Oregon Wine Advisory Board
Research Progress Report

1991 - 1992

Personnel Support for Enology Research and Extension

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Funding History: Wine Advisory Board support for Enology Research and Extension was initiated in 1984. WAB support in 1991-92 : $25,143 includes 35% Enology Research and 15% Enology Extension FTE for salary support (matched by OSU) and funds for supplies and travel.

Objectives:

1. To provide technical services and consultation for solving commercial winemaking problems.

2. To develop applied workshops and technical seminars for the continuing education and professional development of Oregon wine industry personnel.

3. To apply research results to commercial wine production to improve wine stability and quality.

The Oregon wine industry has grown rapidly in recent years to over eighty wineries. There is a strong and increasing need for enology Extension, technical assistance, and enology research relevent to specific problems in our growing industry. Enology Extension at OSU provides technical assistance to wineries with an emphasis on troubleshooting production problems and training of industry personnel. Areas of ongoing support include: chemical and physical stabilization of wine, microbial stabilization of wine, analysis of musts and wines, filtration and sterile bottling, sensory evaluation for commercial wine defects and their correction, and general quality control management of wines.

Progress:

This progress report covers primarily Enology Extension and technical services provided to industry. Progress reports covering Enology Research include a joint report by Horticulture and Food Science (Price, Lombard, and Watson) entitled 'The development of viticultural practices to impove winegrape performance and wine quality" and 'The use of nisin and nisin resistant strains of Leuconostoc oenos to control malolactic fermentation' (Daeschel and Watson).

OSU Enology Laboratory

In the last several years we have observed an increasing number of commercial wines with microbial defects (see Progress Report 1990-1991). The trend toward minimal processing in order to maximize wine quality, inadequate quality control management, and inadequate sanitation of equipment and

cooperage is largely responsible for the problems that are occurring in the industry. Wineries tend to develop their own characteristic winery microflora over time which is dependent on their processing and sanitation practices. Problem wines frequently are those to which little or no S02 are used and which receive minimal or no filtration. In many cases the detection of microbial problems is not recognized until the latter stages of spoilage, often too late to take effective corrective measures. Few wineries in Oregon have the necessary equipment to provide the quality control necessary for the early detection potential microbial spoilage problems.

The OSU Enology Laboratory and the Wine Advisory Board are working together to develop increased technical services and Extension for the Oregon wine industry. The goal is to help provide greater quality control management support for Oregon wineries in order to maintain and to improve wine quality. Technical services are supported by OSU and WAB as well as by moderate fees to help pay for labor, supplies, and equipment. All information obtained from testing of commercial wines is held confidential and will be used to develop a data base on Oregon wines to help develop research and Extension programs which address industry concerns and problems.

The following microbiological testing services are currently available from the OSU Enology Laboratory:

Microscopic Screening- A microscopic evaluation of wine is made during fermentation, processing, aging, and at bottling. Wine samples are centrifuged for five minutes at 10,000 rpm to concentrate cells for microscopic observation. An approximation of cell density and viability of wine yeast and bacteria is made and the presence of any significant number of potential spoilage microorganisms can be detected. Microscopic screening is strongly recommended for all wines during fermentation, processing, and aging, especially for wines which are produced with little or no S02, wines fermented with wild yeast or bacteria, and wines bottled with little or no filtration.

Bottle Sterility Check- Wine samples after bottling are sampled aseptically and are membrane filtered and incubated for growth of yeast or bacteria. Bottled wine samples should always be checked for sterility after each sterile filtration run in order to ensure the integrity of the filters and the bottling procedures.

Differential Plating for Yeast and Bacteria- Wine samples with suspected microbial defects or problems can be plated differentially to identify and enumerate microorganisms present. Our laboratory is currently developing new plating methodology for isolating and identifying wine microorganisms (Daeschel, Bakalinsky, and Watson), including bacteria such as leuconostoc, pediococcus, lactobacillus, and acetobacter and spoilage yeasts such as brettanomyces. In order to confirm that a particular microogranism is responsible for a specific defect, a pure colony has to be isolated and a sterile wine inoculated followed by the development of the defect. Differential plating and subsequent testing is often necessary to prove which microorganism caused a problem.

A questionaire on potenttial enology workshops and technical services which can be offered by the OSU Enology Laboratory has been sent to all commerical wineries this January to determine industry need and interest. Enology workshops which can be offered include training in wine microbiology, wine chemistry, wine processing, and wine stabilization. Additional technical services which can be offered by our laboratory include: 1) a Must and Juice Analysis Package (Brix, TA, pH, organic acid profile, microbial evaluation), 2) a Wine Analysis Package (alcohol, TA, pH, reducing sugar, free and total S02, volatile acidity, heat and cold stability, microbial evaluation, and sensory evaluation), and 3) Fining Trials and Wine Adjustments Evaluations (bentonited fining, acid and pH adjustments, deacidification trials, phenolic and color adjustments, and sulfide/mercaptan detection).

Microbial Stability Problems in Oregon Wines

This winter over 75 wines from 15 wineries were submitted to the OSU Enology Laboratory for microscopic screening. These wines included new wines, wines aging in cooperage, and wines in preparation for bottling. In several cases wines were submitted because of detectable problems such as excessive volatile acidity, turbidity, loss of aroma and flavor, and loss of color. Many wineries submitted numerous samples representing a cross section of their wines including newly fermented wines as well as aged wines. This allowed us to develop an overview of the microbial ecology present in several of the individual wineries.

Wineries tend to develop characteristic microflora which appears to be dependent upon their cellar practices. For example, wineries which use little or no S02 prior to fermentation and which rely on indigenous bacteria to complete the malolactic fermentation invariably have a more complex microflora than wineries which use S02 and inoculate with commercial malolactic bacteria. Wines from the latter group tend to have Leuconostoc oenos as the dominant lactic acid bacteria present, while wines from the former group may have significant populations of pediococcus and lactobacillus species present as well. Wines with spoilage problems characteristic of lactic acid bacteria are usually from the first group.

Lactic acid bacteria in wine can degrade malic acid but also can metabolize other substrates such as sugars, other organic acids, and glycerol which can lead to spoilage. Leuconostoc oenos bacteria are generally responsible for malolactic fermentations in wines, particularly those from cool temperate wine growing regions such as Oregon. Growth of undesirable lactic acid bacteria can occur, however, both during and after a normal, desirable malolactic fermentation. Off characteristics from this type of spoilage can include loss of fruitiness, excessive acetic and lactic acid production due to degradation of sugars (particularly by lactobacillus sp.), excessive diacetyl production from degradation of pyruvate (particularly by pediococcus sp.), excessive bitterness due to production of acrolein from glycerol degradation, and ropy and oily character from the production of polysaccharides from sugar degradation (some strains of leuconostoc).

Several wines from this vintage submitted to our laboratory had problems with excessive acetic acid production apparently due to the growth of lactobacillus sp. during and after a normal malolactic fermentation. Volatile acidity developed rapidly at the end of the yeast fermentation and microscopic observation showed that these wines contained a high cell density of rods characteristic of lactobacilli. In some cases wines had high pH and significant loss of color as well. Microscopic observation of other wines from the same cellars showed the presence of potential spoilage bacteria in other wines in which no obvious defects were apparent yet. The major difference was the higher cell density found in wines with obvious spoilage character. Wine lactic acid bacteria seem to be highly opportunistic in that if they are present in any appreciable numbers and the conditions are right they may cause spoilage. Once established in a cellar they may become difficult to eradicate and problems may occur every year and become more widespread. Conditions favorable for establishing populations of potential spoilage microoganims include poor sanitation of processing equipment, storage containers, and cooperage, use of minimal or no S02 at crushing, encouraging wild bacteria to induce malolactic fermentation, prolonged storage of wines with low or no S02, and maintaining warm cellar temperatures. Typically, problems will occur with greater frequency unless significant steps are taken to improve sanitation and modify processing to discourage growth of wild bacteria.

Processing to prevent potential microbial spoilage by lactic acid bacteria is practiced by many wineries and includes the addition of sulfur dioxide at crushing and to the new wines as soon as malolactic fermentation is completed, inoculation with a high density of actively growing commercial malolactic bacteria, maltainance of cool storage conditions, and timely clarification and filtration of wines during processing. A rough or polish filtration prior to bottling of red wines is highly recommended. Several

commercial malolactic bacteria strains are available including two Oregon isolates EY2D and ERI A which are adapted to Oregon cellar conditions of low pH and cool temperature and are now available as a freeze-dried concentrate.

Research on controlling malolactic fermentation and inhibiting the growth of spoilage bacteria using nisin is continuing (see Progress Report on Nisin, Daeschel and Watson). Additional research needs to address pure culture vs mixed culture fermentations and the timing of malolactic fermentation with respect to microbial by-products, color stability, sensory characteristics and wine quality.

Sensory Workshops on Recognizing Technical Wine Defects

Sensory workshops on recognizing technical wine defects were presented in Salem and Grants Pass in May 1991 and in Salem in cooperation with the Wine Advisory Board. The workshops were attended by winery representatives who wished to participate in commercial wine screenings for WAB promotional events. A WAB screening panel was appointed this summer and two commercial wine screenings were held at which training exercises are presented for recognition of commercial wine defects prior to each screening. The training workshops include the use of control samples and commercial wines with technical flaws to evaluate the performance of the screening panel. Two commercial wine screenings were held in the summer and fall of 1991. Several wines were rejected for defects by a majority consensus of the panel members. Defects noted in rejected wines included excessive oxidation, excessive reduction, and microbial spoilage by bacteria and yeast.

Workshops, Industry Presentations, Publications and Abstracts

Recognition of Technical Wine Defects. May 9,1991. Attended by 30 winegrape industry members. Willamette Valley Vineyards,Turner, OR.

Recognition of Technical Wine Defects. May 16, 1991. Attended by 25 winegrape industry members. Grants Pass, OR.

Recognition of Technical Wine Defects. July 13, 1991. Attended by 24 winegrape industry members. Oregon State Department of Agriculture, Salem, OR.

Oregon Experiences with Malolactic Fermentations. Grape and Wine Forum Proceedings, Agriculture Canada, Research Station, Summeriand B.C. Presented by Watson, July 1991.

OSU Viticulture and Enology Cooperative Research. Grape and Wine Forum Proceedings, Agriculture Canada, Research Station, Summeriand B.C. Presented by Price and Watson, July 1991.

Malolactic Fermentation and Microbial Spoilage. January 9, 1992. Willamette Valley Wine Technical Group, attended by 26 winegrape industry members. Knudsen-Erath Winery, Dundee, OR.

Malolactic Fermentation and Microbial Spoilage. January 21,1992. South Willamette Valley Wine Technical Group, attended by 12 winegrape industry members. Oregon State University, Corvallis, OR.

Coeditor of the Wine Advisory Board Research Report and Newsletter.

Developing Maturation and Vintage Profiles for Pinot Noir. Watson, July 1991. The Wine Advisory Board Research Report. Issue 10.

Oregon Winegrape Grower's Guide (chapter): Evaluation of Winegrape Maturity in Oregon. 4th Edition, 1992.

Member of the OWA Winegrape Day Planning Committee, Oregon Horticultural Society. January 1992.

Member of Projects Committee for the Northwest Chapter of the American Society of Enology and Viticulture, Annual meeting to be held August 13-16, 1992 in Kelowna, B.C. Canada.

Member of the Enoiogy Technical Projects Committee, American Society of Enology and Viticulture.

The Use of Nisin and Nisin Resistant Strains of Leuconostoc oenos to Control Malolactic Fermentation in Wines. U.S. Patent assigned to Oregon State University. Inventors: Daeschel and Watson. October 1991.

OSU Malolactic Bacteria Strains EY2D and ERLA (OSU Patent Inventors: Sandine, Heatherbell, and Watson) marketed commercially as a freeze-dried concentrate by Lailemand Ltd. of Canada and Scott Laboratories, USA beginning August 1991.

Compositional and Flavor Development of Pinot Noir During Maturation: A Comparison of Two Vintages. Presented by Watson at the 42 Annual Meeting of the American Society of Enology and Viticulture, Seattle, WA. June 1991.

Technical Editor for the Proceedings of the International Symposium on Nitrogen in Grapes and Wine. Seattle, WA. June 1991.

Odor Analysis of Pinot Noir Wines From Different Stages of Maturity by OSME, a Gas Chromatography-Olfactory Technique. Miranda-Lopez, Libbey, Watson, and McDaniel. Submitted for publication. Journal of Food Science. July 1991.

Identification of Additional Odor-active Compounds in Pinot Noir Wines. Miranda-Lopez, Libbey, Watson, and McDaniel. Accepted for publication. American Journal of Enology and Viticulture, July 1991.

An Evaluation of Combinations of Yeast and Lactic Acid Bacteria in Malolactic Fermentation of Chardonnay Wine. Avedovich, Sandine, McDaniel and Watson. Submitted for publication. American Journal of Enology and Viticulture. July 1991.

Evaluation of Genetically-Modified Wine Strains of Saccharomyces Cerevisiae. Wightman, Xu, Yorgey, Watson, McDaniel, Micheals, and Bakalinsky. Submitted for publication, American Journal of Enology and Viticulture, July 1991.

Applications of Bacteriocins in Controlling Bacterial Spoilage and Malolactic Fermentation of Wine. Daescehl, Bower, and Watson. Accepted for presentation and publication by lntervitis lnterfructa, Stuttgarr-Killesberg, Germany. May 1992.

Effects of Viticulture Practices, Vintage, and Winegrape Maturity on Color in Pinot Noir in Oregon. Watson and Price. Submitted abstract to the 3rd International Cool Climate Symposium, Gesenheim, Germany. June 1992.