carbohydrate accumulation in the fruit and decreased longevity of vines. Apart from its negative impact on yield and quality of grapes, the spread of GLD to new, healthy vineyards is of great concern for sanitation and grapevine certification programs in the state.

Effects of Plant Parasitic Nematode Densities on Grapevine Establishment - Development of Damage Thresholds

By Ekaterini Riga with Jack Pinkerton and Markus Keller
WAC Funding: $20,378

Success in planting or replanting a vineyard requires the removal or reduction of physical or biological constraints found in the field. Plant parasitic nematodes are major pests of grapes worldwide and are one of the biological constraints in vine establishment. It is estimated that in California root-knot nematodes cause 20% of economic loss. Even low populations of *Meloidogyne* spp. (root-knot nematode), *Pratylenchus vulnus* (lesion nematode), and *Xiphinema index* (dagger nematode) in the soil can result in extensive damage if grapes are being either planted or replanted into a field within three years after perennials were grown. However, most of

the above nematode species are not found in Washington State whose wine grape industry in young and problems such as plant-parasitic nematodes, have not been widely recognized, yet. In 2003, a survey of 77 sites of Washington State vineyards conducted by USDA-ARS and WSU scientists found a cosmopolitan distribution of plant parasitic nematodes, with many vineyards surveyed having nematode densities considered damaging.

The root knot nematode, *Meloidogyne hapla,* and the dagger nematodes, *Xiphinema pachticum* and *X. americanum* were the most common nematodes found during a survey (Pinkerton and Riga, unpublished). In addition, recent soil sample analysis revealed that the dagger populations in WA are mixed populations consisted of approximately 75% *P. pachticum* and 25% *X. americanum* (Riga, unpublished). Dagger nematodes are ectoparasitic nematode, i.e. they do not enter the root but feed on the growing root tips. Some species are virus vectors that stunt plant growth and impact yield and berry quality. Due to their capability to transmit virus, the threshold for dagger nematodes is very low and there are no registered nematicides for use in established fields to control this species. The root knot nematodes are endoparasites, they live part of their lives inside the roots by establishing permanent feeding sites, depriving the plant from nutrients and deforming the roots. Damage thresholds caused by the root knot and dagger nematodes that account for the characteristics in Washington state vineyards are not available.

The strategies used to manage plant-parasitic nematodes in grapevines will depend on the specific nematode species present and the vineyard characteristics. Pre-plant management options to control nematodes include soil fumigation, application of soil amendments, crop rotation, and selection of nematode resistant or tolerant rootstocks. However, there are limited options for managing nematodes in established vineyards. Therefore, it is imperative that growers are aware of how nematode densities effect the establishment of vines during the first 3 years to take appropriate measures, i.e. decide on pre-plant or post-pant management practices and the associated costs.

We propose to evaluate the effect of densities of main species of plant parasitic nematodes found in Washington during the vine establishment period using two grape varieties, Chardonnay and Cabernet Sauvignon. In addition, we propose to develop economic damage thresholds for the above varieties caused by plant parasitic nematode species in Washington during the vine establishment period.

Assessment of Astringency in Washington State Wines Using Sensory and Chemical Methods

By Carolyn F. Ross and James F. Harbertson
WAC Funding: $22,515

Astringency is one of the most important sensory attributes in red wines and is a contributor to consumer acceptance of red wine. Astringency is attributed to the presence of phenolic compounds in the wine, including tannins, anthocyanins, small polymeric pigments and large polymeric pigments. While the contribution of tannins to perceived astringency has been shown in the literature and in present work, the relationship between the different phenolic compounds in the wine, including the human perception of astringency, has not yet been thoroughly examined. In addition, astringency needs to be placed in the wider context of wine quality.

In a broader sense, the impact of the other wine parameters on perceived wine quality is an area of growing interest. Wine characteristics such as ethanol concentration and wine pH have been suggested to alter perceived wine quality. With the increasing alcohol content in table wines being a noticeable trend over the past several years (Smart, 2004), studying the impact of ethanol on wine sensory quality is especially timely. To start the examination of wine quality, perceived bitterness and astringency were selected as attributes of interest for these initial studies due to their importance as components of quality. In the future, effects of different wine parameters on

the aroma and flavor profiles of wines will be proposed, together with methodologies including both analytical and sensory approaches.

The overall objective of this current study is to gain a deeper understanding of the sensory perception of astringency, the wine components that contribute to its perception, as well as other wine parameters that may influence perceived astringency. Research conducted in this project thus far has shown that tannins are not exclusively responsible for perceived astringency, further explored the influence of polymeric pigments on the perception of bitterness and astringency and looked into consumer preference of Washington State red wines.

Impact of Fining on the Sensory and Chemical Properties of White Wine

By Carolyn F. Ross with James F. Harbertson, Bob Berteau and Doug Gore
WAC Funding: $22,000

Fining is critical to the acceptance of white wines. Not only does fining prevent the browning of white wines, which may eventually lead to consumer rejection and economic loss it has an overwhelming impact on the sensory properties and overall quality of white wines. Fining agents are efficient in their purpose of preventing browning of the wine and aid in wine clarification and protein stability. Therefore it is vital that the proper fining agent be applied during wine production at concentrations that sustain the quality of the wine. This research fulfills the Wine Advisory Committee's Priority of additional research into fining agents and identification and characterization of aroma and flavor compounds in wine. This research also addresses the Research Task Force priorities of wine quality and sensory measurement.
The overall objective of this study was is to determine the impact of fining on the sensory and chemical characteristics of white wine. In the first years of this study, the relationship between fining agents used by Washington winemakers and the impact such agents have on the chemical and sensory characteristics of Washington State Gewürztraminer and Chardonnay wines were examined using chemical and sensory analyses. Results showed that while differences were observed in the chemical and sensory properties of the wines, these differences were not as large as expected. This may have been attributed to the clarification (but not fining) treatment that the wine received prior to our application of the fining agents. In order to get a clearer idea of the effect of fining treatment on wine properties, changes to the 2006 approach to address the overall objective are proposed. Specifically, wine will be made at WSU-Pullman using harvested Riesling and Gewürztraminer grapes and different fining agents will be applied, with a focus on plant-based fining agents.

Mealybug Research in Association with Virology

By Doug Walsh with Naidu Rayapati
WAC Funding: $4,600

Mealybugs are suspected to be the primary vector of grapevine leafroll disease in Washington vineyards. Successful management of this disease in our state's vineyards will depend upon accurate diagnosis and appropriate management of mealybug infestations to reduce the spread of this devastating disease to uninfected vines. To date most efforts have been vineyard-oriented. We propose to establish mealybug colonies to enable us to conduct specific research on the topical toxicity of selected candidate insecticides and to conduct detailed studies on the ability of mealybugs to vector GVLR disease.

Organically Acceptable Cutworm Control in Washington Vineyards

By Doug Walsh with Fran Pierce
WAC Funding: $5,000

Delayed-dormant barrier applications with the pyrethroid insecticides fenpropathrin and bifenthrin are now the standard treatment applied for climbing cutworm control in Washington State vineyards. These insecticides are applied to the soil/vine/trellis interface and repel cutworms

from climbing into vines and feeding on swelling buds. Third party certifiers based in Europe are vehemently opposed to pyrethroid insecticides and the industry in general would like to move toward adoption of organically acceptable practices. Walsh demonstrated in 2004 and 2005 that hot pepper wax could effectively repel cutworms if they were applied twice in vineyards in late winter/early spring. Unfortunately, this adds up to over $80 per acre. Technology is under development at the WSU Center for Precision Agriculture that will reduce labor inputs, target applications better, and reduce product used while maintaining efficacy. Additionally, a banding device is under development that will automate application. We are proposing to develop the efficacy groundwork for this technology.