Northwest Center for Small Fruits Research

2005 Annual Conference

Welcome to the 14th 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.

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

Keynote Speaker: The keynote speaker for the annual conference will be Tom Bewick, National Program Leader for Horticulture with USDA-CSREES. His talk is entitled "From Minor Crops to Specialty Crops: a Change in Attitude in Horticulture."

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Berry / Grape Processing

The Bioavailability and Effects of Polyphenolic Compounds in *Vaccinium sp* on Colon Cancer and Immune Function in Rats

JH Exon and TG Taruscio, Department of Food Science and Toxicology, University of Idaho

Small fruits such as berries are a good source of polyphenolic chemicals that are thought to have bioactive properties toward a number of diseases including cancer. The effects of these chemicals vary however between studies. The bioactive chemical profile of ten different types of berries (*Vaccinium* sp) has been recently characterized in our laboratory. The profiles show different levels of four major groups of polyphenolics, flavan-3-ols, flavonols, phenolic acids, and anthocyanins as well as the individual chemicals which make up these major groups. Three different profiles were chosen to study the effects on a colon cancer model in rats. The highbush blueberries contained high levels of phenolic acids, the huckleberries contained high levels of anthocyanins (and the greatest antioxidant activity), and the cranberries contained intermediate levels of all major groups. Three groups of six month old male rats were exposed to 2-3 g berry/rat/day (6.5g/kg) as a supplement equal to about 3% dw of the diet for nine weeks. One group served as the control. All rats were injected ip with azoxymethane to induce preneoplastic lesions, or aberrant crypt foci (ACF), in the colon. Rats exposed to the huckleberry diet had significantly greater numbers of ACF compared to the control. Rats receiving the blueberry or cranberry diets tended to have increased numbers of total ACF, but not significantly different from the control. These results indicate that increased levels of polyphenolic compounds and antioxidant capacity in the diet did not protect against the development of ACF in rats after exposure to a colon carcinogen. No significant effects were seen onhumoral immune responses in any berry-exposed groups.

Improving Fruit Quality and Storage Life of the Hardy Kiwifruit

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Mina McDaniel, Professor, Department of Food Science and Technology, Oregon State University

Bernadine Strik, Professor, Department of Horticulture, Oregon State University

Fruit quality during cold storage as related to packaging and use of edible coatings for extending storage life of fresh hardy kiwifruit were evaluated in the 2003 harvest season. In 2004, influences of harvest maturity (6.0, 8.7, 9.1, and 15.1% average soluble solids content (SSC)) and storage conditions (22±1 ºC and 45% RH, or 2 ºC and 88% RH for three weeks followed by a ripening period at 22±1 ºC and 45% RH) on the physicochemical, sensory, and nutritive qualities of 'Ananasnaya' hardy kiwifruit were investigated. The 2003 results indicated that the low-vent packaging containers significantly slowed down postharvest ripening process, thus reduced weight loss and helped retain desired fruit firmness. SemperFresh based edible coatings further improved the surface glossiness, and reduced weight loss of fresh fruit. The 2004 research results showed that refrigeration significantly ($p<0.05$) reduced titratable acidity and increased SSC of ripened fruit, regardless of harvest maturity, and reduced firmness of fruit harvested at 6.0 and 8.7% SSC. Sensory study using free-choice profiling method revealed that panelists perceived significant ($p<0.05$) differences between refrigerated and room-stored samples in aroma and flavor descriptors as well as differences between harvest maturity treatments. Refrigerated fruit harvested at 6.0 and 8.7% SSC measured highest in total phenolics with over 2 mg gallic acid equivalents/g fresh weight. Antioxidant activity ranged from 1.6-2.3 ascorbic acid equivalents/g fresh weight with no significant difference between treatments. This study demonstrated that quality of ripened hardy kiwifruit can be optimized through identification of ideal harvest date for this Actinidia species and by controlling storage conditions.

GENETICS

Domestication of Western Huckleberries

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

Although long popular regionally, huckleberries and bilberries native to western North America are experiencing increased national and international demands in the face of declining supplies of wild harvested berries. Investigators have made extensive germplasm collections throughout the northwestern United States and evaluated these collections and accessions of the same species collected in Europe and Asia. Seven species have been identified as having commercial potential at this time. Seed propagation protocols have been published for mountain huckleberry (*Vaccinium membranaceum*) and will soon be published for four other species. Protocols for in vitro propagation and ex vitro rooting and growth of microcultured shoots have been developed and will soon be published for three species. Thirteen selections from three species are being distributed to cooperating growers and researchers as potential cultivars. Forty-eight additional selections from four species are in advanced trials. Biochemical analyses have identified the volatile flavor components, anthocyanins, phenolic acids, and other antioxidants for northwest native species, highbush blueberries, and/or half-high blueberries. Soil requirements have been determined and additional soil trials are underway. Trials are also underway to determine optimum light exposure. The Western Huckleberry and Bilberry Association formed in 2004, representing commercial forest land managers, field producers, brokers, processors, marketers, and harvesters. The first crops from forest stands managed by WHBA members were marketed in 2005.

Identifying Blueberry Diversity using DNA Fingerprints

Peter Boches, Kim E. Hummer and Nahla V. Bassil

The United States Department of Agriculture (USDA) - Agricultural Research Service (ARS) - National Clonal Germplasm Repository (NCGR) in Corvallis, Oregon, preserves more than 1500 *Vaccinium* (blueberry family) accessions, representing 68 species originating from 34 countries. This study is part of an ongoing effort by the NCGR to develop DNA marker tools to identify blueberries and that can be used to study the history of *Vaccinium* species. Of 94 potential markers, 45 were classified according to their ability to distinguish 12 species. Thirty of these markers can distinguish between blueberry genotypes. Twenty-eight markers were used to generate unique genetic profiles for 69 blueberries that contained 13 wild accessions and 56 cultivated types. These tools were able to verify the identity of blueberry varieties and species in the NCGR collection and develop characteristic 'fingerprints' for each type. The unique genetic fingerprint for each blueberry is publicly available though the Germplasm Resources Information Network (GRIN) at http://www.ars-grin.gov/cgi-bin/npgs/html/eval.pl?492548.

Inheritance of Vegetative and Reproductive Traits in Black Raspberry (*R. occidentalis*)

Chad Finn and Michael Dossett, USDA-ARS, HCRL

Black raspberries are a major commercial crop in Oregon and yet the main cultivar, Munger, is increasingly suffering from diseases that cause the plants to have to be replanted every few years. No breeding effort has taken place in the Northwest and there are currently no substantial black raspberry breeding programs in the world. The objectives of this work were to determine the inheritance of phenological (bloom date, ripening date),

vegetative (vigor, growth, habit), reproductive (fruit size, fruit color, fertility) and fruit quality (anthocyanin content, pH, titratable acidity, Brix) traits in populations derived from crosses among elite black raspberry cultivars and a selection of the eastern (*Rubus occidentalis*) and western (*R. leucodermis*) black raspberry. In 2001, crosses were made among 8 black raspberry genotypes that looked promising and, in 2003, populations from these crosses were established in Corvallis. In Spring 2004, the plants were cut to the ground and managed throughout the Summer of 2004 as would a commercial black raspberry planting. In 2005, the plants were allowed to flower and set fruit for the first time. Dates were recorded for budbreak, flowering season, and the fruiting season for each plant. Samples of 25 randomly collected non-primary fruit were collected for measurements of average fruit mass, and separate fruit samples have been collected for analysis of differences in chemical/nutraceutical properties of the seedlings. In addition, each plant has been tested for incidence of *Raspberry bushy dwarf virus*, *Tobacco streak virus*, and *Tomato ringspot virus* and scored for incidence of other diseases. Vigor of each plant was rated on a numerical scale from 1-9 and the number of nodes below the terminus of laterals has been recorded. While the data analysis this winter needs to be done to confirm observations, there appeared to be significant differences among populations for several traits, particularly ripening season. A number of preliminary selections have been identified and are being propagated for further observation and testing at grower sites. Plants are being grown and maintained in a manner similar to commercial practices. Data collected this winter will include vegetative measures such as the number of primocanes, cane diameter, and thorn density.

Genotype x Environment Interaction in Elderberry (*Sambucus* sp.) Cultivars and Selections Grown in Oregon and Missouri

Chad Finn, USDA-ARS, HCRL

Cooperators: Andrew Thomas, University of Missouri, Southwest Center

Patrick Byers, SW Missouri State University, Fruit Experiment Station

The purpose of this study is to determine whether the best performing elderberry (*Sambucus* sp.) cultivars and selections identified in a collaborative program in Missouri will also be the best performers in the Pacific Northwest. The University of Missouri Southwest Center (Mt. Vernon) and the Southwest Missouri State University Fruit Experiment Station (Mountain Grove) have been working collaboratively for a number of years on elderberry. Their goal has been to assemble a large collection of cultivars and selections to identify those best adapted to commercial production in their climate. The USDA-ARS small fruit breeding program is not intending to start breeding elderberry, but they would like to evaluate the cultivars that are commercially available and selections that are available to identify those cultivars that would be best for commercial production in the Pacific Northwest. Ideally, the Missouri programs could continue to identify and develop cultivars that could be grown in the Pacific Northwest. The forty-eight elderberry genotypes, primarily *Sambucus canadensis* L. (North American elderberry) but four *S. nigra* L. (European elderberry) as well, are established. The sites represent the Midwest (Mt. Vernon and Mountain Grove, Missouri) and Pacific Northwest (Corvallis, Oregon) environments. The genotypes are either in a replicated trial with three replications or in a single observation plot. While the genotypes included in replicated trial at each location are not identical, several of the standard cultivars are replicated in each trial. The cultivars included at each location: Adams II, Johns, Gordon B and Netzer. In 2004 and 2005, the plants were evaluated for flowering and ripening dates. Fruit were harvested in 2004 and are being harvested in 2005 for yield traits and a subsample frozen for fruit chemistry evaluations. In 2004, for nearly all traits, there were differences among locations, genotypes and there were a genotype x environment interactions. This would suggest that genotypes do need to be evaluated in both regions and that what is true for Missouri may not be true for Oregon. Overall, 'Gordon B' had greater yield and number of panicles than 'Netzer' or 'Johns' but was similar to 'Adams 2'. In the first year, Mountain Grove had by far the highest yield while Corvallis was comparable to Mt. Vernon.

Evaluation of Wine Grape Cultivars and Selections for a Cool Maritime Climate

Gary A. Moulton, Senior Scientific Assistant, Washington State University, Northwestern Washington Research & Extenstion Center

Western Washington has potential for wine grape production that is being explored for its similarity to the fine wine producing areas of northern France and Germany. Several promising grape varieties have already proven successful, producing high quality wines with fruitiness and extraordinary full flavor. In addition, newer early ripening Pinot clones appear to be very adaptable in several western Washington locations, where they can produce a very high quality wine.

A variety trial consisting of five plants of each cultivar, selection, or clone, replicated three times, is established in vineyard plots in two locations, both a higher heat range area and a lower heat area. Training is on a Vertical Shoot Positioning system with cane pruning. First harvest evaluations were begun in 2002, and are planned to continue until 2011.

The effect of the three best performing grape rootstocks in advancing ripeness on the variety Pinot Noir [clone 2A] has already been established, and research is ongoing to determine other effects such as reducing vigor, and/or improving wine quality. A further trial has been initiated to compare the performance of some promising wine grape varieties on two of the best performing rootstocks as determined in the trial with Pinot Noir 2A. Own-rooted plants are used as the control. This will test whether the rootstock effects are also imparted to these other varieties. A vine spacing trial planted in 2004 will test the effects of close planting with regard to vine balance. Data to be collected in the above trials include harvest fruit analysis (Brix and titratable acid), harvest date and yield.

Cooperation of area winemakers has been enlisted for the post-harvest valuation of varieties suitable for wine production. Wines produced from the 2004 crop were given initial evaluation in 2005, and the 2005 crop will be bottled for evaluation in 2006.

Fruit Quality Evaluation of Transgenic 'Meeker' and Major Cultivars of Red Raspberry Grown in the Pacific Northwest

Michael Qian, Department of Food Science & Technology, Oregon State University

Flavor quality of raspberry cultivars including Meeker, Chilliwack, Yellow Meeker, Willamette, Coho and Tulameen were studied. Meeker fruits from four different commercial growing sites were studied for the flavor quality variation. The *RBDV* resistant Meeker selections were compared with the wild type Meeker in both Oregon and Washington for three years. ºBrix and titratable acidity had significant differences for both growing location (p-value 0.0002 for ºbrix and 0.0449 for titratable acidity) and year (p-value 0.0028 for ºbrix and 0.0016 for titratable acidity). In general, Meeker samples from Oregon sites have higher Brix and lower TA than those from Washington sites for both 2004 and 2005. Fruits from 2004 had higher Brix and lower acidity than the fruits from 2005. The flavor quality of RBDV resistant selections and the wild type from the same location in the same year were very similar. Statistical analysis showed that all of the flavor quality parameters performed so far did not distinguish the RBDV-resistant lines from the wild type Meeker. However, these tests did separate all other cultivars of red raspberry studied from the Meeker acceptability interval for at least one characteristic. The results showed that the values of RBDV-resistant selections were not different from the wild type Meeker.

Objective Characterization 'Marion' Flavor and Comparison with Thornless Advanced Selections

Michael Qian, Department of Food Science & Technology, Oregon State University

Collaborators: Chad Finn, USDA-ARS HCRL

Sensory descriptive analysis describes Marionberry as fresh strawberry, raspberry, citrus while other genotypes have more cooked fruits, vegetal, and woody aroma. GC-olfactometry analysis indicated that furaneol could be one of the most important aroma compounds for Marionberry. A reliable and accurate quantitative method was developed to quantify this compound in blackberry. In addition, sugars, acids and the ratio of sugar to acid were used to determine which cultivars were similar to "Marion" in taste and flavor. Although the data varied from year to year due to varying growing conditions. The general trend was very similar. For the year of 2002, 1380-1, 1843-3 and 9351-4 and Marion had high concentration of furaneol while Chester, Thornless Evergreen, Waldo, 1486-2, 1489-1 and 9128-1 all had low furaneol content. The similar trend was observed in both 2003 and 2004 with exception that Waldo had high furaneol contents in both year 2003 and 2004 while 1380 had low furaneol in year 2004. This result is in good agreement with a sensory PCA that grouped Marion, Waldo, 1380-1, 1843-3, 2198-1 and 9351-4 together. Based on sugar acid ratio, 1380-1, 9128-1 resemble Marion the most. Descriptive sensory coincidentally concluded that 1380-1 and 9128-1 were the closest to Marion.

Edible-Fruited Honeysuckle, Lonicera caerulea L.: Germplasm Evaluation and Cultivar Development

Maxine M. Thompson, Professor emerita, Department of Horticulture, Oregon State University

Danny Barney, Professor of Horticulture, University of Idaho, Sandpoint Research and Ext. Center

Introduced germplasm was evaluated at both Corvallis and Sandpoint sites this past season, as has been done for the past 3 years. During this period, several selections having outstanding traits have been identified. One population exhibits traits that appear promising for edible ornamentals: growth habit is low and wide and leaves remain green late in fall, some with good yellow fall color (in contrast to earlier senescing leaves on most plants) and some have mild tasting fruits. Elite forms were used as parents in controlled crosses this year, as in the past 2 years. Parents were chosen for high yield potential, large fruit, upright growth habit, attractive, firm and tasty fruit, early and late fruit maturity. The first group of 2,500 hybrid seedlings came into bearing this year, and another 2,000 were planted in October. Almost all of 2004-planted seedlings bore fruits; these were observed, but not harvested due to insufficient labor and the need to evaluate 2nd, 3rd, ad 4th year seedlings. Also, berries on first year plants are usually smaller than later crops. Hybrid seedlings are expected to reveal higher quality fruits than the previously evaluated open-pollinated seedlings. A great deal of genetic variability among the populations indicates good possibility for rapid selection progress. Several selections were propagated at Corvallis, and 4 in Sandpoint (among a smaller population) for propagation and further observations in our plots. Also, some of these were distributed to cooperators for trial in different locations. Among the plants currently in the field we expect to identify several superior forms that, after sufficient evaluations, will prove worthy of cultivar status. These will provide the basis for a new berry crop with unique flavors and excellent potential for high-value processed products in a niche market.

Pest Management

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

Peter R. Bristow, Washington State University

John N. Pinkerton, UDSA-ARS HCRL

R. Paul Schreiner, UDSA-ARS HCRL

Two field trials (Pierce Co. and Whatcom Co.) with four treatments were initiated in 2003, and planted in 2004 with plants of the root rot susceptible cultivars Malahat and Qualicum. The treatments were: 1) non-treated control, 2) fungicide applications only, 3) solarization only, and 4) solarization plus fungicide applications. Soil was solarized from late July through late September 2003. Soil temperatures were recorded hourly at 10 and 30 cm soil depths during the solarization period. The fungicide program consists of Ridomil Gold applied to the soil at planting and then every fall and spring thereafter, plus Aliette applied to the foliage twice in the fall and twice in the spring. Primocanes were cut to the ground and evaluated late fall 2004. There were more canes per hill and canes lengths and weights were greater in plots that were solarized compared to nonsolarized treatments. Effects were similar for both locations and cultivars. Applications of fungicides in combination with solarization produced no better plant growth than solarization alone. Stand density and height were rated in June 2005. Stands of both cultivars in the Pierce Co. plots were significantly more vigorous in solarized treatments and those plots receiving fungicide applications than in the non-treated controls. Plant growth in the Whatcom Co. plots showed similar trends, but differences were not significant. In laboratory studies, *Phytophthora fragariae* pv. *fragariae* colonies grew slowly at 27º and growth ceased at temperatures greater than 29º. Exposure to 29º for greater than 192 hours proved lethal. Over 200 cumulative hours of temperatures greater than 29º were recorded at 30 cm soil depth in solarized plots at both locations in 2003. Data suggest that climatic conditions in all raspberry production areas in the PNW are suitable for effective solarization to control root rot caused by *P. fragariae*.

Biology and Mangement of Cutworms in Washington Vineyards

David G. James, Irrigated Agriculture Research and Extension Center, Washington State University

The identity of cutworm species and their natural enemies in vineyards in the Yakima Valley was studied using a variety of sampling techniques including attractant-baited traps for adults and pitfall traps for larvae. Timed searches and collection of larvae and beneficial insects from vineyards with differing ground covers were also conducted.

A number of cutworm species were found to be present in vineyards and their identities are being resolved. Larvae damaging grapevine buds were found to be different species from those found on vineyard floors. Ground-dwelling species were largely members of the genus *Euxoa*. Cutworm larvae collected from grapevines at night (often found feeding on grape buds) were dominated by the climbing cutworm species, *Abagrotis orbis* and *Agrotis vetusta*. No evidence that the cutworm species previously considered to be damaging to WA grapes (spotted cutworm, redbacked cutworm), was found. Most bud damage appeared to occur in vineyards with little ground cover or ground cover dominated by grasses. Vineyards with a moderate-high density of broad-leaved weeds tended to have minimal damage despite sometimes large numbers of cutworms.

Applications of New Pest Strategies in Cranberries

Kim Patten, Washington State University - Long Beach Research and Extension Unit

Peter Bristow, Washington State University - Puyallup Center

Based on four years of data, diluted vinegar (3 to 5% acetic acid) applied as a soil drench at rates of 3,000 to 8,000 gpa just prior to bud break (mid- to late April) resulted in fair to good control of false lily-of-the-valley (*Maianthemum dilatatum*). Weed control and crop phytotoxicity were affected by soil moisture level and temperature, timing and soil type. Results were not consistent enough to be predictive. A second crisis exemption was obtained for the reduced risk herbicide mesotrione (Callisto) and large-scale application occurred across the majority of farms in Oregon and Washington. Excellent control was obtained for many of the most critical weed species and millions of dollars in crop loss were prevented. Herbicide trials with combinations of mesotrione and other herbicides were conducted on the more recalcitrant weed species. Mesotrione plus chlorimuron or rimsulfuron provided excellent control of *Potentilla pacifica* and *Lysimachia terrestris*. Late fall applications of imazamox provided excellent control of *Ranunculus repens* and some perennial rushes with no crop damage, but spring or summer application caused significant crop damage.

Of the several sulfonylurea herbicides evaluated (rimsulfuron, iodosulfulron, mesosulfuron, nicosulfuron), rimsulfuron provided the most control of broadleaf perennials without noticeable crop damage. An SLN registration for Admire was obtained for weevil control. Large-scale application occurred in 2004 and 2005. In general, control was adequate but not as good as expected, based on research on sandy soils. Studies were conducted on peat soil using winter applications of imidacloprid and clothianidin. Eighty percent control was achieved, which was not adequate to prevent damage to grower's fields. Summer applications of clothianidin were evaluated for cranberry girdler control. The variation in adult emergence was too high to make inferences on efficacy. Research studies on the early timing and use of Abound, and several new fungicide combinations and timing have been initiated. Comparisons will be made with the standard grower practices. Fruit keeping quality data for 2005 are pending.

Epidemiology and Management of Plant-Parasitic Nematodes in Winegrapes

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Jack Pinkerton, USDA-ARS Horticultural Research Lab

We evaluated the efficacy of post-plant applications of synthetic and biological nematicides as single treatments and combinations of synthetic (at half the recommended commercial rate) and biological nematicides to reduce populations of plant-parasitic nematodes, increase populations of free-living beneficial nematodes and to increase vine productivity. The following organic and synthetic nematicides were tested on their own: Phenamiphos* (Nemacur), Ethaneperoxoic acid (Oxycom), Oxamyl (Vydate), Sodium tetrathiocarbonate (Enzone), DiTera, Promax, SLS, Castor Oil, Sincosin. The following treatments were applied in combination: Nemacur + Dominator, Nemacur + SLS, Nemacur + Castor Oil, Nemacur + LCF, Nemacur + DiTera. In addition, Nemacur was used on its own at full rate while in the combination treatments it was applied at half the recommend rate.

Field experiments were established in May 2002 and May 2003 in a vineyard in the Yakima Valley that was replanted in nematode infested soil after the 1996 freeze. Vines were slow to establish and soil tests revealed populations of six different plant-parasitic nematode genera. In Trial 1, five-vine plots were arranged in a randomized block design with five replicates. All applications except Enzone were made by placing each of the nematicides in cups suspended under each drip emitter in plots (2 emitters per vine). Irrigation water, delivered for 3 hours (1.5 gallons), diluted the nematicide and delivered it to the root zone. Enzone was mixed in a bucket with 3 gallons of water and allowed to slowly drain into the soil at each emitter. Soil samples were collected for nematode analysis in April (pre-treatment), August and after harvest each year. Yield estimates were made by harvesting and weighing fruit in each plot. Cane pruning weight data is collected in the winter. Nematicides

applications were repeated and data were collected in 2003, 2004 and 2005. In Trial 2, all nematicides were applied with the cup system in five vine plots.

There was a great degree of variability in the distribution of nematodes and in vine vigor across the vineyard. Because of this variability, treatment differences between population densities of nematodes and of fruit yields often were not always significantly different. However, in some treatments both significance and consistent trends were observed.

Nemacur was the most effective nematicide in this study. However, it will not be available after 2006. A nematicide is needed to replace Nemacur for treating nematode infestations in established vineyards. So far, DiTera appears to be the most promising bio-nematicide. However, the pruning weight (collected in winter 2006) and nematode density data (obtained end of October 2005) will provide us with more definite answers.

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

Lynell K. Tanigoshi and Jeanette Bergen, Washington State University-Vancouver Research & Extension Unit

A root weevil complex of the black vine weevil, rough strawberry root weevil, strawberry root weevil and the clay colored weevil are primary insect pests on red raspberries and strawberries in the Pacific Northwest. Annually, thousands of acres of these small fruits are chemically treated to control adult damage to foliage, prevent their egg deposition in the soil and eliminate contamination in machine harvested red raspberries.

Most of the weevil's life cycle and key pest status occurs as a larva in the soil feeding on plant roots. Grower education and understanding of the seasonal phenology, feeding behavior and life history of this root weevil complex has resulted in excellent reduction of their population levels and economic management of adults below economic thresholds in red raspberry and strawberry, for the most part. However, the rough strawberry root weevil has emerged as the key weevil pest for strawberry growers in southwestern Washington over the past 4-5 years. Results of this project have advanced grower control tactics about how to monitor and apply adulticides and larvicides, such as the neonicotinoid class of insecticides, within the dense canopy of rainfed or irrigated, matted row cultivation.

Differentiation and Detection of Blueberry Scorch Strains

Robert R. Martin, USDA-ARS HCRL

Blueberry scorch virus (BlScV) was first identified in Oregon and Washington in 1987. At that time a survey of blueberry fields in Oregon, Washington and British Columbia was carried out and the virus was only found in 5 fields in OR and WA and was not found in B.C. BlScV was not observed in B.C. until 2000 and since that time has been detected in more than 140 blueberry fields on the B.C. side of the Fraser Valley. Based on symptoms it appears that the strain of the virus most prevalent in B.C. is similar to that observed in New Jersey rather than that observed in OR/WA. In a survey carried out in OR and WA in since 2000 there was no evidence of the "New Jersey" strain of BlScV in these states. There were two new fields of BlScV in OR and one in WA in this survey from what was observed in 1988 suggesting that the movement of BlSV is quite slow in OR/WA compared to what has been seen in B.C. and recently reported in New Jersey. The purpose of this project was to sequence 'Northwest' isolates of BlScV and coordinate this with a project to sequence severe strains in B.C. Primers have been designed to give complete coverage of the genome of BlScV in short fragments that can be sequenced in a single run without cloning. Two strains of the virus from B.C. have been sequenced and showed about 83% identity at the nucleotide level to the strains sequenced from New Jersey. Sequence information from strains in OR/WA show as much diversity. Isolates of BlScV show a wide range of sequence diversity such that it has been difficult to design primers that detect all strains of the virus. The diversity among "Northwest" isolates is as great as diversity among all isolates, the same is true for the "East Coast" isolates. At this time the ELISA test

appears to be the most reliable method of detection for this virus. Alternate hosts were tested for the presence of BlScV that may explain the dramatic epidemic in B.C. and the relative slow or non-movement of the virus in OR/WA. Cranberry at least on native *Vaccinium* species has been identified as hosts of BlScV. A project to test the feasibility of eradicating BlScV from a blueberry field with low levels of infection was also undertaken. Aphid control combined with virus detection and plant removal are being used to eliminate the virus from established fields.

Evaluation of Northwest Incidence & Lifecycle of Blueberry Gall Midge in Blueberries

Wei Qiang Yang[1], Thomas Peerbolt[2], and Judy Kawasaki[1]

[1] Oregon State University, North Willamette Research and Extension Center; [2] Peerbolt Crop Management

Blueberry gall midge (BGM) is a serious insect pest that can cause substantial yield loss in blueberry production regions of Florida, Georgia, and Mississippi. Sometimes the total crop loss can be up to 100% in heavily infected fields in the southern states. The presence of BGM, its biology and life cycle are largely unknown in the Pacific Northwest.

In field surveys conducted in Oregon and SW Washington, the presence of BGM in all commercial blueberry fields was confirmed. The characteristics of BGM infestation was blacken and aborted young shoot tips. We also find that the peak of BGM infestation appears to coincide with the 'flush' growth pattern of blueberry plants. The BGM present in the northwest was identified as *Dasineura oxycoccana* Johnson (Diptera: Cecidomyiidae) by Dr. Blair Sampson, a midge authority from the USDA. The life cycle of BGM was also completed for the first time in the northwest. We developed a simple, easy to use, and effective technique to observe BGM rearing *in-situ*. Using this rearing technique, we have observed that it takes about two weeks for the midge larva to become an adult fly. There may be more than four generations during the growing season. We conclude that BGM is a potential new pest and further studies are needed to investigate its potential effect on plant growth.

Production / Physiology

Developing Tissue Nutrient Standards for Irrigated Wine Grape in the Pacific Northwest

Joan R. Davenport, Associate Soil Scientist & Robert G. Stevens, Extension Soil Scientist, Washington State University, Irrigated Agriculture Research and Extension Center

Soil and plant tissue testing are routine tools used by growers to assess the status of their crops to determine what, if any, supplemental fertilizers are needed to reach both quality and quantity production goals. In wine grape, as in many perennial fruit crops, leaf tissue testing is often used as the primary assessment tool. In this project, we undertook to use a survey approach to begin the process of establishing tissue nutrient guidelines. Leaf petiole and blade samples were collected from six different winegrape cultivars (2 white, 4 red) from eight different sites that geographically encompass the Columbia Valley AVA (inclusively), the Milton-Freewater area in Oregon, and the Parma area in Idaho. Samples were collected at three different growth stages and analyzed for nutrients by a commercial laboratory. Preliminary findings from this one-year sampling suggest that variety, sampling time, and growing area all affect tissue nutrient levels. Additional years of collection of this survey type data are needed if tissue nutrient guidelines are to be established.

Table Grape Variety Evaluation and Improving Berry Quality, Size, and Yield Under Desert Conditions of the Pacific Northwest

Esmaeil Fallahi, Professor of Fruit Physiology, University of Idaho, Parma Research and Extension Center

Table grape, even at a small scale would fit perfectly in the operation of any wine grape and small fruit grower and will have excellent local market and export potential. In addition to this factor, pome and stone fruit markets fluctuate widely. Among the contributing factors for this fluctuation are the competitive nature of the global fruit market and the use of CA storage, which has resulted in extending the time of availability of fruit in the market and reducing or eliminating the window for the PNW market. Therefore, a large number of growers are seeking an alternative fruit crop, and table grapes seem to be an excellent alternative fruit crop for growers in Washington, Idaho, and Oregon. In the first phase of this project, we experimented with Canadice, Challenger, Concord, Concord Seedless, Delight, Einset, Fantasy, Fiesta, Flame 1, Alborz, Fresno, Himrod, Interlaken, Mars, NY36095, NY36289, NY36661, NY47616, NY65.479.1, NY65.483.2, Pasargad, Red Globe, Reliance, Ruby, Vanessa, V52139, Saturn, Lake Mount, Venus, Exotic, Italia, Emerald, Crimson, Calmeria, Jupiter, Emporer, Rouge Deloire-4, and Neptune and found some varieties that can be successfully grown under the climate conditions of southern Idaho. . In the second phase of this project, we have been evaluating adaptation, vine growth, maturity, quality, berry size, and consumer preference of new selections and cultivars in cooperation with Dr. John Clark of University of Arkansas Table Grape Breeding Program and other institutions. These selections are A-1105, A-1966, A-2034, A-2126, A-2304, A-2310, A-2335, A-2392, A-2412, A-2473, A-2480, A-2485, A-2486, A-2494, A-2497, A-2514, A-2560, A-2600, A-2610, A-2612, A-2640, and A-2653. In addition to these new selections in phase 2, several new cultivars, including 'Lady Finger', 'Autumn Royal', 'Emerald', 'Strawberry', and 'Ralley' were planted during the first year of this proposed project. These selections and cultivars were chosen based on their desirable characteristics such as seedlessness, color, flavor and texture. We have been studying the effects of cluster thinning, cluster cutting, GA application, and girdling on berry size and other quality factors in those desirable and selected cultivars that show promising performance in the first and second phases in our conditions. In 2004 and 2005 cluster removal and cluster cutting with and without girdling were practiced in 'Alborz', Emerald', and a few Arkansas selections. 'Alborz' vines that received cluster removal (cluster thinning) but not cutting shortening as well and those with cluster removal, plus cluster shortening and girdling had significantly larger cluster weights than controlled vines in 2004. Alborz vines that received cluster shortening and cluster removal plus girdling had significantly larger berries than control vines. Alborz vines that received no treatment (control) as well as those with cluster removal but not shortened had significantly longer clusters than all other treatments. In 'Alborz', yield, sugar, and color were not affected by cluster cutting or cluster removal or girdling in 2004. In 'Emerald', vines that received cluster removal but not cluster shortening had significantly heavier clusters than those with cluster removal and cluster shortening in 2004. Control vines and those with cluster removal but not shortened had significantly longer clusters than all other treatments in 'Emerald'. Vines that received girdling plus cluster removal and shortening had significantly larger berries than control vines and those with non-cluster removal but shortened clusters in 'Emerald'. Vines with cluster removal plus shortened clusters had significantly higher soluble solids than control vines in 'Emerals' in 2004. In 2004, all Arkansas table grape selection at the University of Idaho had sufficient crop and they were evaluated for berry quality and yield in 2 different harvests. A-2486, A-2412, A-2514, A-2640, and A-2310 had excellent berry quality and size. Therefore, these selections other than A-2310 received cluster cutting and/or cluster removal treatments in 2005 to further increase berry size and sugar. This project is considered as "number 1" priority for Idaho and several PNW fruit growers. Variety and quality evaluations and other objectives of this project are also on the top of "Table and wine Grapes Priority List' developed by the Northwest Center for Small Fruit Research. Based on our research, there are indications that with practices such as girdling and cluster removal and cutting we can produce table grapes with excellent cluster and berry sizes in the region. Our results indicate that many of tested cultivars, not only mature after California grape production has slowed down or finished but also they have superior berry color without adding any plant growth regulators. Every year, numerous potential table grape growers visit our experiments and a large number of growers have added new acres of table grapes. In summary, the future for table grape as a new alternative fruit for Pacific Northwest is bright and very promising, and we will continue our experiments in 2005 and 2006.

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

Markus Keller, Associate Horticulturist/Viticulturist, Washington State University

We are investigating both genetic (variety, rootstock) and seasonal effects on grapevine yield formation. We used a modified air-conditioner either during budbreak or during bloom to test the effects of bud or flower cluster temperature on flower and fruit development of field-grown Cabernet Sauvignon. In addition, we are measuring yield formation and fruit composition in a rootstock trial with Merlot, Chardonnay, and Syrah on their own roots or six different rootstocks. A rootstock trial with pot-grown Syrah was also conducted in conjunction with our Australian collaborator to test the influence of root-derived plant hormones on growth and yield formation. We found that warmer bud temperatures in spring were associated with earlier budbreak, dramatically accelerated shoot growth, improved fruit set, and higher yield. However, berries had slightly lower soluble solids and titratable acidity, and higher pH, while color was unaffected. Cooling clusters during bloom retarded bloom time and cluster development, decreased fruit set, berry weight, fruit soluble solids and pH, and increased titratable acidity, but did not affect color and shoot periderm formation by harvest. Graft survival in the WSU-Prosser rootstock trial following the cold events in the 2002/03 and 2003/04 winters was much better in Merlot and Chardonnay than in Syrah. Scion survival also varied with rootstock, with 110R and 140-2 performing very poorly. Thus 110R and 140-2 may not be cold-hardy enough for Washington. Soluble solids were highest when yields were between 3-4 kg/vine in both Merlot and Chardonnay and decreased slightly when crop levels exceeded 4 kg/vine. All of the high-crop vines were own-rooted Chardonnay. Hormone analysis suggested that cytokinins at budbreak but not at fruit set were influenced by rootstock. The highest yielding rootstock (Ramsey) produced the most cytokinins, and the lowest-yielding (5BB) produced the least cytokinins. Moreover, higher cytokinin concentrations also were associated with earlier budbreak, increased vigor, and higher flower numbers. We also observed a significant influence of rootstock on fruit composition, and differences were strongly related to rootstock-driven effects on yield.

Dynamics of Grape Berry Growth and Physiology of Fruit Volume Change

Markus Keller, Associate Horticulturist/Viticulturist, Washington State University

Winemakers often complain about a "dilution of grape quality" or even cracking of berries from volume increase due to late-season irrigation or rainfall. It is unclear whether this change in berry size is due to an increase in soil moisture or to absorption of water directly through the berry skin. We are using large pressure chambers to pressurize the root system of pot-grown Merlot and Concord vines, enabling us to determine the influence of soil moisture on changes in berry volume. Soil moisture was altered using drip irrigation and dry-down/rewatering cycles. In addition, we are using a chemical dye to trace water movement in the vines' water-conducting "pipelines" (xylem). We found that pre-veraison berries behaved like leaves, and their volume responded very rapidly and reversibly to changes in soil moisture. Post-veraison berries, on the other hand, responded little to soil moisture. Application of irrigation water after veraison merely prevented weight loss. Post-veraison Concord, but not Merlot, berries cracked when root pressure was applied. We also found that the xylem connection between the berries and the rest of the vine remained intact after veraison, but the berries gradually (with increasing Brix) stopped using this pathway for water uptake. We were able to reverse this trend by applying pressure to the shoots. Although our results have direct practical implications in terms of changes in berry volume in response to late-season irrigation, the reason and physiological basis for the observed behavior remain unknown and require further study before they can be fully exploited by growers.

Modeling and Effects of Drying and Cold Stratification on Cascade Huckleberry (*Vaccinium deliciosum* Piper) Seed Germination

Omar A. Lopez, University of Idaho, Sandpoint Research & Extension Center

Cascade huckleberry (*Vaccinium deliciosum* Piper) is a new crop that has value for nursery production due to its excellent fruit flavor and high concentrations of anthocyanins and phenolic antioxidants. The goal of this research was to develop a mathematical model of the germination process and to determine the effects of drying and cold stratification on the rates (speed) and cumulative germination percentages. This information will be used to develop recommended seed handling protocols for researchers and propagators because little or nothing has been published about the effects of drying and cold stratification on Cascade huckleberry. Seed sources collected in Washington in 2003 and 2005 were used for this research. Fresh seeds, nonstratified seeds dried for 7days, and dried seeds stratified at 2 to 4^{o}C in the dark for 14, 28, and 42 days were used for this research. A logistic regression model was used to characterize seed germination and to determine the effects of drying and cold stratification on the germination curves, rates, and maximum cumulative germination percentages.

Personal Introduction-Information: My name is Omar Lopez. I come from Quito-Ecuador. I have a bachelors degree in Farming Engineering obtained at Polytechnic School of the Army (Escuela Politétcnica del Ejército-ESPE) in Quito-Ecuador. I am in a second-year Master's in Plant Science at the University of Idaho, working at the Sandpoint Research & Extension Center with Dr. Dan Barney in projects involving seed and in vitro propagation of *Vaccinium* species native to western North America.

Identifying Optimal Nutrient Concentrations for Premium Winegrape Production Based on Physiological Needs and Fruit Quality

R. Paul Schreiner, Research Plant Physiologist, USDA-ARS-HCRL

Cooperators: Jungmin Lee, USDA-ARS-HCRL; James Kennedy & Michael Qian, Department of Food Science, Oregon State University; Anne Connelly & Leslie Fuchigami, Department of Horticulture, Oregon State University; Joan Davenport, Washington State University; and Alan Campbell, Chemeketa Community College

The primary goal of this project is to develop better tissue nutrient standards for winegrape production based on fruit quality and physiological performance. 2005 was the third (and final) growing season of Pinot Noir vines in our pot-n-pot, sand-culture vineyard in preparation for the experiment to manipulate N, P, and K supply in 2006 & 2007. Baseline data collected this year showed that vine growth under uniform complete nutrition was excellent (maybe a little excessive). Trunk cross sectional area increased 3-fold over last year. Leaf and petiole nutrient concentrations at bloom were comparable to typical bloom-time values for Pinot Noir grown in Oregon, although copper was a little low. No nutrients were at excessively low or high concentrations, so our rate of nutrient supply this year (which will be the control rate next year) appears to appropriate. Measurements of water status of vines and the sand medium showed that vines were mildly water stressed prior to veraison as planned, but we had some difficulty achieving a consistent level of moderate water stress during the ripening period. This was due, in part, to rainfall and large daily changes in evapotranspiration during ripening. We identified the soil moisture content (6.7% in this system) at which vines shut down gas exchange and wilt, so that we can better control the level of intended water stress during ripening in 2006 & 2007. This information combined with daily reference evapotranspiration levels will be used to achieve consistent water stress levels. Our data showed that we cannot rely solely on leaf water potential measurements taken with the pressure bomb as our indicator of plant water stress, as stomatal closure was often observed in leaves that had relatively high leaf water potentials.

Water and Nutrient Competition with Cover Crops in Willamette Valley Vineyards

R. Paul Schreiner, Research Plant Physiologist, USDA-ARS-HCRL

Rebecca Sweet, Graduate Student, Dept. of Horticulture, Oregon State University

Cooperators: Robert L. Bugg, Senior Analyst, UC Sustainable Ag. & Research Program; Stirling Fox (grower cooperator), General Manager Oregon Grape Management; Leigh Bartholomew (grower cooperator), General Manager Archery

Little is known about appropriate cover crops for use in cool climate Oregon vineyards. It is estimated that 50-75% of Oregon vineyards are now tilling at least alternate vineyard alleys in order to 1) reduce water stress 2) increase vineyard canopy temperatures and 3) increase nutrient availability. Because many vineyards are situated on steep hillsides, frequent tillage will likely result in increased soil erosion, decreased soil quality and potential pollution of watersheds. The focus of this research is to identify various cover crop mixtures that will minimize drawbacks and maximize benefits of using cover crops in vineyard alleys as an alternative to tillage. In September 2003 we applied seven cover crop treatments in a randomized block design at two commercial vineyards in the Northern Willamette Valley. Treatments are: clean cultivated, resident vegetation, sub-clovers, perennial grasses, cereals, native grasses, and native forbs plus grasses. Volumetric soil water content was monitored throughout the growing season and revealed decreasing trends in all treatments. Pruning weights were low at both sites in the cereal treatment in 2004. Fine root density was higher in the vine row than in the alley at both sites at harvest but at only one site at bloom. Mycorrhizal colonization (arbuscules) was higher in the vine row than in the alley at both sites at bloom and at one site at harvest. No differences were observed between treatments in soil water content, vine water stress, fruit yield, or juice quality. Analysis of tissue nutrients and canopy temperatures will be conducted this fall.

Water Management to Optimize Canopy, Yield, and Quality of 'Merlot'

Krista Shellie, USDA-ARS

Own-rooted, four year old Merlot vines were exposed to four differential, evapotranspiration based, irrigation regimes: low, medium, or high vine water stress from bloom to veraison, or high preveraison stress altered to a medium level from veraison to harvest (high-med). This multi-year trial (2002-2004) was situated at a commercial vineyard in southwestern Idaho, USA (latitude 43°28'N, longitude 116°42'W, elevation 841 m). Weekly midday leaf water potential (Ø) values detected differences in vine water stress among treatments within three weeks after start of differential irrigations. Vines from high water stress plots had lower yield, smaller berry size, lower cluster weight, and less trunk growth than vines from low water stress plots. Fruit harvested from high water stress plots had lower titratable acidity and resulted in wine with higher intensity than fruit from low water stress plots. However, fruit harvested from high preveraison stress plots that experienced medium rather than high postveraison sress had similar cluster weight, seasonal trunk growth, and wine intensity as fruit from low water stress plots. The amount of water provided to these high-med plots was similar to high stressed plots in the pre-veraison period, to medium stressed plots in the post-veraison period, and about 50% less than low water stress plots. Results suggest that desirable vine and fruit attributes can be manipulated using less supplemental water by inducing a high preveraison stress that is altered to a moderate level between veraison and harvest. A biological based indictor of vine water status with greater sensitivity than midday Ø would be useful for managing irrigation scheduling to achieve optimum severity and timing of imposed vine water stress.

Cover Crops to Supply N for Organic Grape Production

Robert G. Stevens and Joan R. Davenport, Washington State University, Irrigated Ag. Research & Ext. Center

Cover crops have many potential roles in vineyard management. If a plant material with the ability to turn the nitrogen (N) in air into plant available N (called fixing N) is used, this has the potential to serve as an organic fertilizer for the vineyard. In this study we have compared two different leguminous plants that fix N to soluble organic and conventional N fertilizers in Concord grape vineyards. We also looked at timing of planting – either fall or spring – and time of mowing and or incorporating the plant material to how well it supplied N relative to the grape plant's need. Both of the legumes we used, yellow sweet clover and common vetch, were able to supply sufficient N to support grape production. We are utilizing the data gathered in this project to develop a model for guiding growers in when to plant, mow and/or incorporate a legume for organicConcord grape production.

Fertility and Soil Management in Newly Established Blueberry Fields

Linda White and Bernadine Strik, M.S. candidate and Professor, Dept. Horticulture, Oregon State University

Cooperators: Wei Yang and John Hart, OSU; Dave Bryla, ARS-USDA

The objectives of this study are to determine the impact of pre-plant incorporation of sawdust and surface sawdust mulch on nitrogen fertilizer needs (uptake) of plants, plant growth and yield, soil moisture status, and the natural colonization of mycorrhizae in a newly established blueberry planting. The treatments are: 1) + sawdust incorporation (SI) + surface mulch (M) + low N (22 kg N/ha in the planting year and year 2, split); 2) +SI + M + medium N (68 kg N/ha); 3) + SI + M + high N (114 kg N/ha); 4) + SI – M (no mulch) + low N; 5) + SI - M + medium N; 6) + SI - M + high N; 7) – SI (no incorporation) + M + low N; 8) - SI + M + medium N; 9) - SI + M + high N; 10) – SI - M + low N; 11) - SI - M + medium N; and 12) - SI - M + high N. We also have an unfertilized treatment. We are using 'Elliott' a popular late-season blueberry cultivar on which no fertility work has been done to date.

In 2004, shoot growth was affected by surface mulch with unfertilized plants having shorter individual shoots in plots with a surface mulch as compared to bare soil. By the end of the season unfertilized plants in amended plots had shorter whips than fertilized plants in amended plots. In addition, whips were longer in all plots without amendments. In 2005, shoot growth again appears to be affected by sawdust amendments. Growth due to differing nitrogen rates is much more variable in amended plots than in treatments without sawdust amendment. Shoots are growing approximately two times longer in length than at similar dates in 2004.

TDR measurements of soil moisture indicated that amended plots had less percent soil moisture than plots without soil amendment throughout the early summer, 2004, perhaps because water percolated through these faster in spring and then they were hard to re-wet. The amended plots require much longer and more frequent irrigation than non-amended plots. Nitrogen fertilization rate had a significant effect on N, P, K, Cu, B, Zn, Fe, Al, and C concentration of leaves, Aug. 2004. Pre-plant amendment with sawdust had a significant effect on N, P, K, Mg, B, Al, and C concentration. Surface mulch had a significant effect on N, K, Fe, and Al concentration. Phosphorus concentration was lower than "normal" in amended plots than in un-amended plots. Unfertilized plants had very low %N in leaves in plots that were amended. Amendment reduced %N as did surface mulch. Fertilized treatments differed little in plots without soil amendment. The percentage of fertilizer N in the leaves was high, ranging from 33 to 65%. The amount of total N that came from the fertilizer was positively correlated with N fertilization rate. Also, plants in amended plots had more N from the fertilizer in the leaves, perhaps indicating they took up more fertilizer N. Under all nitrogen rates, the largest total plant size via dry weight was seen in the non-amended, with sawdust mulch plots. The smallest plants were in the plots where sawdust was used as both an amendment and a mulch.

Choosing Rootstocks to Optimize Canopy Size, Mineral Uptake, Water Status, and Fruit Composition of the Cultivars Pinot Noir, Chardonnay, Pinot Gris and Merlot

M. Carmo Vasconcelos, Associate Professor, Viticulture, Department of Horticulture, Oregon State University

Cooperator: Tiago L. Barros Sampaio, Graduate Research Assistant, Dept. of Hort., Oregon State University

Rootstocks are the only practical way to overcome problems such as phylloxera, nematodes or site difficulties. They can also control vigor, yield, and fruit composition, playing a fundamental role in the overall success of vineyard operations.

This trial was planted at the OSU Woodhall research vineyard in 1997 and includes two experiments: Experiment one includes Pinot noir, Chardonnay, Pinot gris and Merlot grafted to 9 rootstocks and ungrafted, in a split-plot design. In experiment two, Pinot noir was grafted to 10 additional rootstock selections, in a completely randomized block design. Vines are now fully established and the data presented reports the 5th full crop.

Both plant physiological performance and yield components were dramatically affected by the different rootstocks.

On experiment one, Riparia Gloire had the lowest photosynthetic and transpiration rates. Vines grafted to this same rootstock also suffered the highest water stress, followed closely by vines grafted to 101-14 Mgt and Gravesac. Higher transpiration and photosynthetic rates were found in vines where the scion was grafted to 420A, 5BB or on their own roots, while the opposite was true for Riparia Gloire and 101-14 Mgt. The four varieties didn't differ in their water use efficiency or water relations.

Vines grafted to Riparia Gloire had overall higher soluble solids, higher pH levels, lower acidity. This was probably due to the very small crop these vines produced. 5 BB and 420 A rootstocks generated the highest yields with lower pH levels and higher acidity of the juice. Ungrafted vines and those grafted to 3309C had lower soluble solids in the juice when compared to the other rootstocks.

Results on experiment two were some how similar to those found on experiment one. Not withstanding was the fact that no significant differences were found in water potential in response to rootstock. This can be explained by the abnormally high amount of precipitation (for this region) occurring during the summer. Pinot noir vines grafted to 101-14 Mgt and Riparia Gloire had lower photosynthetic rates. Rootstocks with increased drought tolerance, such as 1103-P, 125 AA and 140Ru had overall a better photosynthetic performance. Ungrafted vines also had high photoynthetic rates No difference in juice soluble solids and cluster weights was found across all the rootstocks. However, vines grafted to 140Ru had 3.3 times more fruit than those grafted to Riparia Gloire. In a year of extremely poor fruit-set this is of extraordinary economic importance. The very small crop of the Pinot noir grafted to Riparia Gloire had the highest pH levels and lowest juice acidity. In contrast, 1103-P and 125 AA generated the highest juice acidity. The number of clusters per vine was the major contributor to the differences in yield, explaining more than 90% of the variation occurred.

Wine Processing

Limiting Reductive Character Formation in Wines from the Pacific Northwest

C.G. Edwards, Food Scientist/Professor, Washington State University

Minimization of problem alcoholic fermentations including reduction of H_2S formation has been studied. In previously funded reseach, the project has focused on two vitamins, biotin and pantothenic acid, given their roles in the metabolism of *Saccharomyces*. To evaluate the nutritional status of musts, grape samples were taken from vineyards and wineries in Washington, Oregon, and Idaho from 2001 to 2003. In general, most of the grape musts in the Pacific Northwest contain adequate amounts of biotin and pantothenic acid needed for problem-free

fermentations. However, several musts were deficient in one or more vitamins (<1 µg/L biotin or <150 µg/L pantothenic acid). Year had a great impact on these concentrations as evidenced by grape musts from 2003 having much lower concentrations of biotin and pantothenic acid than those obtained in 2001 or 2002. Active dry forms of commonly utilized yeast strains have been prepared at a commercial pilot processing plant under newly devised conditions based on the yeast nutritional research performed. These yeast preparations are being under commercial conditions at a regional winery using two different grape musts, Rieslings and Syrah (2004 and 2005) with favorable results.

Inducement of Malolactic Fermentation in Musts from the Pacific Northwest

C.G. Edwards, Food Scientist, Washington State University

Research was initiated to study the complex interactions between wine yeast (*Saccharomyces*) and malolactic bacteria (*Oenococcus*). Frequently, these interactions hamper the growth of the bacteria and therefore delay malolactic fermentation in wines. Alcoholic fermentations were induced in the synthetic grape juice by seven different yeast strains. At regular intervals, 100 mL samples were removed from the fermenters and analyzed. It was found that many strains of *Saccharomyces* produce enough SO_2 during alcoholic fermentation to inhibit *Oenococcus*. The SO_2 produced was in "bound" forms, compounds not normally known to have anti-bacterial properties. In addition, some yeasts were capable of inhibiting *Oenococcus* but did not produce large amounts of SO_2. Rather, one of these yeast strains produced a protein-based molecule(s) inhibitory to *Oenococcus*. Additional research is needed to characterize these compounds in order to (a) develop methods to degrade these compounds so winemakers can induce malolactic fermentation more easily and (b) evaluate use of "natural" anti-fungal peptide/protein agents.

Grape Phenolics and Wine Quality: Measuring Spatial Variability in a Commercial Vineyard Using Precision Agriculture Tools

Jessica M. Cortell[1], John Baham[2], Anne Connelly[3], Andrew V. Gallagher[4], Michael D. Halbleib[5], John N. Pinkerton[6], Timothy L. Righetti[3], R. Paul Schreiner[6], Barney T. Watson[1], James A. Kennedy[1,*]

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The research goal was to investigate how variations in soil/landscape characteristics within a commercial vineyard influenced wine quality with an emphasis on phenolic chemistry. The hypothesis was that zones within the vineyard with reduced vine vigor would produce fruit with higher levels of proanthocyanidins in the fruit and wine. A practical application was to determine the technical feasibility of using precision management to influence wine style in cool climate vineyards. The study was done in two commercial vineyards where blocks within each vineyard consisted of the same clone, rootstock, age, and vineyard management practices. The experimental design involved monitoring soil, vine growth, yield components and fruit composition on a grid pattern by GPS location to assess patterns in growth and development. Vine vigor parameters were used to designate zones within both blocks to produce research wines to investigate the vine-fruit- wine continuum. There was no significant influence of vine vigor on proanthocyanidin per seed and only minimal differences in seed proanthocyanidin composition. The major findings were a large increase in skin proanthocyanidin (mg/berry), proportion of (-)-epigallocatechin, molecular mass and pigmented polymer content in fruit from zones with decreasing vine vigor. In the wines produced from low vigor zones, there were increases in proanthocyanidin concentration in general and skin proanthocyanidin concentration in particular. In addition, an increase in proanthocyanidin molecular mass and pigmented polymers was observed, while the flavan-3-ol monomer concentration decreased.

Characterization of Tannin Isolated from Red Wine During Maceration

James A. Kennedy, Department of Food Science and Technology, Oregon State University

Tannins are grape-derived compounds that are extracted into the must/wine during maceration and are an important part of red wine quality, providing it with astringency. Anecdotally it is generally accepted that tannins have different sensory properties depending on their origin (skin or seed tissue). It is also generally accepted that differences in wine astringency quality can be traced to the vineyard.

Wine texture is a much broader term than astringency and encompasses not only the sensory properties of tannins, but also that of other wine components and their affect on our perception of tannins. Texture is an important aspect of overall red wine quality, yet our understanding of how to control it is limited due in part to our poor understanding of what precisely wine texture is. It is accepted though that tannins play a central role in wine texture, and again, from a qualitative standpoint, it is thought that the vineyard is an important aspect of this variability.

A considerable amount of work has been directed to the understanding of tannin chemistry in grapes to provide a partial explanation of the observed differences in wine texture. Although temporal differences in tannin composition during the development of grapes have been observed, these changes alone do not explain textural differences perceived in wine. A possible explanation for this may be due to the selective extraction of tannins that occurs during red wine production.

The goals of this project are to understand how the composition of tannins change with respect to variety, apparent quality, and maceration time, and to compare this compositional information with that from grapes. Out of this project, a better understanding of how tannins are "selected" during maceration will be made, and furthermore, information on how these tannins interact with proteins will be determined.

The information from this research will help winemakers to better understand the extent to which tannins play a role in texture and to determine how and what type of tannin molecules should be selected for.

Characterization and Formation of Off-Flavor in Oregon Wine

Michael Qian, Department of Food Science & Technology, Oregon State University

Most volatile sulfur compounds are undesired in wine due to their low sensory thresholds, and sulfur off-flavor has recently become an increasingly important issue in wine in Oregon. In order to understand the sulfur compounds formation in wines, a quantitative and sensitive method was developed using solid phase microextraction (SPME) and GC-Pulsed Flame Photometric Detection (GC-PFPD). Eleven sulfur compounds could be quantified by this method, including hydrogen sulfide (H_2S), methanethiol (MeSH), ethanethiol (EtSH), dimethyl sulfide (DMS), diethyl sulfide (DES), methyl thioacetate (MeSAc), dimethyl disulfide (DMDS), ethyl thioacetate (EtSAc), diethyl disulfide (DEDS), dimethyl trisulfide (DMTS), and methionol. Most of them can be detected at ppb and some can be detected at ppt levels. In addition, a total of 44 wine samples from seven major Oregon wineries were obtained and the sulfur concentrations in these wines were analyzed. The results showed that the mean of hydrogen sulfide was 7.59 ppb (SD = 6.98), the mean of methanethiol was 2.91 ppb (SD = 2.65), and there was no ethanethiol in normal wines. For these wines with sulfur off-flavor, H2S and MeSH were much higher concentration, and ethanethiol was also detected, which means these three high volatile sulfur compounds are major key for wine sulfur of-flavor.

Rootstock and Scion Influences on Grape and Wine Composition and Quality

Sara Spayd, Extension Food Scientist/Food Scientist, Washington State University

Cooperators: Markus Keller, Washington State University; Julie Tarara, ARS-HCRU

In 2004 Fruit composition of Merlot and Chardonnay scions grafted to Ruggeri 140-2, MGT-101-14, 3309, 5C, 1103, or Richter 110 rootstocks were compared with own-rooted vines. Factors measured were: berry weight, soluble solids, titratable acidity, pH, and absorbance at 520 nm (Merlot only). In 2004, their first year of fruit production, no differences were found in any of the factors measured between any of the rootstocks or between the grafted and own-rooted vines. This data provides a baseline of information for subsequent years. At least in the initial year, the lack of difference in fruit composition is a positive factor as own-rooted grapes in Washington State have been shown to produce wines of excellent quality.

STATUS OF FUNDING: Currently, approximately $7,867.81 remains in the account. We will use these funds to partially support expenses for analyzing fruit from the 2005 vintage.

Small Fruit Initiative - Plant Improvement

Quality Evaluation of Berry Selections and Varieties

In cooperation with Chad Finn and the USDA-ARS/Oregon State University Small Fruit Breeding Program

Brian Yorgey, Senior Faculty Research Assistant, Food Science & Technology, Oregon State University
Yanyun Zhao, Assistant Professor, Food Science & Technology, Oregon State University

Objectives:

1. Evaluate advanced breeding selections from Chad Finn's breeding program (USDA/ARS/NCSFR) and variety trials for objective attributes related to processing or fresh market potential

2. Process samples of advanced selections, selected field crosses, and standard varieties for display to and evaluation by breeders and the industry

3. Include blueberries, black raspberries, and other berries grown around the region along with strawberries, blackberries and raspberries as has been done in the past

4. Prepare summary of all data in report format for use by breeders and industry members

Our part in this group effort to bring new berry varieties to the growers, processors and consumers of the Northwest is focused on fruit quality evaluation. Berries from the breeding plots at the North Willamette Research and Extension Center plots were picked weekly and brought to the OSU Food Science Department in Corvallis for evaluation from early June through September 2005. Basic chemical data were collected on strawberries, raspberries, blackberries, and blueberries for several harvest dates throughout this period. Samples were frozen and will be displayed to industry representatives and researchers during the fall, winter and early spring. This information will be used with field data to select the berries which will be included in further breeding trials.

During the 2005 season the following numbers of samples were processed and analyzed:
strawberries – 38 selections and 5 varieties
raspberries – 11 selections and 6 varieties
black raspberries – 2 selections and 10 varieties
blackberries – 63 selections and 10 varieties
blueberries – 18 selections and 16 varieties

Five new varieties of thornless blackberries were named and released to nurserymen and growers during this year: 'Black Diamond', 'Black Pearl', 'Nightfall', 'Obsidian' and 'Metolius'. Another selection, ORUS 1843-3, is in the process of being named and released

There will be an industry evaluation of new red raspberry selections from Pat Moore's breeding program that were machine harvested. This blind tasting and evaluation will be held some time in the early spring of 2006.

Small Fruit Breeding for the Pacific Northwest at Washington State University Puyallup

Patrick P. Moore, Washington State University

Objectives**:**
1. To develop processing red raspberry cultivars that are adapted to the PNW that are machine harvestable. Additional traits to incorporate into new cultivars are RBDV resistance and root rot tolerance.

2. To develop strawberry cultivars that are adapted to the PNW and that have higher picking efficiency than current industry standards. Additional traits to incorporate into new cultivars are: fruit firmness and disease resistance.

In 2005, a planting was established to evaluate selections for machine harvestability with 46 WSU raspberry selections. This planting will be machine harvested in 2007 and 2008. A machine harvesting planting was established in 2002 with 50 WSU selections and another in 2003 with 53 selections. These two plantings were machine harvested in 2004 and 2005 and the selections subjectively evaluated for machine harvestability. Several selections appear promising and are being propagated for further evaluation. The machine harvesting planting established in 2004 (that included 51 WSU selections) will be evaluated in 2006 and 2007. Ten thousand raspberry seedlings were planted in 2005 and selections will be made in this planting in 2007 and 2008. Ninety-six crosses were made in 2005, using selections that appear to machine harvest well as parents. Seedlings from these crosses will be planted in 2006 and selections made in 2008 and 2009. Selections made in 2005 are being propagated for inclusion in a machine harvesting planting in 2006.

Two raspberry cultivars were released in 2005, 'Cascade Dawn' and 'Cascade Bounty'. 'Cascade Dawn' is an early season, local fresh market cultivar that has some root rot tolerance and appears to be RBDV resistant. 'Cascade Bounty' is a mid-season processing cultivar that is machine harvestable, very productive and has very high levels of root rot tolerance. 'Cascade Bounty' is the first summer fruiting, machine harvestable red raspberry for the Pacific Northwest that has significant levels of root rot tolerance.

Seventy-seven strawberry crosses were made in 2005 with parents chosen for large fruit size, firm fruit and productivity. Seedlings from these crosses will be planted in 2006 and selections made in 2007. In 2005, a replicated planting was established with 45 WSU strawberry selections. This planting will be harvested and these selections evaluated in 2006 and 2007. Five thousand strawberry seedlings were planted in 2005. These seedlings will be evaluated in 2006. The replicated plantings established in 2003 and 2004 were harvested and selections evaluated. Selections made in 2005 are being propagated for inclusion in a replicated planting in 2006.

Breeding Improved Berry Crop Cultivars for the Pacific Northwest

The USDA-ARS/OSU Small Fruit Breeding Programat the North Willamette Research and Extension Center

Bernadine Strik, NWREC, Oregon State University and Chad Finn, USDA-ARS

Objectives:
To develop small fruit cultivars that meet the needs of the commercial berry crop industries in the Pacific Northwest. Specifically:

* *Blackberry:* For processing, thornless, machine harvestable cultivars with fruit quality comparable to 'Marion'; for fresh market, cultivars that advance and extend the fruiting season and have excellent flavor and quality for shipping
* *Blueberry:* For fresh market, high quality, late ripening cultivars; for processing, excellent cultivars adapted to machine harvest including those with a very small fruit size
* *Strawberry:* For processing, cultivars that have excellent fruit quality and are economical to grow and harvest; for fresh market, cultivars that are suited for local sales and regional marketing
* *Black raspberry:* cultivars that have fruit quality comparable to 'Munger', are machine harvestable, and have a longer planting life than 'Munger'
* R*ed raspberry:* for processing, cultivars that are machine harvestable and have excellent processing characteristics; for fresh market, floricane and primocane fruiting cultivars that extend the season, can be shipped, and maintain excellent fruit quality

Towards these goals, the USDA-ARS conducts crosses and plants and evaluates seedlings in Corvallis Oregon. Selections from these crosses are then planted at the Oregon State University, North Willamette Research and Extension Center (NWREC) in observation and replicated trials and grown using standard commercial practices. Strawberries are typically planted in either one (observation) or three (replicated) 8-plant plots. Blackberries, raspberries, and black raspberries are grown in either a single, three observation plot or in four, 3-plant replicated plots. Blueberries are planted either in single 3-plant plots or three, 3-plant replications. Commercial cultivars are included as standards. While many selections are established at NWREC, only those genotypes that continue to look promising are harvested. During the season, fruit is hand harvested to determine yield and fruit size. Fruit is shipped to the OSU Department of Food Science for processing to assess processed fruit quality. The plots are subjectively scored for characteristics related to plant health and growth habit and fruit quality. Genotypes that perform well are moved into larger trials and grower trials.

In 2005, the following successful crosses were made: 130 in raspberry (black and red) and blackberry; 100 in strawberry; and about 35 blueberry within our program and another 20 from other programs. Dozens of selections were made within each crop. Selections were planted, harvested and evaluated at NWREC. Five new blackberry cultivars were released in 2004-2005; 'Black Diamond', 'Black Pearl', 'Nightfall', 'Obsidian' and 'Metolius' and one selection, ORUS 1843-3, is slated for release as soon as plants are commercially ready and a name is chosen. ORUS 1142-1 red raspberry and ORUS 5-1 blueberry are being propagated for grower trials.

Citations:

Finn, C.E., B. Yorgey, B.C. Strik, H.H. Hall, R.R. Martin and M.C. Qian. 2005. 'Black Diamond' trailing thornless blackberry. HortScience 40:(Accepted, in press).

Finn, C.E., B. Yorgey, B.C. Strik, R.R. Martin and M.C. Qian. 'Black Pearl' trailing thornless blackberry. HortScience 40:(Accepted, in press).

Finn, C.E., B. Yorgey, B.C. Strik, and R.R. Martin. 2005. 'Metolius' trailing blackberry. HortScience 40:(Accepted, in press).

Finn, C.E., B. Yorgey, B.C. Strik, R.R. Martin and M.C. Qian. 'Nightfall' trailing thornless blackberry. HortScience 40:(Accepted, in press).

Finn, C.E., B. Yorgey, B.C. Strik, R.R. Martin, and C. Kempler. 2005. 'Obsidian' trailing blackberry. HortScience 40:(Accepted, in press).

Kempler, C., H.A. Daubeny, B. Harding, and C.E. Finn. 2005. 'Esquimalt' red raspberry. HortScience 40: (Accepted, in press)

Blackberry Research Priorities 2004-2005

(Revised August 1, 2005)

1) Blackberry rust control - *Phragmidium violaceum*

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

Purple blotch control

Thorn management and reduction systems

Fruit composition and nutraceutical properties

2) Third party certification for sanitation (traceability)

Primocane management/systems approach

Fresh market

Season extension

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

3) New processing methods

Color stability study

Protection of fruit shelf life

Raspberry Bushy Dwarf Virus

Plant nutrition and nitrogen use

Northwest Center for Small Fruits Research

Blueberry Research Priorities 2004-2005

1) Establishment of a Northwest breeding program to develop and evaluate adapted cultivars for season extension, disease resistance, mechanical harvesting, and improved fruit characteristics

Improved fresh market quality through mechanical harvesting plant architecture, cultivar development, cultural inputs harvester engineering and post harvest handling

Better utilization of inputs through better management of nutrients, irrigation, pests and diseases, weeds, soil amendments and integrated soil health

Biology and control of diseases (e.g. SOD, scorch, shock mummyberry, viruses, and fruit rot complex)

Biology and control insect and arthropods e.g. root weevil gall midge, winter moth, and insect contamination

2) Alternative weed control methods including organic methods; Organic production Research

Biology and control of vertebrate, e.g. birds, deer, etc.

Develop added-value products e.g. nutraceutical, controlled atmosphere storage, packaging, and health benefits

Biology and greater understanding of Mycorrhizal Relationships in a production system

Genotyping

3) Investigation of critical pollination issues affecting blueberry production

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Cranberry Research Priorities 2004-2005

1)	Weeds
	Cranberry girdler
	Market expansion through nutraceuticals/health benefit research
	New cultivar development for fresh fruit production
	Keeping quality (storage of fresh fruit)
2)	Genotyping
	Pollination/fruit set
	Fall Fruit worm
	Tipworm
	Black vine weevil
3)	Dieback
	Vine overgrowth
	Cottonball
	Twig Blight
	"Monkey face" – physiologic disorder?

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Grape (Table, Wine & Juice) Viticulture Research Priorities 2004-2005

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 and Nematodes C) Development of integrated/sustainable 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 the quality of table juice and wine grapes E) Biology and management of powdery mildew, viruses and vectors, spider mites, nematodes, cutworms, mealy bug, leaf hoppers and Asian lady beetle.
2)	A) Yield Estimation/Modeling/Yield Prediction B) Organic production C) Biodynamic production D) Biology and control of Botrytis bunch rot and sour rot, Thrips, crown gall, weeds, Glassy-winged Sharpshooter, and Eutypa fungal disease. E) Wasp and hornet control

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Minor Crops Research Priorities 2004-2005

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

Cultivar Development: 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 (fertilization)

Irrigation of Hardy Kiwifruit

Phytophthora in Hardy Kiwifruit

Red/Black Raspberry Research Priorities 2004-2005

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

Soil ecology effect on plant health and yield

Virus complex control strategies

Root rot control strategies

Identifying replacements for diazinon, fenamiphos (Nemacur), methyl bromide, and azinphos-methyl (Guthion)

2) Weed control

Cane management (including trellising systems and primocanes control)

Fruit rot including pre-harvest, post-harvest and/or shelf-life

Control of insect harvest contaminants

Mite control

3) Season extension: improve viability for fresh marketing

Food safety and sanitation from field through processing

Tomato ringspot virus and vector control strategies

Nutraceutical/nutritional benefits for product development

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Strawberry Research Priorities 2004-2005

1) Phytophthora
Root weevils
Develop cultivars with processed and fresh market potential, including earlier and later ripening cultivar
Nutritional/Nutraceutical benefits
Alternate production systems for economic efficiency (e.g. harvest efficiency), increased yield and cultivar management

2) Weeds
Development of research programs to define and enhance strawberry quality related to marketability
Cyclamen Mite
Increased quality (firmness, color, shelf life, etc.)
Fruit rots - botrytis

3) Food safety/sanitation/security
Mites - Twospotted
Irrigation Management
Powdery Mildew
Value added products

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Wine Processing Research Priorities 2004-2005

1) Effects of vineyard cultural practices, rootstocks and clones on grape and wine quality including nutritional status, fermentation behavior, water management, cover crops, and fruit maturation composition.

Problem Fermentations

- Yeast/bacterial interactions
- Reductive character
- Yeast and bacterial spoilage organisms
- Stuck/sluggish fermentations
- Tannin management in the winery and vineyard

Managing fermentations to optimize wine quality

2) Winery waste management and utilization for value added products

3) Ethyl carbamate

Organic processing

Processing Technology (high pressure, filtration)

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

IR-4 Priorities

From Joe DeFrancesco (http://ir4.rutgers.edu/FUW2005.html)

"A" priorities that resulted from the IR-4 Food Use Workshop in September 2005

"A" priority projects will get funded, initiated and completed in the 2006 field season; the residue data collected from these projects will lead to a pesticide registration (barring any unforeseen circumstances). There were no 'A' priorities for grapes or kiwi for the 2006 field season. Currant and gooseberry registrations are generally covered by blueberry residue projects (blueberry data covers the bushberry subgroup, of which currant and gooseberry are a part of).

- Blueberry/V-10116 for mummy berry control
- Blueberry /spirodiclofen (Evindor) for bud mite control
- Blueberry/halosulfuron (Sandea) nutsedge and broadleaf weed control
- Caneberry/oxamyl (Vydate) for nematode control
- Caneberry/E2Y45 for raspberry crown borer control
- Strawberry/oxyfluorfen (Goal) broadleaf and grass weed control

Weed Science Priorities for 2006

"A" Priorities

Blueberry Halosulfuron
Strawberry (Annual) Oxyfluorfen

"B" Priorities

Blueberry Oxyfluorfen
Blueberry Rimsulfuron
Caneberry (Raspberry) Oxyfluorfen
Caneberry (Raspberry) Rimsulfuron

Disease Priorities for 2006

"A" Priorities

Blueberry Spirodiclofen
Blueberry Spirodiclofen

"B" Priorities

Blueberry Spirodiclofen
Blueberry Spirodiclofen

Insect Priorities for 2006

"A" Priorities

Blueberry Spirodiclofen
Blueberry Spirodiclofen

"B" Priorities

Blueberry Spirodiclofen

Pest Management Strategic Plan
Blueberry Production in Washington and Oregon March 2004

http://pestdata.ncsu.edu/pmsp/index.cfm

Most Critical Pest Management Needs

The following priority areas must be addressed to maintain the long-term viability of the blueberry industry in Oregon and Washington.

RESEARCH

- Identify and develop economically feasible organic pest management alternatives.
- Address bird control.
- Develop prediction models for fruit and cane diseases.
- Determine economic thresholds for nematodes and insect pests.
- Maintain full funding for Extension and research programs at land-grant universities. Recent budgetary cutbacks and personnel layoffs threaten the viability of IPM research.

REGULATORY

- Expedite the full registration of fenbuconazole (Indar) and propiconazole (Orbit) for mummy berry disease control and iodomethane (Midas) for soil fumigation.
- Encourage EPA to allow multiple Section 18 (emergency exemption) registrations for the same pest/crop complex for resistance management.
- Develop a certification program for blueberry diseases and viruses for the entire United States.
- Expedite registration of any insecticide that has the potential to be a replacement for diazinon.
- Continue to allow multiple applications of diazinon.

EDUCATION

- Maintain full funding for Extension and research programs at land-grant universities, as well as personnel and programs at the USDA Northwest Center for Small Fruits Research facility. Recent budgetary cutbacks and personnel layoffs at the university level threaten the viability of IPM implementation and the dispersal of information between publicly funded agencies and the blueberry industry.
- Develop materials, such as pocket guides and CDs, to educate growers about scouting and other IPM tactics in blueberry production.
- Continue to educate growers about the importance of proper timing and application techniques (e.g., adequate coverage) when making a pesticide application.
- Continue to educate growers, via printed material, CDs, or video, about the principles of resistance management and techniques to avoid resistance.

Northwest Center for Small Fruits Research

Pest Management Strategic Plan
Caneberry Production in Washington and Oregon July 2003

http://pestdata.ncsu.edu/pmsp/index.cfm

Summary of the Most Critical Needs

The following priority areas must be addressed in order to maintain the long-term viability of the caneberry industry.

RESEARCH

• Develop methods for control of insect contaminants in machine harvested fields. .

A unique problem for caneberry growers is the presence of insect contaminants in harvested fruit caused by the mechanical harvesting methods. Vibrating rods move through the plant canopy causing ripe fruit, along with any insects present, to drop on to a conveyer belt. Many of these insects can be removed by mechanical or visual methods, but some species have characteristics that make this very difficult. The method of choice to prevent this contamination has been broad spectrum insecticide application prior to and during harvest.

• Develop and evaluate economic thresholds for incorporation into forecast models that will predict pest occurrence and severity

Much work remains to be done to help in the decision-making process for pest management control.

• Develop strategies, which may include resistant cultivars, for control of raspberry bushy dwarf virus.

Bushy dwarf virus is the direct cause of major economic losses for raspberry growers. It causes fruit to become crumbly and unfit for high-end uses. Fields that would normally be productive for ten to twelve years must be removed after four to six years. The virus is vectored by pollinating bees, making control very difficult.

• Identify replacements for diazinon, fenamiphos (Nemacur), methyl bromide, and azinphos-methyl (Guthion).

After EPA completes its review of these compounds, they may no longer be available for use in caneberries or have a limited use pattern.

• Need insecticides with shorter PHIs and REIs for use as a clean up spray to control insect contaminants just prior to or during harvest

• Develop strategies, which may include resistant cultivars, for control of Phytophthora (root rot)

Root rot is a major limiting factor in caneberry production, especially in raspberries

• Develop control strategies for perennial weeds.

Quackgrass, thistle, equisetum, nutsedge, and bindweed are particularly difficult to control with current weed management methods.

• Develop long range investment in new technologies.

In order to remain economically viable in a global marketplace, it will be necessary to develop practical and realistic long-range goals that include innovative technologies to reduce cost, improve quality and increase yields.

Northwest Center for Small Fruits Research

Pest Management Strategic Plan
Cranberry Production in Washington and Oregon May 2004

http://pestdata.ncsu.edu/pmsp/index.cfm

Cranberry Pest Management Plan Summary

Pesticides

- OP's are critical to the continued production of cranberries in the US:
- Chlorpyrifos and diazinon are the most widely used insecticides in cranberry production
- The only insecticide to control Sparganothis spanworm and cranberry weevil in Massachusetts is chlorpyrifos
- Carbaryl is not as effective as chlorpyrifos or diazinon for some pests
- Phosmet is a new registration and needs further research to determine full spectrum of control.
- Bt. is limited by short persistence, application systems (e.g., by irrigation in MA) and timing considerations
- Cost is an increasingly important consideration in the choice of control due to a precipitous decline in cranberry price. While OP insecticides are favored by this economic climate, the use of "no cost" or low-cost controls, including innovative floods, is also favored

IPM

- IPM practices are currently implemented on 94% of cranberry acres. Programs involve the use of scouting techniques, pheromone traps, economic thresholds, cultural practices such as flooding and sanding, augmentation of predaceous nematode populations, biopesticides and pheromones, and the use of traditional insecticides (procedures have been developed to improve timing of pest controls to coincide with critical stages of the pests life cycle). The extent of use of these tools varies between pest, season and region.

OP's and IPM

- Organophosphate use is an integral part of successful cranberry IPM programs. Few alternatives to OP's exist for the control of most cranberry pests. Tebufenozide and a carbamate (carbaryl) are the only alternatives. Until other chemistries are registered (e.g., spinosad, thiamethoxam and methoxyfenozide), the OP's will continue to play a critical role in cranberry pest control and production.

Alternatives

- The cranberry commodity has invested heavily over recent years (±$225,000; 1996-9), with grower and handler funding, in the identification, field development and registration of new reduced risk alternatives to the OP's and carbamate insecticides currently registered. Some of these products are now registered and available as Section 18's, but grower education must occur to facilitate broad implementation in the near future. Safer products include tebufenozide, spinosad, methoxyfenozide, thiamethoxam, two mating disruption pheromone products (for Sparganothis and Blackheaded fireworm), natural pyrethrins, and synthetic Cryolite bait. These products will be incorporated into existing cranberry IPM programs.

Pest Management Strategic Plan
Washington State Wine Grape Production May 2004

http://pestdata.ncsu.edu/pmsp/index.cfm

Priority List of Critical Needs

The following priority areas must be addressed in order to maintain the long-term viability of the wine grape industry in Washington. Economic sustainability must be considered with respect to any pest management measure if it is to be viable.

RESEARCH

- Determine virus-vector relationships.
- Refine disease modeling, including powdery mildew and botrytis bunch rot.
- Study cover crop management and IPM impacts on all pests.
- Develop economic thresholds for insects, mites, and nematodes.
- Develop control/management strategies for thrips.
- Research use of green manures/cover crops for management of nematodes and soilborne insects.
- Conduct phylloxera rootstock trials and industry surveys on pest prevalence.

REGULATORY

- Address quarantine issues, including:
    - Phylloxera quarantine, need new surveys (WSDA);
    - Virus quarantines, need new surveys (WSDA);
    - Vine mealybug inclusion in current quarantine description.
- Register flumioxazin (Chateau), zeta-cypermethrin (Mustang Max), lambdacyhalothrin (Warrior), cyprodinil + fludioxynil (Switch).
- Add wound-protectant use against Eutypa dieback to the thiophanate methyl (Topsin) label.
- Expedite “List of 54” review (EPA).
- Increase enforcement efforts at home & garden centers for grapes/ornamentals (WSDA).

EDUCATION

- Develop scouting field guide for all pests, including identification, timing, and links to Web-based information.
- Explain thresholds and how they relate to choice of pest control methods.
- Emphasize importance of certified planting material and proper importation protocols.
- Teach systems approach to pest management.
- Explain use of predictive models for disease management.
- Instruct growers on identifying and reporting off-target herbicide spray drift from other crops onto grapes.
- Emphasize importance of sanitation (equipment, plants, workers, etc.) for prevention of pests in the field.