Northwest Center for Small Fruits Research

2002 Annual Conference

Welcome to the eleventh annual conference of the Northwest Center for Small Fruits Research in Portland, Oregon. We hope you will find this year's program interesting and useful.

Schedule: A detailed schedule has been provided in order to best choose the sessions you would like to participate in throughout the day. Each Technical Working Group will include a section for research reports and a featured presentation.

Research Priorities: During the conference, time is set aside to revisit all research priorities by commodity. After the Technical Working Group meetings, commodity groups will meet separately to review and revise priorities. Please refer to the enclosed schedule for the time and room assignments. Copies of all priorities can be found at the back of this booklet.

Organizational Handbook: The Organizational Handbook has been included in your registration packet. This booklet provides an overview of the NCSFR operations, detailed funding information and a member directory.

Oregon Wine Tasting: Prior to this evening's dinner, we will have the opportunity to enjoy sampling a variety of Oregon wines.

Keynote Speaker: Dr. Mary Ann Lila, Professor of Plant Physiology and Department Head for the Department of Natural Resources & Environmental Sciences at the University of Illinois, will be the keynote speaker. Her talk, "'Hot' berries - what we know now about berry fruits and human health protection", will provide an overview of her nutraceutical research.

Table of Contents

Berry/Grape Processing

Can *Escherichia coli* and *Salmonellae* Contaminate Harvested Berries and do they Survive in Fresh and Frozen Berry Juices/Purees?

Mark Daeschel - OSU

Cooperators: Cindy Bower - OSU, Carol Miles - WSU and Yanyun Zhao - OSU

Overall objectives are to determine if there is significant contamination of Northwest fresh berries with *E. coli O157:H7* and *Salmonella* species at the point of harvest and to evaluate the ability of acid resistant strains of *E. coli O157:H7* and *Salmonella typhimurium* to survive in non pasteurized juice products from blueberry, raspberry, strawberry, blackberry and table grapes. Survival studies were initiated to determine the persistence of *E.coli* and *Salmonella* in berry juices and puree's. These were commercially made products to which we intentionally added approximately $1x10^7$ cells per ml of bacterial cells. The cells were then enumerated over a period of 5 days. The data indicate that neither *E.coli* nor *Salmonella* are rapidly inactivated (less than a 2 log reduction) in berry juices or purees within a five day time frame. This study will be continued for extended times and in juices and purees that are frozen. This summer we received manure samples that are used to fertilize raspberry fields. These were collected by Dr. Carol Miles of WSU Extension at Vancouver. We are in the process of developing methodology to assess whether manure can serve as a source of pathogen contamination of fresh berries. We have also received raspberry samples from fields that were fertilized with and without manure. These are also under evaluation for the presence of pathogens.

Soil Sampling for Drip Fertigated Grapes

Joan R. Davenport and Robert G. Stevens - WSU, Irrrigated Agriculture Research and Extension Center

To determine what zone of soil should be sampled to reflect plant nutrient availability in a vineyard where both water and nutrient management is via drip irrigation, a non-radioactive tracer was used. The tracer element bromine (Br) moves through the soil-plant-water system similarly to the plant nutrient nitrate nitrogen. A potassium bromide solution was applied to drip emitters a set distance from 8 Cabernet Sauvignon grape plants at two different vineyards (16 plants total) at the key growth stage veraison. Soil and plant tissue (both leaves and petioles) was collected 1and 2 days after the application, 2 days after the next irrigation set, and after the last seasonal irrigation. Soil samples will be collected the spring (pre-bud break) following the application and tissue samples collected at bloom to trace the movement of fertilizer from the previous year. To determine which soil sampling zone location relative to the drip emitter is most closely correlated with plant uptake, soil samples were collected in a radial pattern around the emitter (16 locations) at three depths - 0 - 20, 20 - 40 and 40 - 60 cm - so that a three dimensional picture of Br could be developed. Each soil sample was used for soil moisture determination then stored dry for Br analysis. Analysis of samples for Br concentration is ongoing.

Investigation of Potential Climatic and Nutritional Causes of Grape Chlorosis

Joan R. Davenport and Robert G. Stevens - WSU Irrigated Agriculture Research and Extension Center

Every year Concord grape in the Yakima Valley show a leaf yellowing symptom known as grape chlorosis. The severity of this disorder varies from year to year and from vineyard to vineyard. However, leaves of grape

plants that develop this symptom eventually die and fall off resulting in a reduction of productivity and, in time, can result in vine death. Historically grape chlorosis was thought to be due to a deficiency in the plant nutrient iron. However, research looking at iron supplements has had little to no positive effect on the disorder. Foliar iron sprays have been shown to green existing affected leaves with no effect on leaves produced after the spray. The fact that the disorder appears around bloom and varies from year to year indicate that there may be a relationship with annual weather (climatic) patterns. There is also a possibility of a nutritional relationship. The objective of this project is to evaluate plant nutrition and climatic conditions for their roles as environmental stress factors in causing chlorosis in Concord Grape. We hypothesize that the possible causes of grape chlorosis are a single element nutrient deficiency, a multiple element nutrient insufficiency, high concentration of one nutrient element causing the exclusion of uptake of other nutrient elements, plant water stress affecting roots ability to access nutrients, or a combination of these factors. In 2001 we established study sites in 6 commercial vineyards that vary from having chlorosis never to some years to every year where we mapped the incidence of the disorder and monitored nutrients (soil and tissue Ca, Mg, K, Na, Fe, and Al), soil moisture, soil temperature, and macro level climatic factors (e.g. air temperature). The monitoring was continued in 2002 as was chlorosis mapping. Several soil nutritional parameters appear as being consistently related to the occurrence as does soil moisture near bloom.

Advanced Drying Technologies for Berry Products

Juming Tang, Carter Clary, Caleb Nindo, and Andy Gamache - WSU, Biological System Engineering

The aim of our research is to develop and evaluate effective commercial drying technologies for production of high quality dehydrated berry products. Refractance Window™ and microwave vacuum dehydrator (MIVAC®) are two systems that have been designed with the objective of drying or evaporating moisture from food products with minimal loss of quality. The Refractance Window™ system works best if the starting material is liquid and spreads or flows uniformly on a plastic film. The fluid food is heated from below using circulating hot water. Pureed products typically dry within 3~5 minutes at circulating water temperature between 194~208°F. Preliminary experiments with the 13'x 66" evaporator version resulted in 43kg of water being evaporated within 15 minutes. The MIVAC® was used in the drying of whole, topped, strawberries. This preliminary test was done to determine if the strawberries could be dried using the MIVAC® system while still maintaining the aesthetic characteristics of the fresh product. The initial moisture (IM) content of the strawberries used was 91.25%. When dried the final moisture (FM) content was 6.39%. The length of time that was required for 1630g of product to be dried to 156g with a FM of 6.39% was 70min. The initial power setting for the microwave power supply was 2.7kw. The power setting of the microwave was reduced to 0.8kw and 0.5kw when the time remaining was 30min and 15min respectively. Throughout the processing time the pressure of the vessel fluctuated between 18 Torr and 42 Torr. The average temperature of the product during processing time was 102°F with a range of 65°-120°F. The use of the MIVAC® system preserved the color, shape, and intensified the aroma and flavor of the strawberries.

Impact of Blackberry Polyphenolics on Juice Quality

Ronald E. Wrolstad - OSU, Department of Food Science & Technology

Cooperators: Thanyaporn Siriwoharn (GRA), FST OSU; Robert W. Durst, FST OSU; Chad Finn, USDA/HCRL

The objectives of this investigation are to further characterize the major polyphenolics in authentic blackberry extract, and to determine their role along with other polyphenolics in the formation of sediment and haze in blackberry juices. These major compounds were unknown; however they were tentatively identified on the basis of alkaline hydrolysis as ellagitannins. Methodology for further characterization is the liquid chromatography with tandem mass spectrometry. Another investigation is on the polyphenolic composition and the antioxidant activity of Marion and Evergreen blackberries at three maturity stages (part-red-part-black, ripe, and over ripe). The same analyses will also be performed on twelve blackberry cultivars, which represent generic diversity and commercial importance, at one maturity stage (ripe).

Enhancement of Storability and Nutritional Values of Strawberries and Raspberries by Nutraceutical Integrated Edible Coatings

Yanyun Zhao - OSU, Department of Food Science & Technology

Cooperators: Chunran Han - OSU, Department of Food Science & Technology; Scott Leonard and Maret Traber - OSU, Linus Pauling Institute

Chitosan-based edible coatings were studied to extend the shelf- life and enhance nutritional quality of fresh and frozen strawberries (*Driscoll* and *Totem*, respectively) and fresh red raspberries (*Framboises*). Three coatings, chitosan, chitosan containing 5% calcium, or chitosan containing 0.2% vitamin E were used. Chitosan based coatings significantly reduced decay rate and weight loss, preserved the total acids of fresh berries during storage at 2°C and 88% RH, and decreased the drip loss and improved texture quality of frozen berries. The shelf-life of fresh strawberries (*Driscoll*) and raspberries (*Framboises*) were extended to 14 and 21 days, respectively based on their decay rate and physicochemical properties. Coatings also helped to maintain the integrity of frozen strawberries after thawing. In addition, coating containing calcium or vitamin E significantly increased the nutritional value of the product. About 6% DRI calcium and 32% DRI vitamin E were obtained in 200 g of fresh or frozen strawberries, and 9% calcium and 78% DRI vitamin E in 200 g of raspberries. Thawing didn't decrease the content of vitamin E in the berries. This study proved the potentials to use edible coating as a carrier of nutraceuticals to extend shelf-life and enhance nutritional value of fresh and frozen berries.

Flavor Volatiles of Marion (*Rubus spp. hyb*) and Evergreen (*Rubus laciniatus* L.) Blackberries

Keith Klesk and Michael C. Qian - OSU, Food Science and Technology

Cooperator: Chad Finn - USDA-ARS

Research funding received May 31, 2000 to isolate, identify, and quantify the flavor volatiles of two blackberry cultivars (*Rubus spp. hyb,* 'Marion' and *Rubus laciniatus* L., 'Evergreen'). Blackberry aromas were analyzed with a purge-and-trap gas chromatography-olfactometry/mass-spectrometry (GC-O/MS) technique. Fifty-eight aromas were identified; 30 were common to both cultivars, and 22 have not been previously reported in blackberry fruit. Nine compounds of the newly reported 22 were reported in red raspberry. Identification of the 22 compounds reflects the extraction and analysis methods used and the pedigree of the Marion blackberry, which contains at least five bramble species, including raspberry. Comparison of cultivars shows the Marion blackberry contains more esters, while the Evergreen contains more alcohols. The aroma profile of blackberry is complex, as no single volatile was unanimously described as characteristically blackberry.

Genetics

Development of Winter Hardy Blackberry through Genetic Engineering

Rengong Meng[1, 2], Tony H.H. Chen[2] and Chad E. Finn[1, 2] - [1]USDA/ARS HCRL; [2]Dept.of Horticulture - OSU

Experiments were conducted to optimize conditions for *Agrobacterium*-mediated transformation of 'Marion' blackberry. Factors examined included: leaf explant age (14, 21, 28 days); *Agrobacterium* cell density (OD_{600} 3.0,

2.1 1.7, 0.5); length (0', 5', 10', 15') and intensity (60%, 100%, 140% power) of sonication treatment; surfactant concentration (0, 0.1%, 0.5%, 1.0% Tween 20); *Agrobacterium* strains and plasmid combinations (EHA105/pIG, EHA105/pCAMBIA1304, EHA105/pCAMBIA 1305, AGL/pIG, AGL/pTOK233, and LBA4404/pTOK233); and types and levels of antibiotic selection agents (hygromycin 0, 3, 5, 10 mM and kanamycin 0, 5, 10, 15, 20, 40 mM). Transient expression of the GUS gene was not affected by leaf explant age. The combination of *Agrobacterium* cell density at OD_{600} 2.1, sonication treatment under 140% power for 10 or 15 minutes, and 1% Tween 20 significantly improved the transient expression of the GUS gene. *Agrobacterium* strain EHA105 harboring pCAMBIA1304 and LBA4404 harboring pTOK233 were the most effective strains and plasmids tested. Hygromycin at 3 mM and kanamycin at 15 mM completely inhibited rooting of nontransformed shoots. Experiments were also conducted to regenerate shoots from transgenic callus in the presence of selection agent hygromycin (5mM) with different types and levels of cytokinin (BA 0, 5, 10, 20, 40, 80 mM; TDZ 0, 0.5, 1, 5, 10 mM) and auxin IBA (0, 0.5, 1 mM). Shoot regeneration from callus was obtained from TDZ at 0.5 and 1 mM without IBA in the media.

Propagation of WSU Strawberry and Raspberry Selections for Testing

Patrick P. Moore - WSU, Puyallup Research and Extension Center

Cooperator: Robert R. Martin - USDA-ARS

Project Initiated: Fall 2002

In 2001-02, strawberry selections were micropropagated at WSU Puyallup, transferred to Bob Martin's (USDA-ARS, Corvallis, OR) laboratory where they were heat-treated and meristemmed for virus elimination, then returned to WSU Puyallup where they were multiplied in tissue culture and planted at WSU Puyallup.

Twenty-three strawberry selections were propagated, treated for virus elimination, and planted in the field at WSU Puyallup in 2002. Additional selections have been propagated; heat treated and multiplied, but were not ready for field planting in 2002. These selections will be planted in the field in 2003 along with selections made in 2002. It is estimated that 27 WSU strawberry selections should be ready for field planting spring 2003. Forty-four new selections were made in 2002 and these are being propagated. Many of these selections have already been transferred to Bob Martin's laboratory for virus elimination and the remaining selections are being propagated and will be transferred this winter.

Fifty raspberry selections were tissue culture propagated and planted in the field in 2002. These selections were planted in a grower field in Lynden for machine harvesting evaluation. Additional selections were propagated, but were not ready for field planting in 2002. These selections will be planted in the field in 2003 along with selections made in 2002. It is estimated that 40 WSU raspberry selections should be ready for field planting spring 2003. Sixty-two new raspberry selections were made in 2002 and these will be propagated in 2002-03.

Identifying Winter Tolerant Blackberry Selections and Cultivars

Derek Peacock - Enfield Farms; Chad Finn - USDA-ARS; Mary Peterson - USDA-ARS

'Marion' blackberry's lack of winter tolerance and its thorniness are consistently cited as two of the major problems facing the Northwest's trailing blackberry industry. The USDA-ARS breeding program needs to have a method to identify selections and breeding material that are more winter tolerant if they are going to make progress towards developing winter hardy cultivars. Waiting for a test winter and artificial freezing runs are two approaches to identification of tolerant plants, but we feel at this point in time that these are unsatisfactory approaches. Placing the genotypes in an environment such as northern Washington where they are more likely going to receive a test winter in a commercial setting should help address several challenges. The objectives of this work are to identify winter tolerant, primarily thornless trailing blackberry genotypes in the USDA-ARS breeding program and to determine whether these thornless selections are machine harvestable. Thirty-four USDA blackberry selections and standards were planted spring 2001, trained up in August to maximize exposure to winter temperatures, and were evaluated for bud break spring 2002. While the winter was somewhat mild,

with only a handful of days reaching well below freezing, the March weather roared in like a lion and there were two occasions when, for several days each, temperatures plummeted reaching a low of 17° F on March 7th and 22° F on March 20st (1st day of spring!). Accompanying winds sometimes reached 40 mph, contributing to the desiccation and cold injury of the canes. Several selections and cultivars had little to no winter (spring) cold injury; these included Apache, Chester, ORUS 1316-3 and NZ 9128R-1. Some selections suffered slight to moderate injury including Marion, Waldo, Silvan, ORUS 1442-2 & -3, ORUS 1486-2, and NZ 9199-1. Selections that suffered moderate to severe injury would include ORUS 1377-1, ORUS 1382-1 & -2, ORUS 1489-2 and ORUS 1572-1. No selections suffered extreme cold injury and were totally killed back. Machine harvest and yield potential were examined this summer and will be reported on at the annual meeting. An additional 47 USDA selections and standards were planted this spring 2002, trained-up this past August, and will be evaluated along with the initial 34 selections over the next two years.

Objective Characterization of "Marion" Blackberry Flavor and Comparison with Thornless Advanced Selection

Michael C. Qian - OSU, Food Science and Technology

Cooperator: Chad Finn - USDA-ARS

This study is to develop objective measurements of blackberry flavor to assist USDA-ARS breeding program, particularly in quest to develop winter-hardy, thornless cultivars with "Marion" flavor. Our research timetable for the first year is to develop methods to identify the most important characteristic aroma compounds in "Marionberry". A dynamic headspace gas chromatography-olfactometry/mass-spectrometry (GC-O/MS) technique has been developed to study aroma active compounds in "Marionberry". Fifty-eight aromas were identified including aldehydes, esters, ketones, alcohols, hydrocarbons (terpenes), allo-ocimene, neo allo-ocimene, dimethyltrisulfide, theaspiranes A and B.

The aroma profile of blackberry is complex, as no single volatile was unanimously described as characteristically blackberry. Further study (solvent extraction, aroma extract dilution analysis (AEDA), odor activity values (OAV), aroma compound quantification) are underway to clarify their specific compositions and characterize cultivar differences.

Evaluation of Raspberry and Strawberry Cultivars for Local Specialty Sales in Southern Idaho

Jo Ann Robbins - University of Idaho; Michael Colt - University of Idaho

Cooperator: The Sawtooth Botanic Garden, Idaho

Selected cultivars of raspberries ('Algonquin', 'K-81-6', 'Lauren', 'Nova', 'Qualicum', and 'Reveille') and strawberries ('Allstar', 'Cavendish', 'Honeoye', 'Jewell', 'Kent', 'Mesabi', 'Mira', 'Northeastern', and 'Winona') are being grown under short season, cold winter conditions in Idaho. Plants were planted on May 26, 1999. Spring of 2002 was cold. Below freezing nights occurred May 7th through 12th, May 23rd and 24th, June 9th through 11th, and June 19th.

The raspberries were harvested for the second time in 2002. On June 19th, few flowers were open and little freeze damage occurred. Weekly harvests were made from July 26 through September 13. Highest yielding cultivar was 'K-81-6' followed by 'Algonquin'. These replaced 'Nova' and 'Reveille' as top producers in 2001. Fruit weight for all cultivars was around 2 grams and peaked near mid-season. The early fruiting cultivar was 'Reveille' followed by 'Lauren' and 'Nova'. Late fruiting cultivars were 'Qualicum' and 'K-81-6'. Fruit quality was good for all cultivars, but 'Reveille' rated lower overall. Jam was made from each cultivar for evaluation.

The straw mulch had recently been removed from the strawberry plants at the May 7th freeze. The new leaves were completely frozen on May 7th – 12th, but the crowns looked only slightly damaged. Plants were

covered with floating row cover only during the May 23rd – 24th freeze. The plants, which were in full bloom on June 9th – 11th, sustained heavy freeze damage to the flowers. It was estimated most of the yield was lost on some cultivars. Weekly harvests were made from July 3 through August 7. This was the third year of harvest. As in 2001, 'Mesabi' out yielded all other cultivars. 'Mira' and 'Kent' produced better than the rest of the cultivars. Berry weight began large and generally decreased at varying rates in all cultivars as the season progressed. Over the whole season, 'Cavendish' had the heaviest fruit. Early fruiting cultivars were 'Northeastern' and 'Honeoye'. Late fruiting cultivars were 'Winona' and 'Mira'. Fruit quality was worse than in previous years. Flavor was rated highest in 'Cavendish' and lowest in 'Mira'.

Domestication of Western Huckleberries

Danny L. Barney - University of Idaho, Department of Plant, Soil & Entomological Sciences

Efforts to develop western huckleberries and related species as managed crops began in 1994 and have begun to yield significant results. Germplasm necessary for development of improved varieties and cultural practices has been collected and made available to *Vaccinium* researchers and the USDA-ARS National Clonal Germplasm Repository in Corvallis, Oregon. In 2002, 18 black huckleberry and one oval-leaf blueberry genotypes were selected for further evaluation and as parents in a breeding program. Models for natural stand management and production in cultivated fields have been developed and testing will begin in 2003. Cooperating growers are being identified to conduct test plantings and, provided funding continues, planting stock will be available beginning in 2004. Flavor chemistry has been completed for three species and biochemical profiles for seven species have been determined. Several species contain high concentrations of anthocyanins, antioxidants, and/or other compounds with the potential to help prevent cancer and heart disease or otherwise improve human health. At least four of the ten species native to the northwestern United States show excellent potential for managed production of culinary fruits and medicinal/dietary supplement products. A market analysis has been completed, identifying the present state of the huckleberry industry and its potential for expansion.

Evaluation of New Cranberry Cultivars and Selections for the Pacific Northwest

Kim Patten – WSU, Long Beach and Peter Bristow – WSU, Puyallup

A replicated planting of 16 cranberry genotypes (12 cultivars and 4 selections) was established in 1994 on the farm of the Pacific Coast Cranberry Research Foundation with the objective of evaluating the genotypes for: a) horticultural traits (yield, berry size, color, return bloom, etc.), and reaction to b) insects (black-headed fireworm and cranberry fruitworm, and c) diseases (fruit rots, cottonball and rose bloom). 2001 was the sixth harvest. Pilgrim has the highest cumulative yield for the period 1996-2001, followed in order by #35, a fresh market selection from Wisconsin and Wilcox. All four genotypes out-yielded Stevens and McFarlin. Yields in 2001 were correlated with those from 2000 and cumulative yield (1996-01). Disease pressure from fungi causing fruit rot was low in 2001. The incidence of fruit rot at harvest (field rot) was not influenced by genotype while significant differences were found in the incidence of fruit rot after 8 weeks in refrigerated storage. Wilcox, #35, and the selection from Wisconsin combined high yield with good keeping quality. Less than 4% of the berries were damaged by insects in 2001 with no differences between genotypes. Because yield of Stevens and one or two other genotypes declined in 2000, sand (ca 2 cm) was applied to one half of each plot during winter 2000-01 to stimulate new vine growth. Sanding had no impact on yield or fruit rot in 2001. In 2002, upright growth was enhanced in the sanded portions of plots for some genotypes. Yield and other data are being collected from both the sanded and unsanded portions of plots. Growers are beginning to plant new or re-plant older beds to promising genotypes identified in this field trial.

Evaluation of Recently Introduced Germplasm of Blue Honeysuckle (Lonicera caerulea L.) for Direct use as a Potential New Berry Crop and as Possible Parents in a Breeding Project

Maxine M. Thompson – OSU, Department of Horticulture

Activities reported herein represent the third year of this research. New germplasm acquired in 2000 was propagated in 2001 and field-planted October, 2001. These 2,800 seedlings consisted of some new accessions from continental Russia, some that originated in the Kurile Islands, and some from Hokkaido, Japan. Another group of seedlings were started in March 2002 and field-planted October 2002. These consist of only Kurile Island and Japanese seed sources due to superior adaptation.

Evaluations of plant vigor, growth habit, time of phenological phases, flower density, yields, and berry traits have been made on all plants each year. There is a distinct difference between the continental Russian forms and those from the Kurile Islands and Japan. After 3 yearÕs observations it is clear that the continental Russian types are not at all adapted to our mild climate. Because of a very short dormancy and its early onset, 3 traits lead to reduced yields; plants bloom too early for bee activity (necessary for cross-pollination), fall flowering is common, and much shoot die-back occurs in winter (threby reducing the fruit-bearing surface). By contrast, plants from the Kurile Islands and Hokkaido seem to be well adapted to western Oregon. Growth is vigorous, blooming occurs in April, 2-4 weeks later than the Russian forms, plants retain leaves late into fall, and there is no winter shoot dieback. Therefore, all future work will involve plants from these two sources. Elite selections have been propagated for advance trials and for use as parents in a breeding program. Due to the precocious bearing of blue honeysuckle plants (about 85% bore at least a few fruits the first year in field) there is excellent potential to make rapid selection progress towards well-adapted plants with high quality berries.

Pest Management

Soil Solarization as a Component of an Integrated Program to Control Phytophthora Root Rot of Red Raspberry

Peter Bristow - WSU; Jack Pinkerton, USDA-ARS, HCRL

The objective is to evaluate soil solarization alone and in combination with raised beds and gypsum soil amendment in an integrated plan for controlling raspberry root rot. Soil at the test site is naturally infested with *Phytophthora fragariae* var. *rubi.* The six treatment are: 1) flat bed, no solarization (untreated check), 2) raised bed, no solarization, 3) flat bed, solarization, 4) raised bed, solarization, 5) raised bed, gypsum incorporated (into the soil at the rate of 6 tons/A), and 6) raised bed, gypsum incorporated, solarization. Gypsum was added and raised beds were formed in mid summer 2000. Plots to be solarized were covered with clear polyethylene tarps from late July 2000 through just before planting in May 2001. Tissue culture propagated plants of the root rot susceptible varieties (Malahat and Willamette) were planted. Cane weights (grams per plant, fresh weight) at the end of 2001 and the number of healthy canes in 2002 were significantly greater in solarized raised beds than in other treatments. Disease incidence (percent of primocanes that wilted) was greater in nonsolarized plots. Gypsum amendment did not improve plant growth of reduce disease incidence. Solarization of flat beds was not as effective in managing root rot as in a previous experiment at this location. Solarization reduced weed growth in 2001 and the effects were still visible in 2002 (two years after solarization). Canes will be tied to the trellis for harvest in 2003.

Detection & Disease Management Strategies for Grapevine Leafroll-Associated Viruses

K.C. Eastwell - WSU; S.E. Spayd - WSU; R.C. Larsen - USDA-ARS, WSU-Prosser

Objectives are two-fold: develop a more reliable serological assay for the viruses associated with grapevine leafroll disease, and investigate possible nutritional adjustments that could be invoked to negate the impact of leafroll disease while vineyards are transitioning to virus-free plantings.

Diodia vein chlorosis virus, a relative of the viruses that cause grapevine leafroll disease, has been propagated in *Diodia virginiana*. Protein profiles from infected and non-infected plants are being compared to identify proteins encoded by the virus genome. A second strategy is to clone candidate genes from grapevine leafroll associated viruses and express them in bacteria. In both cases, the protein obtained will be used to elicit antibodies to enhance diagnostic capabilities.

The symptomatology of virus-infected plants can sometimes be substantially modified, even with relatively simple treatments. We are determining which minerals might ameleriorate some of the symptoms associated with leafroll disease. Vineyards have been identified and surveyed where virus-infected and virus-free vines exist in close proximity. Vines have been tested to establish virus status. Rachis samples are being analyzed for mineral content, and the berries are being analyzed for quality characteristics. Abnormalities in mineral content will provide clues as to which nutrients could diminish some of the debilitating effects of leafroll disease.

Temperature Effects on the Life Stages of Populations of Grape phylloxera (*Daktulosphaira vitifoliae*) that are from Different Grape Growing Regions of the Pacific Northwest

James R. Fisher - USDA, ARS, HCRL

The objective for 2002 has been to develop life tables that describe and compare the rate of development and survival (egg - stage 2/3 – stage 4 –adult – egg) and also describe fecundity and fertility of grape phylloxera from Washington and Oregon and California when exposed to three different fluctuating seasonal temperature regimes. The project was not started until funding was received (May 2002). At that time we gathered temperature records and began building populations of grape phylloxera (GP) for the experiment. There are three growth chambers; all simulate the average daily diurnal fluctuations of temperature at the 10 – 15m depth from May 1 – October 30 either at Prosser, WA (6 – 10 yr average), near Corvallis, OR (8-14 year average), or Davis, CA (30 yr average). As of this writing, 10 October 2002, we are in the middle of the experiment. The California chamber was in operation at the end of June, the Washington chamber about 2 weeks later and the Oregon chamber was started at about the same time but broke down after 4 weeks and that portion was started again in mid- August. As of this writing we have had 4 generations of GP from OR and CA and 3 from WA in the CA chamber. There have been 3 generations of OR and WA and 4 generations from CA in the WA chamber and only one generation each in the Oregon chamber. The first generation of all populations in the CA chamber required about 70 days, 2nd generation ~ 50 days, 3rd generation ~37 days and 4th generation ~ 34 days. The WA population died off in the CA chamber before the completion of the 4th generation. Interestingly, in the WA chamber, all three populations took about 75 days for the 1st generation, 2nd generation ~ 30 days, and 3rd generation for CA and Oregon ~ 20 days , for WA ~ 35 days. It appears that warmer temperatures, i.e. CA may be harmful to the GP from WA.

Implementation of Mating Disruption as a Management Strategy for the Currant Borer, *synanthedon tipuliformis*

David G. James - WSU, Irrigated Agriculture Research and Extension Center

Full scale commercial trials of mating disruption for currant cane borer (*synanthedon tipuliformis*) were conducted during 2002 on 78 acres of red currants in the Prosser area of south central Washington. Conventional twist tie dispensers containing the formulation of pheromone used by Washington *S. tipuliformis,* identified in 2000, were obtained from Shin-Etsu in Japan and placed in four fields at rates from 250-300/acre during 7-9 May (higher rates were used in fields known to have larger populations of borers). Novel, high release-low point (HRLP) source lures were obtained from Chem Tica Internacional in Costa Rica and used in a two fields at a rate of 24/acre. An abandoned red currant field served as a reference site. Pheromone-baited sticky traps placed within blocks and timed counts of moth activity monitored the success of mating confusion.

Few moths were caught in monitoring traps during the trials indicating mating disruption was effective. For example in a field that had a trapping rate of 88 moths/trap/week prior to mating disruption (insecticide control) in 2000, only 0.6 moth/trap/week was caught in 2002. Trap rates in the other mating disruption (twist-tie) fields were 0, 0.07 and 0.4 moths/trap/week. Less success was achieved in the HRLP fields with 1.9 and 8moths trapped/week/trap. An average of 19 moths/30 minutes was observed during the flight period in a field that averaged 54 moths/30 minutes in 2000. Cooperating growers were extremely pleased with the results. Mating disruption for control of currant borer in Washington red currants appears to be a practical and cost-effective solution, substantially reducing chemical inputs to this crop.

Biological Control of Spider Mites in Washington Viticulture

David G. James- WSU, Irrigated Agriculture Research and Extension Center

Sampling sites for spider mites and natural enemies were established in June 2001 at a number of conventional, low-input and abandoned vineyards in south central Washington. These sites were visited monthly from June until September in 2001 and 2002 for leaf and vacuum sampling of arthropods. Samples were examined in the laboratory and mites and natural enemies of mites were identified and recorded.

Results to date indicate spider mite populations overall were generally small in most vineyards. However, they were larger in vineyards using fungicides alone or fungicides and insecticides, than in unsprayed or abandoned vineyards. Predatory mite (Phytoseiidae) populations were larger in unsprayed vineyards than in sprayed vineyards. Spider mite populations in 2002 peaked in August (4/leaf, mean of all sites), but rarely reached damaging levels, except at a few sites that used insecticides. Non-phytoseiid predators of spider mites were more diverse and common on unsprayed than on sprayed vines.

Epidemiology, Detection, and Management of Tomato Ringspot Virus and Xiphinema Americanum in Red Raspberry

Pinkerton, J.N., Kraus, J. and Martin, R.R. UDSA ARS HCRL

Population densities of Xiphinema americanum were monitored monthly for three years in plots established in an infected red raspberry field. The ability of the nematode to vector tomato ringspot virus (ToRSV) was assayed with cucumber seedlings planted in soil collected from each of 12 blocks. Cucumber leaves were assayed for ToRSV by ELISA. Nematode population densities were greatest in the winter and early spring, with lowest densities observed in the summer. Conversely, virus was not detected in assay plants in the winter while virus infection was greatest in the summer. Crop rotations were evaluated for the control of the nematode and ToRSV. Eighteen months cropping with rapeseed or clean fallow significantly reduced nematode densities as did

soil fumigation, while cropping with fescue and raspberry did not. Raspberries were planted in the cover crop plots and tested for ToRSV after 12 months. ToRSV was not detected in raspberry leaves from plants in any treatment. A reverse transcriptase-polymerase chain reaction was developed to detect ToRSV in nematodes.

Raspberry Bushy Dwarf Virus in 'Marion' Blackberry

Crystle Chamberlain, Jennifer Kraus and R.R. Martin

With the recent identification of Raspberry bushy dwarf virus (RBDV) in blackberry there was concern if this represented a new strain of the virus or a rare transmission event. The goal of the project was to determine if the RBDV found in 'Marion' blackberry represented a new strain of the virus. Samples were collected from 14 blackberry cultivars. The coat protein and movement protein of each of these was cloned and sequenced and compared to known sequences of RBDV and several two sequences of RBDV from raspberry that were obtained in this project. The sequences showed that the RBDV in blackberry was identical to RBDV from raspberry in the Pacific Northwest but distinct from RBDV sequences from Europe. The isolates from blackberry were grafted to 'Meeker' but did not infect 'Willamette' red raspberry. Isolates from red raspberry were graft transmissible to blackberry. This work supports the hypothesis that the RBDV in blackberry was transmitted from red raspberry in the Willamette Valley and does not represent a new strain of the virus.

Sudden Oak Death in Cultivated Blueberries and Cranberries: Evaluating the Potential for Disease, Detection, and Control

J. L. Parke[1], R. G. Linderman[2], and E. M. Hansen[1] - [1]Dept. of Botany and Plant Pathology, OSU, [2]USDA-ARS Horticultural Crops Research Laboratory

Phytophthora ramorum, cause of sudden oak death in California, Oregon, and Europe, has a broad range of natural hosts, including *Vaccinium ovatum* (evergreen huckleberry). We developed a detached leaf assay to test the susceptibility of cultivated *Vaccinium* to this new pathogen. We inoculated leaves of highbush blueberry, half-high blueberry, rabbit-eye blueberry, cranberry, and lingonberry with zoospores of the fungus under controlled conditions, and later evaluated leaves for the extent of necrosis. Five wild *Vaccinium* species were also included in the assays. Of the 19 blueberry cultivars tested to date, four cultivars appear highly susceptible, four are moderately susceptible, and nine are slightly susceptible. Two blueberry cultivars ('Bluecrop' and 'Polaris') appear to be resistant, as does the cranberry cv. 'Stevens'. Lingonberry (cvs. 'Red Pearl' and 'Koralle') and all five of the wild *Vaccinium* species tested appear highly susceptible to this pathogen. Whole plant inoculations on a subset of species and cultivars confirmed the validity of the detached leaf assay as a predictor of plant disease response. Further goals are to screen additional *Vaccinium* species and multiple cultivars for resistance to *P. ramorum,* evaluate disease management strategies for this disease, and improve methods for the rapid detection of the pathogen to enable certification of pathogen-free plants and fruit.

Cranberry Pest Management

Kim Patten, WSU- Long Beach and Peter Bristow, WSU- Puyallup

Post-emergent herbicide efficacy trials were conducted on Potentilla pacifica, Ranunculus repens, Aster subspicatu and Lotus corniculatus, using triasulfuron, chlorimuron and mestrione. Control ranged from good to excellent for triasulfuron and mestrione, depending on timing, rates and number of applications. There was no crop damage with either product. Excellent control of Maianthemum dilatatum was achieved with vinegar (5% acetic acid) applied as a soil drench at ½ gallon/ft2. Vine damage varied based on timing (none to severe). Insecticidal efficacy trials using "reduced risk" or alternative products (acetamiprid, imidacloprid, indoxacarb, methoxyfenozide, spinosad, tebufenozide, thiamethoxam, thiacloprid) were conducted for several problematic

insects. Acetamiprid, indoxacarb, spinosad, tebufenozide and thiacloprid all provided some control of blackheaded fireworm (BHFW) but much less than traditional products like Orthene and Diazinon. Of these alternative insecticides, acetamiprid, methoxyfenozide and thiacloprid usually provided the best control of BHFW. Blackvine weevil was controlled by fall or winter applications of imidacloprid or thiamethoxam. No new products were effective on cranberry gridler. Field trials were conducted to evaluate spray timings and insecticides for control of a new fresh fruit insect pest (Lotisma trigonana). Data will be collected on fruit held in storage for 3 weeks. Several fungicides for control of twig blight disease caused by the fungus Lophodermium oxycocci were evaluated. Products were applied in summer 2001 and disease severity was assessed in May 2002. Numerically, fenbuconazole, azoxystrobin, and a sequential treatment (azoxystrobin followed by Bravo then fenbuconazole) had the lowest disease severity (0.6 – 1.1% blighted uprights) but they were not significantly different from Bravo, BAS 500 F, triflozystrobin or Dithane M-45 (1.9 – 5.8% blighted uprights). Three new "low risk" alternative fungicides, azoxystrobin, fenbuconazole and fludioxonil+cyprodinil, were evaluated for fruit rot control. In 2001, azoxystrobin tended to be the most effective fungicide, especially when applied early (fruit set). Data are pending for 2002.

Development of an IPM (Integrated Pest Management) Program for Leafrollers in Caneberries

Tom Peerbolt - Peerbolt Crop Management & Lynell K. Tanigoshi - WSU, Vancouver Research & Extension Unit

Leafrollers are one of the primary insect pests on caneberries, contaminating thousands of pounds of fruit annually. This is the third year of a three-year project, which surveyed weekly caneberry fruits throughout Clark and Cowlitz counties and Clackamas and Marion counties in Oregon. Forty-two fields of red raspberry, blackberry, marionberry and boysenberry were surveyed for leafrollers throughout the aforementioned counties from 8 April to 13 September. Sampling technique was a 15-minute visual search of dead leaves and new foliage per site. The majority of the larvae collected and reared to adults were orange tortrix, winter moth, obliquebanded leafroller and European leafroller. Parasitoids were present in many of the larvae collected. These will be sent to respective authorities for identification. Overwintering orange tortrix larvae were collected in April and these first generation larvae peaked by late June, which coincides with the start of red raspberry harvest. Peak second generation occurred around mid-July with numerical increase for the third generation beginning mid-August. Total pheromone trap numbers over the past three year period increased on average 2-fold. Peak numbers of OT adults occurred in late spring and mid-fall. Winter moth's peak larval abundance occurred in late April with a decline to zero by the first of June. Obliquebanded leafroller's first generation appeared by 21 April with the second generation peaking in late July and early August. Peak parasitism occurred between 23 June and 29 July and larval parasitism was about 30%. Pheromone trap counts and larval species composition will be analyzed to determine the accuracy of pheromone traps to predict actual field populations of larvae. These data will eventually be used to determine the timing of various control strategies for chemical control, biological control and insect growth regulators and degree-day model to improve chemical timing.

Pre-plant Options for Improving Economics of Strawberry Production and Minimizing Weeds and Root Weevil Larvae

Bernadine Strik and Gil Buller - OSU, Department of Horticulture

The objectives of this study are to determine whether growing and incorporating meadowfoam (*Limnanthes alba*) prior to planting strawberries, will reduce weed and root weevil larval populations. Also, we are determining whether strawberry growers can harvest a cash crop, peas or meadowfoam for seed production, prior to establishing strawberries in the planting year. The study is being conducted at the North Willamette Research and Extension Center. The following treatments are being compared prior to planting strawberries: 1) meadowfoam seeded October 12, 2000 and incorporated into the soil at bloom (May 24, 2001); 2) meadowfoam seeded in fall, 2000 (October 12) and incorporated into the soil after seed set (June 12, 2001); 3) fallow ground in winter 2000/01, with peas seeded (February 28, 2001) and harvested June 11, for a commercial crop and

residue incorporated (June 12, 2001); and 4) an unseeded, fallow, control with hoeing of any weeds present or use of conventional tillage prior to planting strawberries. After residue incorporation, raised beds were formed in each 10' by 30' plot and 'Totem' planted in 15" single matted rows on June 18, 2001. The pea crop was harvested with the remaining residue (1,702 dry biomass per acre on average) incorporated. The average pea yield in this study was 5,713 lb/acre in 2001 (state average is approximately 2.5 tons/a). In 2001, there were no significant treatment effects on weed populations, other than a trend ($P<0.10$) where pre-plant peas plots had fewer grass weeds on August 20, 2001 than other treatments. There were no significant treatment effects on strawberry plant size in 2001. On May 16, 2002, there was a trend ($P<0.10$) for the meadowfoam incorporated at seed set treatment to have a larger root weevil larval population per plant (0.8 larvae/plant) than the meadowfoam incorporated at bloom (0.1); however, three of the former plots were adjacent to an older strawberry planting and thus may have more exposed to migrating adults. There was no treatment effect on weevil adults or pupae in 2002. There was no treatment effect on percentage of soil organic matter in July, 2002. Weeds were counted on four dates in 2002. There were no treatment effects on grasses. Plots in which meadowfoam was incorporated at seed set had more broadleaf weeds than the pea or fallow plots in March and April, 2002. There was no treatment effect on total yield (kg/plot), percentage of fruit rot, or berry weight through the season. Pre-plant treatments also did not affect earliness or lateness of the fruiting season. There was no treatment effect on yield because pre-plant treatments in 2001 did not affect the number of crowns, trusses, or fruiting sites per meter of row in 2002. However, the fallow control plots had significantly fewer unrooted runners per meter of row (36-42%) than plots in which green residue was incorporated prior to planting. This may have an effect on yield in 2003.

Further Evaluation of Control Strategies for Root Weevils in Strawberries and Red Raspberries

Lynell K. Tanigoshi - WSU, Vancouver Research and Extension Unit

Several promising biorational or reduced risk insecticides and those EPA calls OP alternatives were tested in the lab and field to three *Otiorhynchus* species on red raspberry foliage. After nearly a decade of usage in commercial settings and our lab and nursery bioassays with bifenthrin (Capture®, Brigade®) suggest populations of root weevils are showing trends toward increased tolerance to Capture or its reduced efficacy under field conditions. These trends further underscore the urgent need to register new mode of action insecticides such as the neonicotinoids and insect growth regulators. When field collected adults of the black vine weevil, rough strawberry and strawberry root weevil were place on one hour-old residue of Capture and several experimental insecticides, differential efficacy was quickly manifested within 3 days post treatment. However, when these same insecticides were bioassayed for field residual on red raspberry foliage applied with a Hudson hand sprayer to runoff at 1, 3 and 5 day post treatment, highest mortality was only 52%. Field residual activity for Capture applied at preharvest on the Vancouver REU provided only 75% morality at 3 DAT and only 13% at 6 DAT to new cohorts of black vine weevil placed on these respective field aged foliage in Petri dishes. Though the initial knockdown by the tested neonicotinoids is not as rapid as Capture, their eventual registration will provide the industry with a new mode of action chemistry that is known to be softer on beneficial insects and mites and a tool for resistant management that will extend the usefulness of Capture.

Production/Physiology

Manipulation of Soil Moisture and N-Availability in the Vineyard to Improve Fermentation Behavior and Wine Quality. Part I: Effect of Nitrogen, Irrigation, and Soil Management on Vegetative Growth, Gas-Exchange, Yield, and Fruit Composition of Pinot noir

Jessica Howe and M. Carmo Vasconcelos - OSU, Dept. of Horticulture

The goal of this study was to observe vine physiological response to various vineyard practices aimed at increasing nitrogen availability to the vine. Treatments were applied in a factorial design to vary irrigation, cultivation, and nitrogen application to Pinot noir grapevines during two seasons. Irrigated vines received supplemental irrigation after lag phase (82mm in year one, 90mm in year two). Cultivation of alternate rows was performed in early spring to encourage nitrogen utilization and reduce nutrient and water competition. Nitrogen treatments consisted of soil-applied urea (39.2kgN/ha), foliar applied urea (2.98kgN/ha), and zero nitrogen. Soil nitrogen was applied in early spring. Foliar nitrogen was applied once at the onset of ripening and again at véraison. The trial was established in a commercial vineyard located in the South Willamette Valley. Photosynthesis, transpiration, water use efficiency, chlorophyll content, maximum quantum yield of photosynthesis, soil moisture, leaf petiole nutrition, ripening dynamics, juice composition, yield components, pruning weights, and carbohydrate reserves were measured during two growing seasons. Leaf water potentials were measured during the first growing season. During both seasons irrigated vines assimilated CO2 and transpired at a significantly higher rate than non-irrigated vines. Similarly, tilled treatments assimilated CO2 at a significantly higher rate and maintained higher water use efficiency. Tilling tended to increase the efficiency of light driven photosynthetic reactions and chlorophyll content. This response became more apparent in the second year of the study, which may indicate a delayed effect of soil cultivation on maximum quantum yield of photosynthesis and chlorophyll content in grapevines. Nitrogen treatments had little impact on leaf gas exchange and chlorophyll content. Soil cultivation had the largest impact on petiole nutrient content, with significant differences in phosphorus, potassium, manganese, copper, boron, carbon and total nitrogen. Irrigation increased total petiole nitrogen in the second year of the study.

During both seasons, irrigated Pinot noir vines had lower titratable acidity than non-irrigated vines and tilled treatments had higher soluble solids than non-tilled treatments. Significant effects from tilling suggest that there may be a delayed benefit from soil cultivation. Irrigated vines tended to have a higher berry weight, however, yield components differed only slightly between treatments and year.

Vine vigor (pruning weight) increased with cultivation in both years and cane weights were higher after the second year. Irrigation and nitrogen did not affect vine vigor. Wood carbohydrate reserves were higher for vines on tilled ground but only after the second year. The other treatments did not affect stored carbohydrate reserves.

Evaluation of Rootstocks for the Cultivars Pinot Noir, Chardonnay, Pinot Gris, and Merlot

Ray Shaffer and M. Carmo Vasconcelos - OSU, Dept. of Horticulture

This trial was planted at the OSU Woodhall research vineyard in 1997 and consist of two experiments: Experiment one includes Pinot noir, Chardonnay, Pinot gris and Merlot grafted to 9 rootstocks and ungrafted. In experiment two, Pinot noir was additionally grafted to 10 other rootstock selections. The objectives of this research were: 1) Evaluate the affinity of Pinot noir, Chardonnay, Pinot gris, and Merlot to a wide choice of phylloxera-resistant rootstocks; 2) Describe the effects of rootstock on initial vine growth, canopy development, gas-exchange performance, and crop size and quality; and 3) Identify the most efficient scion-rootstock combinations able to avoid drought stress, and optimize carbohydrate production and storage (long term goal).

On experiment one, there were no interactions between scion and rootstock on gas-exchange performance of the four varieties studied. Ungrafted vines had the highest photosynthesis rates followed by vines grafted to 420A, 3309,5BB, and Gravesac. Lowest rates were measured on vines grafted to Riparia gloire. Transpiration rates were highest when the scion was grafted to 420A or ungrafted and lowest when grafted to Riparia gloire. There were no differences in rootstock and variety on the efficiency of the light dependent photosynthesis reactions (Fv/Fm) and on water use efficiency. Chlorophyll content was highest for ungrafted or vines grafted to 5BB. Lowest leaf chlorophyll content was measured on vines grafted to 101-14 and 44-53. The four varieties differed on their gas-exchange performance: Pinot noir had the highest transpiration rate and the second highest photosynthesis rate; Merlot had the lowest transpiration and photosynthesis rates; Pinot gris reached the highest rates of photosynthesis; Chardonnay had intermediate rates of transpiration, and photosynthesis. Leaves of Pinot gris had the highest chlorophyll content and the lowest was measured on Pinot noir.

On experiment two, Pinot noir photosynthetic rate was highest when grafted to 1103 P or 125AA. Lowest rates were observed when the rootstock was Riparia gloire. Highest chlorophyll contents were found on vines grafted to 125AA, 99R and 5C and lowest on vines grafted to Börner, 3309 and Gravesac. There was no rootstock effect on Pinot noir transpiration rate, water use efficiency, and Fv/Fm.

On experiment one, shoot diameter was increased when the scion was grafted to 5BB or Gravesac. The narrowest shoots were on vines grafted to Riparia gloire. Except for Pinot noir, shoot length did not significantly differ among rootstock. On this variety, 5C and Börner induced the longest and shortest shoots, respectively. The opposite was true for shoot diameters.

Vines grafted to 5BB and 420A had the highest number of berries per cluster, berry weights, and cluster weights, resulting in the highest yields. Ungrafted vines had the lowest yields and yield components. Juice soluble solids was highest when vines were grafted to Riparia gloire or 44-53 and lowest on ungrafted vines. Chardonnay, Pinot gris, and Pinot noir juice pH did not respond to rootstock. Merlot juice had the highest pH when grafted to Gravesac and lowest when ungrafted. Interestingly, ungrafted Merlot vines produced juices with high acidity and the opposite was true for ungrafted Pinot gris and Pinot noir. Vines grafted to 5BB, 420A, and SO4 produced above average yields of above average quality. Ungrafted vines showed the opposite tendency.

Differences in yield components and fruit composition of Pinot noir grafted to 20 rootstocks were less defined. Juice composition did not respond to rootstock. Highest fruit yields were obtained when vines were grafted to 420A, 1103P, and 5C. Vines grafted to Schwarzman or ungrafted produced the smallest crops. 5BB, 140Ru and 8B produced above average crops of above average quality. The opposite was true for vines grafted to Börner, 3309C Riparia Gloire and 110R.

Pruning weights were differed among rootstocks, with 5C, 140 Ruggeri, and 1103 Paulsen producing more prunings. The Ravaz Index (yield to pruning ratio) was highest for ungrafted vines and lowest for vines grafted onto 101-14.

Evaluation and Selection of Wine Grape Cultivars for Adaptability of High Fruit Quality Under Desert Conditions of the Pacific Northwest

Esmaeil "Essie" Fallahi - University of Idaho, Parma Research and Extension Center

Objectives:

1. To evaluate cold tolerance of wine grape cultivars under cool desert conditions, similar to those of Southwest Idaho, Eastern Oregon, and Washington; 2. To determine adaptation, nutritional physiology and requirement, fruit maturity, and vine and berry physiological characteristics of each cultivar under cool desert conditions; 3. Canopy management, and irrigation requirements of different varieties of wine grapes.

Materials and Methods:

A wine grape vineyard has been established at the University of Idaho Parma Research and Extension Center. The vineyard ground was plowed and prepared in spring of 1997. The spacing is 7 x 9 ft. Cuttings from several varieties/clones were rooted and planted in each spring of 1997, 1998, 1999, 2000, and 2001 in four replications of eight vines per plot. A drip irrigation system was installed in 1997 and 1998.

Results and Discussion:

Planted cultivars in the first phase of this experiment are: Cabernet Franc, Cabernet Sauvignon, Carignane, Dijon Clone (any Dijon), Chardonnay 29, 30 or 31, Dolcetto, Grenache, Limberger, Malbec (cot), Merlot, Meunier, Nebbiolo, Petit Verdot, Petite Sirah (Durif), Sangiovese, Valdepenas, Viognier, Pinot Noir - 18, Gamay Beaujolais,

and Pinot Gris. In the second phase, Barbera 02, Cabernet Franc 04, Cabernet Sauvignon 02, Cabernet Sauvignon 04, Merlot 01, Merlot 15, Muscat of Alexandria, Pinot Gris 04, Shiraz 07, and Chardonnay 37 were planted in 1998. In 1999, Chardonnay 38, Blauer Portugieser 01, Pinotage 01, Tempranillo 02, and Flora 01 were added to this experiment. In the Spring of year 2000, Chardonnay 49, Flora 01, Pinotage 01, Souzao 01, Shiraz 07, Touriga 02, Chardonnay 38, Tempanillo 02, Cabonett Franc 04, Primitivo, Blauer Portugieser 02, and Pinot Gris 04 were planted to complete and/or add to the previous cultivars/selections. Several additional new cultivars was added to this experimental vineyard in 2001. Cabernet Franc 01 and Malbec 06 were more seriously damaged by winter or spring freeze, thus had a higher number of vines with new growth from mid-trunk area than other cultivars in 1999. Chardonnay 29 and 49 were the first ones to ripen and harvested and Dolcetto was the latest one. Seventeen cultivars had sufficient fruit in 2000 and over 25 cultivars were harvested in 2001. Fruit from all varieties were harvested according to their sugar content every year. Wines were made by Saw tooth winery in 1999, by Parma Ridge Winery in 2000, and by Ste Chapelle in 2001. In year 2000, Carignane, and Grenache had high higher yield and large clusters but Chardonay 49 and Petite Verdot had smaller clusters and lower yield. Merlot 01 and Dolcteto had higher sugar but Carinane had lower sugar. Harvest dates (maturity) for 2001 are presented in Table 1. Chardonnay 49 was the earliest cultivar but Carignane 06,Dolcetto 01,Muscat of Alexandria 02, Petite Sirah 03 Petite Verdot 01, Shiraz were the latest ones to mature under conditions of this experiment during 2001. Average cluster weight in 2001 in most varieties was similar to those in 2000 with exception to Mucat of Alexandria in which clusters were heavier in 2001 than those in 2000, because vines were older. Similar to the situation in 2000, Petite verdot had the smallest clusters in 2001.

Effect of Primocane Suppression on Plant Vigor and Purple Blotch Management in EY Marion Blackberries

Diane Kaufman - OSU, NWREC

Objectives: Evaluate the effect of chemical primocane suppression on plant vigor and incidence of purple blotch disease in Marion blackberries cropped every year (EY).

Progress: The experiment was originally designed with the intention of conducting it in an established planting at NWREC in which we have been studying purple blotch for the past two years. However, because that planting was confirmed to have Raspberry Bushy Dwarf Virus (RBDV) in 2002 and we have decided to remove all RBDV infected plantings from NWREC, we will have to establish a new planting for this experiment. Our plants arrived late in the summer of 2002 and were transplanted into gallon-size pots in which we will keep them over winter. The planting will be established at NWREC during spring, 2003. New primocanes will be trained that spring and a baby crop will be produced in 2004. Suppression treatments (Aim herbicide) will be applied to primocanes emerging in spring, 2004 and the first year of data for this experiment will be collected in late summer, 2004 (cane growth measurements), late winter-early spring, 2005 (purple blotch lesion counts), and summer, 2005 (yield data).

Rootstock and Varietal Effects on the Variability in Cluster Initiation and Development

Markus Keller - WSU-Prosser

A forced-convection cooling/heating system was used to test the impact of air temperature on flower cluster initiation and development of Cabernet Sauvignon vines growing in a mature vineyard at WSU-Prosser. Four temperature regimes were applied to exposed buds during budbreak and to inflorescences during bloom: ambient, cool (ambient-5°C), heat (ambient+5°C), double-heat (ambient+10°C). Budbreak treatments were imposed from the beginning of sap flow till individual flowers were visible. Bloom treatments were imposed from the beginning of bloom till fruit set. Shoot length and leaf area were measured weekly, clusters and flowers were counted after budbreak, and berries were counted at harvest. Environmental conditions (solar radiation, temperature, relative humidity, soil water status) were monitored throughout the season.

The two heat treatments applied during budbreak advanced budbreak and accelerated early-season shoot growth, whereas the cool treatment delayed budbreak and retarded shoot growth compared with ambient air. However, flower numbers per cluster were unaffected by temperature treatments. The heat treatments applied during bloom reduced shoot growth, shortened bloom time and improved fruit set compared with the cool treatment. These data suggest that temperature may not influence cluster differentiation during bud break, but has significant effects on fruit set and sink strength of clusters.

Blueberry Performance on Marginal Soils with Short Growing Season Conditions

Cindy A. Kinder and Jo Ann Robbins - University of Idaho

Camas County is typical of many high altitude, cold climate, and short season areas throughout the Pacific Northwest. The growing season in Camas County is short, 60-85 days. Nine cultivars of blueberries were planted at two sites with three replicates in May 2001. Cultivars selected were a combination of winter hardiness (short and half high bushes) and early to mid season flower and fruiting. Cultivars selected were 'Bluetta', 'Chippewa', 'Hardyblue', 'Meader', 'Northblue', 'Northland', 'Patriot', 'Polaris', and 'St. Cloud'. Soils at the planting site have a pH of 6.1. These were the lowest pH soils located, which is not unusual for southern Idaho - an area with predominantly highly alkaline soils. Fences were built around the plots and an irrigation pump was purchased for one of the sites. Objectives of the project are: 1) to determine whether blueberries will survive cold winters typical of high altitude Idaho locations, 2) to determine whether blueberries will grow in marginal soils, and 3) to determine whether blueberries will flower and fruit to produce an economic yield in areas with cold winters and spring frost. Cultivars 'Meader' and 'Polaris' plants died during the season of planting. Other plant died the first winter. Four of six 'Polaris' plants died and 3 of 6 'Meader' and 'St. Cloud' plants died. Plants began leafing out May 20th, 2002. The 'Northblue' and 'Bluetta' cultivars received a higher winter hardiness rating than the other seven cultivars. Six of the 9 cultivars bloomed the first season after establishment, with an average of 11 flowers per plant (range 2 to 25 flowers per plant). Fruit were present on 'Chippewa' and 'Northblue' plants. Growth/vigor rating showed 'Hardyblue', 'Northblue', and 'Chippewa' as the top cultivars. All plants within the trial have an upward plant habit. The next few years we will determine which cultivars best survive, flower and fruit in the soil and climate conditions found in Camas County.

Water Management to Optimize Canopy, Yield and Quality of 'Cabernet Sauvignon'

Krista Shellie - USDA-ARS, Parma

In spring of 2002, a 1-acre irrigation trial was established in a 30 acre block of own-rooted, 4th leaf, *'Merlot'* grapevines on a sandy loam soil at Skyline Vineyard in Nampa, ID. A similar irrigation trial was also established at the U of I experimental vineyard in Parma, ID on 17 different V. *vinifera* varieties (2 clones of 'Merlot', three clones of 'Cabernet Sauvignon', and one clone each of 'Cabernet Franc', 'Lemberger', 'Viognier', 'Tempranillo', 'Chardonnay', 'Malbec', 'Dolcetto', 'Grenache', 'Nebbiolo', 'Petite Sirah', and 'Sangiovese'). At both sites, neutron probes were used to monitor soil moisture and a pressure bomb was used to monitor leaf water potential throughout the growing season. At Skyline, four irrigation treatment levels (full vine evapotranspiration (FVET), 70% FVET, 35% FVET until veraison, then 70% FVET, and 35% FVET until harvest) were evaluated in a randomized block design with 4 plot replications per treatment level. At Parma, two irrigation levels (FVET and 35% FVET until veraison then 70% FVET until harvest) were evaluated with 2 field replications for each irrigation level. Data was collected on berry size, berry temperature, cane length, canopy light penetration, yield per vine, juice soluble solids concentration, titratable acidity, and pH, and wines were made from each of the replicated Skyline trail plots.

Can Blueberry Plant Yield be Increased and Labor Requirements Reduced by Cropping Plants the First Two Years After Planting? — Effects of Cultivar and In-row Spacing

Bernadine Strik and Gil Buller – OSU, Department of Horticulture

The effect of early cropping (no blossom removal the first two years after planting; thus cropped in 2000 and 2001) and in-row spacing (1.5' and 4') are being studied in 'Duke', 'Bluecrop', and 'Elliott' in a planting established at the NWREC in October, 1999. No yield was produced on the non-cropped plants in 2000 and 2001. In the early-cropped treatments, yield at 1.5' was about three times that at 4' in all cultivars in 2000 and 2001. 'Duke' and 'Elliott' produced the highest yield in 2000. In 2001, yield increased 8 to 16 fold at the 1.5' spacing, depending on cultivar. Pruning weight per plant was affected by cultivar, in-row spacing, and early cropping. In winter 2000/01, after one year of early cropping, there was no treatment effect on the percentage of fruit buds per lateral. However, in winter 2001/02, early-cropped plants had a lower percentage of fruit buds in 'Bluecrop' and 'Duke' than plants that were not cropped early. Plants spaced at 1.5' also had a lower percentage of fruit buds than those at 4' in 'Duke' and 'Elliott'. Total plant dry weight in February, 2002 was affected by cultivar and early cropping, but not in-row spacing. Early cropping reduced the dry weight of the root system, crown, and one-, two-, and three-year-old wood in all cultivars. 'Bluecrop' plants had less total dry weight than those of 'Duke' or 'Elliott'. In 2002, all treatments were cropped for the first time. Total yield per plot, picking efficiency (g fruit picked/min), and berry weight (g) were significantly affected by cultivar, in-row spacing, and early cropping. There was a significant early cropping by cultivar interaction for yield; early cropping reduced yield in year three (2002) by 18% in 'Bluecrop', 26% in 'Duke', and 54% in 'Elliott'. For example, in 'Bluecrop' plants spaced at 4' that were not cropped early yielded 9.7 kg/plot (3 tons/a) in year three compared to 6.1 kg/plot (2 tons/a). 'Elliott' produced 36.7 kg/plot (11 tons/a) in the no early-cropping treatment compared to 12.4 kg/plot (5.1 tons/a) in the early-cropped treatment. All of the data for 2002 will be presented.

Alternative Production Systems for 'Marion' Blackberry

Bernadine Strik and Gil Buller – OSU, Department of Horticulture

The objectives of this study are to determine the impact of high-density planting and primocane training methods, as compared to an industry standard on: 1) yield in every-year and alternate year production; 2) cold hardiness; 3) possibilities for machine training of primocanes in the off-year of alternate year production systems; and 4) the impact of alternative training methods on thorn contamination in machine-harvested fruit. A planting was established at the NWREC in May 2000 with the following treatments: A) 2' spacing (in-row), alternate year (AY), primocanes topped at 6' once they reach the wire during the growing season; B) 2' spacing, AY, primocanes not topped during the growing season; C) 3' spacing, AY, primocanes not topped (trained on 2 wires one at 6', the other at 4'); D) 5' spacing, AY, primocanes not topped; and E) 5', EY (every-year), primocanes not topped (industry standard). The AY plots are designed such that half of each plot will be in the on-year and the other half in the off-year in any given year. In the EY treatment, primocanes are trained in February, as is more common in the industry. There are 5 replicates arranged in a randomized complete block design. Plots are 20' long. Plants were not cropped in 2001, thus essentially all treatments were in an "off" year, primocanes were trained as they grew and no topping was done. For this reason, it is only appropriate to compare the yield etc. of the following treatments in 2002: B) 2' AY, primocanes not topped; C) 3' AY, primocanes not topped; and D) 5' AY. The additional treatments: 2' AY, primocanes topped at 6'; and 5' EY, primocanes not topped , February trained (industry standard) cannot be compared until 2003 as the primocane topping treatments and the "every-year" production system did not start until this year. In-row spacing had a significant effect on yield per plant and per unit area. The 2' in-row spacing produced 5 tons/a compared to 3.6 tons/a at the 5' spacing. Floricane number per plant was higher at the 5' spacing (17.6) than at the 2' spacing (12). There was no significant treatment effect on the number of fruit/lateral, percent budbreak or the number of thorny leaf petioles per harvested kilogram of fruit. We will evaluate cold hardiness (through bud break) in spring, 2003. In 2003, all treatments will be compared.

Impact of Nitrogen (N) Fertilization Rate on N Uptake, Growth and Yield of Blueberry as Affected by In-row Spacing

Pilar Banados and Bernadine Strik – OSU, Department of Horticulture

This study is designed to determine the effects of N fertilization rate on fertilizer N uptake and partitioning in blueberry and the impact of in-row spacing on N use/uptake. We are using ^{15}N (depleted ammonium sulfate) that can be traced in the plant, for this study. In-row spacing treatments for this experiment are 1.5′ and 4′. Nitrogen rates within each spacing are 0, 100, or 200 lb N/a applied as a triple split (1/3 just after bud break; 1/3 at bloom; and 1/3 in June). The no nitrogen treatment allows us to look at the impact of only having N available through mineralization of organic N, which usually occurs in late summer. A mature planting of 'Bluecrop' at the North Willamette Research and Extension Center is being used for this project that involves digging up plants. Plants were fertilized (100 or 200 lb N/a) with ^{15}N-depleted ammonium sulfate in spring, 2002. In 2003, plants will be fertilized with the same N rate treatments, but only un-labeled N will be applied. This will allow us to look at use of stored N (from fertilizer applied the previous season). Uptake and movement of fertilizer N (2002) and stored N (2003) is being measured by destructively harvesting and separating plants into their parts and analyzing for N and ^{15}N. Yield, berry size, fruit quality (i.e. rot), and plant growth data are also being collected. In 2002, one plant per treatment/rep (plot) was dug up on February 9, 2002, before N applications, to establish a fresh weight/dry weight base line. Plants were divided into their parts (roots, crown, one-, two-, three-year-old wood etc.) and dried and weighed. Tissue was ground and analyzed for N, P and K concentration. In addition, one plant per plot was dug up on each of the following dates: April 25, May 23, July 2, and September 11. Seven additional digging dates will be done between December, 2002 and January, 2004. Plants were separated into: current season growth, leaves, floral and vegetative buds, flower clusters and fruit (depending on stage of development), one-, two-, and three-year-old and older wood, large and small roots and crown tissues, weighed (fresh and dry) and a sub-sampled ground for tissue analysis for N and ^{15}N. Yield and fruit size data were collected during the fruiting season of 2002. Although we have all of the data mentioned above collected, we are just now starting to get some (April) of the tissue analyses (N and ^{15}N) back from the lab in New Mexico. Thus we have no fertilizer uptake data to report here. The yield data are presently being analyzed. We will report on treatment effects on yield, fruit size, plant growth and any available N uptake data in December at the NCSFR meeting.

Using Whole-Vine Photosynthesis to Understand the Effects of Water Stress on Premium Wine Grapes

Jorge Perez Peña and Julie Tarara - USDA-ARS

Photosynthesis contributes directly to the yield and quality of wine grapes. Environmental variables like radiation, temperature, humidity, nutrition, and water affect photosynthesis at the vine level. Measurements of whole-vine photosynthesis reflect the integrated response of the vine to its environment and are important to understand the effects of management practices imposed on the vineyard. With this in mind, an open-top chamber (8 m3 volume) was built for the measurement of gas exchange (CO2 and H2O) from a whole vine. The design criteria and materials used were selected to minimize any artifact caused by the chamber itself and to accommodate the trellis of a mature field-grown vine. Considering no transpiration, a maximum internal temperature increase of 2.5°C was expected according to a radiation balance based on the size, shape, and ventilation rate of the chamber. Temperature profiles of vines inside and outside the chamber were measured. Solar radiation inside the chamber was approximately 90% of ambient. Several chambers will be used to measure net photosynthesis in a vineyard under regulated deficit irrigation (*Vitis vinifera* L. cv. Cabernet Sauvignon) in Washington State. This type of chamber could be used for other studies where an understanding of the whole vine responses is needed.

Effect of Mulch and Pre-plant Soil Amendment on Soil Nitrogen Availability in Highbush Blueberry

Wei Q. Yang - NWREC

Nitrogen is one of the most required nutrients in highbush blueberry production systems. The amount of nitrogen applied to achieve optimal plant growth and berry yield is largely dependent on plant age, crop load, and soil conditions. The availability of fertilizer N for plant uptake is affected by many factors, in particular, the amount of soil organic matter and the rate of its decomposition. How rapid the organic matter decomposes is largely determined by the amount of carbon relative to nitrogen (C/N ratio) in the organic matter. During the processes of decomposition, soil microbes will need N to break down soil organic matter (a process called nitrogen immobilization). The immobilized soil N will not become available for plant uptake until the C/N ratios in the organic matter reaches about 25:1. In general, the rate of decomposition is initially rapid and becomes slower as the C/N ratio approaches that of the microbes themselves (a situation rarely happens in agricultural production systems). To determine how much fertilizer N is tied up during the decomposition processes, the C/N ratio in the organic matter has to be measured over time under field conditions.

An experiment has been set up at the North Willamette Research and Extension Center to determine the rate of decomposition of two kind of sawdust. To mimic the current blueberry production systems, aged and fresh sawdust were chosen as the experimental material. The treatments include 50% sawdust (fresh vs. aged) soil amendment, 6" surface mulch (fresh vs. aged) with no soil amendment, and 50% aged sawdust soil amendment plus aged surface mulch. These treatments are crossed completely with a high and low nitrogen treatment. The experiment is conducted in 25 gal nursery containers so the weight changes of the organic matter can be measured accurately. Soils and fresh/aged sawdust were sifted through a 5 mm screen prior to filling the container. A mobile scale unit with an accuracy of 10 gram has been purchased to weigh the containers. Soil moisture, temperature, and container weight changes (a reflection of decomposition process) will be monitored throughout the experiment. The C/N ratios in the mulch, organic soil amendments, and leachates will be determined during the entire course of the study. At the end of this study, the decomposition rate of fresh and aged sawdust and the amount of N fertilizer tied up by them over time will be determined.

Wine

Impact of Selected Vitamins on Alcoholic Fermentations Induced by *Saccharomyces*

C.G. Edwards - WSU, Department of Food Science and Human Nutrition

A significant amount of time in 2001-02 was spent preparing a manuscript summarizing the research investigating the effect of pantothenic acid and assimilable nitrogen on fermentation characteristics (Wang et al., 2002). In addition, a novel method for the analysis of volatiles produced during fermentation has been developed (Bohlscheid et al., 2002). Solid phase microextraction (SPME) has been used for the selective extraction and concentration of volatiles from a fermentation. The use of a polyacrylate SPME fiber allows for the selective extraction of higher alcohols, esters and medium chain fatty acids from a wine sample. Using this SPME method, synthetic grape juice media fermented by EC1118 and UCD 522 with different levels of nitrogen (60 and 250 mg/L "yeast assimilable nitrogen" or YAN) and pantothenic acid (10, 50, or 250 µg/L) were analyzed for yeast-synthesized volatile compounds (Wang et al., 2002).

Assimilable nitrogen and pantothenic acid both affected production of higher alcohols, medium-chain fatty acids, and esters. In summary, higher alcohol production was enhanced under nitrogen deficiency while the formation of medium-chain fatty acids and ethyl esters generally increased with an increase in pantothenic acid.

Since both nitrogen and pantothenic acid affect synthesis of several odor/flavor compounds, it seems likely that changes in the organoleptic quality of wines would also be probable but requires further study.

Research was initiated to adapt microbiological methods for determination of biotin and pantothenic acid initially based on the efforts of a French student who performed a six month research internship in our laboratory in 2001. Briefly, a standardized basal medium without the vitamin being analyzed is prepared and different concentrations of the vitamin are added prior to inoculation of the test microorganism. Based on growth of the test microorganism, a standard curve is prepared and utilized for sample analysis. Development of these assays has now been partially completed. One difficulty has been selection of a test microorganism since the strain used by most standardardized protocols, *Lactobacillus plantarum* strain ATCC 8014, can not utilize different "vitamers" (chemical analogs, *i.e.*, molecules similar in structure that can substitute for other molecules) of biotin unlike *Saccharomyces*. As such, different commercial strains of *Saccharomyces* are being investigated for use for assaying vitamin concentrations in the collected grape samples. Grape and must samples have been taken from vineyards and wineries during fall 2001 for analysis.

Inducement of Malolactic Fermentation in Musts from the Pacific Northwest

C.G. Edwards – WSU

Alcoholic fermentations were induced in a Chardonnay grape juice using different yeast strains and samples were periodically removed, sterile filtered, and inoculated with *O. oeni*. During alcoholic fermentation, yeast V-1116 exhibited the greatest inhibition against *O. oeni* and produced the largest amount of total SO_2 while strain Saint Georges exhibited the least bacterial inhibition and produced low amounts of total SO_2. Although these fermentations implicate SO_2 in causing bacterial antagonism by yeast, capillary electrophoreis did not detect any free SO_2 during these alcoholic fermentations. This finding suggested that the inhibition was due to the presence of 'bound' SO_2 rather than the 'free' form. However, additional evidence suggests the presence of other unidentified inhibitory factor(s) produced by the yeast.

A New Technology for Simulatneous Tannin and Pigments Analysis in the Northwest Wine Industry

Moris L. Silber - WSU, NRS-Pullman

Taste and color are the most important palatable qualities in wines that depend on the quantity of tannins (proanthocyanidins) and pigments (anthocyanins), the two most abundant classes of phenolic compounds in grape berries and red wines. They contribute bitterness and astringency to red wines and are a major sensory and quality component. Therefore, monitoring tannin and pigments during growing grape berries and processing red wines is very important in winery practice. Until present, tannins and polymeric pigments have been determined separately in tedious multiple steps. Conversely, we have designed a new bioassay for simultaneous measurement of both tannins and pigments in one simple and low cost technology. Overall, the procedure is high sensitive, accurate, and reproducible. It is trivial in use, requires only short training of the personnel, and is currently undergoing modification for in-the-field application.

To test its feasibility, red wine samples of different varieties produced under different experimental and industrial conditions have been analyzed during the year one research of this project. Also, we began creation of a database information on tannin/pigments content in red wines.

Cabernet Sauvignon -- Impact of Irrigation and Crop Load Strategies of Flavor and Phenolic Profiles of Grapes and Wines

S. E. Spayd and R. Smithyman

Cooperator: J. Tarara, D. Gore, M. Nye, and J. Fellman

Cabernet Sauvignon vines were irrigated under three regimes: 1) standard irrigation (weekly irrigation based on water use and loss), 2) during period of berry cell division weekly irrigation to replace 50% of water consumed (early deficit), and 3) standard irrigation until veraison when only 50% of water replaced (veraison deficit). Two crop loads were established by cluster thinning within each irrigation level: 1) ca. 3 tons/acre (low) and 2) ca. 6 tons/acre (high). The treatments were replicated four times. Processed products were prepared at the Stimson Lane research facility. After about two years of aging, the products from 1999 were analyzed for phenolic profiles and sensory characteristics in 2001. Phenolic profiles and sensory characteristics were similar between all treatments for the 1999 product. Volatile analysis, using solid-phase microextraction and gas-chromatography, indicated minor differences in a few of the roughly 50 compounds detected in the finished product. Berry samples and wines from the next year of treatments will be evaluated fall and winter 2002.

Effect of Nitrogen, Irrigation and Soil Management Practices on Fruit Composition, Yeast Assimilable Nitrogen Content, Fermentation Behavior, and Wine Composition and Quality

Barney Watson - OSU, Department of Food Science and Technology

Commonly, winemakers experience fermentation problems with fruit from specific vineyard blocks over the course of several vintages and may need to modify vineyard management practices and/or add supplemental nutrients in order to obtain timely, healthy fermentations. Fruit ripening and fruit composition at harvest may be affected by soil nitrogen availability and water availability. Under drought conditions and/or conditions of low soil nitrogen availability, the fruit at harvest may have inadequate levels of yeast fermentable nitrogen. The specific objectives of this project were to investigate the effects of irrigation and nitrogen availability in a commercial vineyard on Pinot noir fruit composition, yeast assimilable nitrogen content, fermentation behavior, production of sulfides, and wine composition. This study was conducted at Benton Lane Vineyards, a mature commercial Pinot noir vineyard in the south Willamette Valley during the 1999, 2000, and 2001 vintages in collaboration with Carmo Vasconcelos in the Department of Horticulture and Mina McDaniel in the Department of Food Science and Technology at Oregon State University. The effects of vineyard cultural practices including nitrogen fertilization, irrigation, and soil cultivation treatments were evaluated. A total of 12 field vineyard treatments were monitored at each site and experimental wines were produced in triplicate lots from individual field replicates. Juice samples were analyzed for ammonia (enzymatic assay) and for alpha amino acid content (NOPA) to determine the yeast assimilable nitrogen content. Fermentation rates were monitored and wines were analyzed for compositional differences. The wines underwent sensory evaluation in the Sensory Science Laboratory at OSU and selected wines were analyzed for volatile sulfur compounds (ETS Laboratories).

Northwest Center for Small Fruits Research

Blackberry Research Priorities 2001-2002

1) Breeding cultivars that are summer bearing, thornless, high-yielding, winter hardy, machine harvestable, disease resistant, and that have superior fruit quality

Botrytis control to be done with an emphasis on efficacy work to meet Food Quality Protection Act standards for reduced risk and biorational control

Plant nutrition

Purple blotch control

Thorn management and reduction systems

2) Fruit composition and nutraceutical properties

RBDV

Primocane management/systems approach

Develop and improve IPM systems with special attention to fruit contaminants

Develop and improve cultural chemical and biological practices to improve cold hardiness

3) Red berry mite

Color stability study

Food safety/sanitation field practices through processing using a systems approach

Protection of fruit shelf extension

Crown gall control

Northwest Center for Small Fruits Research

Blueberry Research Priorities 2001-2002

Our long term vision calls for research that places emphasis on a whole systems approach with the goal of better utilization of inputs such as water, fertilizers, chemicals and labor.

1) Sudden Oak Death (SOD) *Phytophthora ramorum*

Continue testing of outside varietal selection

Fruit rot complex control

Optimum water rates and methods throughout the season

Scorch mapping and detection

Fertilizer rates for optimal growth including mycorrhizal associations

2) Mummyberry control

Establish a breeding program

Improved mechanical harvesting systems for fresh market

Identification and control of insect contamination on blueberry fruit

New end-use product development for blueberry fruit (value-added)

3) Alternative weed control

Post harvest color uniformity and retention

Bird control

Nutritional benefits

Northwest Center for Small Fruits Research

Strawberry Research Priorities 2001-2002

1) Cyclamen

Root weevils

Develop cultivars with fresh market and processed market potential, including earlier and later ripening cultivar

Nutritional/Nutraceutical benefits

Alternate production systems for economic efficiency and increased yield

2) Weeds

Phytophthora

Increased quality (firmness, color, shelf life, etc.)

Food safety/sanitation/security

Fruit rots - botrytis

3) Mites - Twospotted

Color stability

New variety management

Marketing strategies

Harvesting efficiency

Northwest Center for Small Fruits Research

Red/Black Raspberry Research Priorities 2001-2002

1) Develop cultivars that are summer-bearing, high-yielding, winter hardy, machine-harvestable, disease resistant, virus resistant and have superior processed fruit quality.

   Root weevil control strategies

   RBDV control strategies

   Root rot control strategies

   Preharvest, fruit rot and shelf-life

2) Stress management and whole plant physiology

   Cane management (including trellising systems and primocanes control)

   Season extension: improve viability of fresh marketing

   Nutraceutical/nutritional benefits

   Mite control

3) Food safety and sanitation from field through processing

   Weed control

   Leafroller control

   Tomato ringspot virus and vector control

   Nutrition and precision farming adaptation

Northwest Center for Small Fruits Research

Minor Crops Research Priorities 2001-2002

Lonicera, Bilberry, Schisandra chinensis Baill, Gooseberry, Currants, Hardy Kiwifruit, Lingon Berry, Huckleberry, Chokeberry (Aronia melanocarpa), Elderberry, Sea Buckthorn Berry (Hippophae), Buffalo Berry (Shepherdia)

Note: Priorities ranked "1" (five of them) apply to all minor berry crops; those ranked "2" & "3" are commodity specific.

1) Pesticide tracking, registration and re-registration issues for new up-and-coming crops

Germplasm collection, improvement, evaluation, and introduction

Develop a production system (how do we grow these crops?)

New product development/marketing

Nutraceuticals

2) Foliar disease Ribes

Fresh market storage of Hardy Kiwifruit

Investigation of mycorrhizal associations in Huckleberry

Pollination/fruit set Hardy Kiwifruit

3) Quality of Hardy Kiwifruit

Currant fruit fly (also called gooseberry maggot)

Nutrition of Hardy Kiwifruit plants (fertilzation)

Irrigation of Hardy Kiwifruit

Phytophthora in Hardy Kiwifruit

Northwest Center for Small Fruits Research

Grape (Table, Wine & Juice) Viticulture Research Priorities 2001-2002

1) A) Evaluation of varieties, clones, and rootstocks for cold hardiness, vigor, water requirements, effect of edaphic factors, nutritional status, yield parameters, and grape quality attributes.

B) Biology and control of Phylloxera

C) Development of integrated production systems, including pest economical thresholds

D) Effect of viticulture practices (e.g. nutrient management, canopy management, crop load, water management, vegetation management, cover crops) on grape and wine quality

2) A) Biology and control of powdery mildew, spider mites, nematodes, cutworms, mealy bug, viruses, and leaf hoppers.

B) Yield Estimation/Modeling/Yield Prediction

C) Organic production

3) A) Biology and control of Botrytis bunch rot, Thrips, crown gall, weeds, Glassy-winged Sharpshooter, and Eutypa fungal disease.

Northwest Center for Small Fruits Research

Cranberry Research Priorities 2001-2002

1) Weeds

Cranberry Girdler

Control of a fruit pest tentatively identified as Carposinid spp.

Market expansion

Black-headed fireworm/biocontrols

2) Tipworm

Pollination/fruit set

Evaluation of selections and cultivars

Cottonball

Cranberry nutraceuticals/nutrition

3) Dieback

Black vine weevil

Vine overgrowth

Keeping quality (storage of fresh fruit)

Pesticide applicator techniques

Northwest Center for Small Fruits Research

Wine Processing Research Priorities 2001-2002

1) Effects of vineyard cultural practices on fermentation behavior and wine quality (nutritional status, water management, cover crops, fruit maturing, etc.)

Problem Fermentations
- Yeast/bacterial interactions
- Reduced character(Hydrogen Sulfide, etc.)
- Controlling wine spoilage organisms
- Stuck/sluggish fermentations

Managing yields and effects on wine quality (estimating yield, timing of thinning, etc.)

2) Rootstocks and clones

Maturing analysis (fruit composition, flavor, tannin, etc.)

Winery waste management
- Waste water
- Value added products(tartaric acid, anthocyanin, antioxidant grapeseed tannin/oil)

3) Effects of vineyard cultural practices on aging and maturation including UTA (Untypical Aging Syndrome)

Effects of rot and mold on wine quality

Ethyl carbamate

Organic processing

*The subheadings under each priority are not presented in any order and simply represent key areas to be investigated.