THE SCIENCE OF WINE: WASHINGTON STATE UNIVERSITY SCIENTISTS AND THE DEVELOPMENT OF THE WASHINGTON WINE INDUSTRY, 1937-1992

By

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To the Faculty of Washington State University:

The members of the Committee appointed to examine the dissertation of

CYNTHIA STEWART KAAG find it satisfactory and recommend that it be accepted.

_____
(Chair)

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Beatrice Nagel, wife of the late Dr. Charles Nagel, supported my interviews with her husband and has answered specific questions not covered in the archival resources.

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THE SCIENCE OF WINE: WASHINGTON STATE UNIVERSITY SCIENTISTS AND THE DEVELOPMENT OF THE WASHINGTON WINE INDUSTRY, 1937-1992

Abstract

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Chair: Jerry Gough

WSU scientists and researchers were the main force behind creating the knowledge base necessary for the Washington grape and wine industry to grow from a few hundred acres of vines, producing undistinguished grapes for undistinguished wines, to a major state industry. Horticulturists, plant pathologists, entomologists, food microbiologists, enologists, climatologists, soil scientists, agricultural engineers—they came from many disciplines across the University—worked to solve the problems of cold hardiness and efficient vineyard management, trellising and mechanical harvesting, certification of virus-free stock and testing of hundreds of grape varieties, balance of sugars and acidity in wines, and consumer preferences. Their research results were shared with growers, processors, and winemakers in several ways: they corresponded with individual viticulturists and enologists, they spoke at local luncheons, state conventions, and national meetings, and they published their results in scholarly journals, popular magazines, newspapers, conference proceedings, and through the University's outreach and Extension programs. This intersection between basic research and practical application was the crux of the University's obligations to the citizens of the state, and testament to the value WSU added to their lives.

Abbreviations and Acronyms

2,4-D	2,4-Dichlorophenoxyacetic acid (herbicide)
ARS	Agricultural Research Service (U.S.)
AVA	American Viticultural Area
AWG	American Wine Growers (important early winery)
DCED	Department of Commerce and Economic Development (Washington)
DDT	DIchloro-diphenyl-trichloroethane (pesticide)
EDA	Economic Development Administration
GDC	Geneva double curtain (trellis system)
IAREC	Irrigated Agriculture Research and Extension Center (1965 on)
IES	Irrigation Experiment Station (1919-1965)
MASC	Manuscripts, Archives and Special Collections, WSU Libraries
OSU	Oregon State University
USDA	United States Department of Agriculture
WSC	Washington State College (1905-1969)
WSDA	Washington State Department of Agriculture
WSGS	Washington State Grape Society
WSHA	Washington State Horticultural Association
WSU	Washington State University (1969 on)
WURDD	Western Utilization Research and Development Division
WWGGC	Washington Wine and Grape Growers Council
WWC	Washington Wine Council

GLOSSARY

2,4-D (2,4-Dichlorophenoxyacetic acid) - a common systemic herbicide developed to control broadleaf weeds and increase crop yields

abscission - shedding of plant parts, such as leaves or berries. The process is regulated by the plant hormone abscisic acid.

acaricides – pesticides which kill mites

acidity – term for the fresh or tart taste produced by the natural acids in wine. Acidity can affect color and growth of yeast and bacteria.

amelioration –improvement of wine; sometimes called Chaptalization or enrichment. It may involve the addition of extra sugar, acidification, or deacidification.

appellation - term for an officially designated viticultural region.

Associated Vintners – major Washington winery, founded by a group of friends in 1962; in 1983 the name was changed to Columbia Winery.

black leaf - condition caused by a potassium deficiency that causes the leaves on a vine to turn black as chlorophyll is lost. Prevents vine from transmitting sugar to the grape effectively.

black vine weevils (*Otiorhynchus sulcatus)* - vineyard pests the grubs of which fed on grapevine roots for nearly a year before emerging as adult beetles.

Botrytis cinera – a mold that desiccates grapes, thus concentrating their sugars and resulting in a very sweet wine.

Brix – measurement of total dissolved compounds in grape juice; one degree Brix equates to about 18 g/l sugar.

certified stock - stock grown from vines that had been checked and declared free of all known viruses.

Chateau Ste. Michelle - the oldest winery in Washington state, having evolved from American Wine Growers (founded 1954), which had been formed by the merger of Pommerelle Wine Company and the National Wine Company (founded 1934, after Prohibition ended.)

clone – a population of vines derived from a single “mother vine.” These may differ in their properties, and clonal selection is the primary means of improving grape varieties.

cold hardiness - ability of the vine to survive low temperatures; affect by many factors other than cold, such as maturity of the vine and cultural practices during the preceding season.

crop load - the amount of fruit the vine is allowed to produce, controlled by cultural management.

crown gall – disease caused by the bacterium *Agrobacterium tumefaciens*; weakens vines by plugging up the tissues that carry water and nutrients

cultural practices - activities within the control of the grape grower, such as setting out the vines; trellising, training, and pruning; controlling timing and amount of water applied; spraying and fertilizing; and hardening off the vines before winter.

DDT *(*Dichloro-diphenyl-trichloroethane) - pesticide used to control mosquitoes and other insects.

dying arm disease – dieback of shoots and cordons caused by the ascomycete (fungus) *Eutypa lata*.

filtering – removal of suspended particulates, such as yeast cells, resulting from the fermentation process. It can be important for the future clarity and stability of a wine.

Geneva double curtain – training system with vine canopy divided in two curtains trained to grow downward from high cordons.

gibberellins – natural plant hormones which regulate growth.

grape mealybugs – any of three species of grape mealybugs (*Pseudococcus)*, all of which damage grapes by contaminating clusters with cottony egg sacs, larvae, adults, and honeydew. Often the honeydew is covered with a black sooty mold. Mealybugs can transmit grape viruses.

grape schools/seminars - one or two day meetings where growers came together with scientists to talk about grape problems and practices.

heat treatment - one of the ways viruses are eliminated from a specific clone of a variety; the process has an incidental effect of increasing growth vigor. Plants are grown at high temperatures and then propagated from shoot tips, which must in turn be tested to ensure they are virus free.

heat units – measurement of climate conditions predictive of suitability for plants. It is calculated as the difference between the average of the daily maximum and minimum temperatures, and a critical developmental "threshold" temperature, which varies between species.

indexing - the process of checking each variety prior to certification and dissemination to make sure it is disease free.

integrated pest management (IPM) – use of both organic and (limited) chemical means to control insects on plants.

kalte ende- German for "cold ends" or the leftovers from several bottles of wine mixed together, changed over time to "kalte ente," meaning "cold duck."

Kniffin trellis – training system with two levels of canes coming off the trunk at different heights.

malolactic fermentation - a bacterial process by which malic acid is changed to lactic acid and carbon dioxide.

maturity – in grapevines, hardening off of the plant after harvest in preparation for dormancy and colder weather. In the wine, achievement of optimal aging for drinking enjoyment.

must - freshly pressed juice including solids such as the skins, stems, and seeds.

petiole – leaf stalk, the part which attaches the leaf to the stem.

pH – scale of measurement of acidity.

phenolics – chemical compounds responsible for color, flavor and aroma in wines.

phenology - the science of the relations between climate and seasonal biological phenomena, such as the flowering and fruiting of plants.

Phylloxera (*Daktulosphaira vitifoliae*, also called *Phylloxera vitifoliae* or *Phylloxera vastarix,* dry-leaf devastator) - native North American plant louse-like insect that feeds on vine roots; it became a worldwide pest of commercial grapevines after it was accidentally introduced to Europe in the 1850s.

powdery mildew - a fungal disease, caused by *Uncinula necator* ,that damages vines and gives wine a bad taste.

pruning – removal of unwanted plant parts, usually done in winter.

rootstocks – the root system of a vine to which a different variety may be grafted; usually undertaken to improve resistance to pests and diseases.

soluble solids - refers to the total dissolved sugars, salts, and tannins in the grape juice.

sooty mold – fungus, often a *Cladosporium,* which sometimes develops on the honeydew or excretions of grape mealybugs; serious infestation renders the grapes unsuitable for wine.

***spätlese* –** wines, typically sweet dessert types, made from grapes that have been allowed to wither on the vines.

tannins - plant polyphenols that are the source of the bitterness or astringency sometimes found in wines.

tasting panels – groups of non-specialists who were recruited and taught to recognize around 20 significant factors in wines that they could then use to compare the samples they were tasting.

terroir - the climate, latitude, soil, and other factors influencing the growth of wine grapes.

titratable acidity – amount of total fixed and volatile grape acids. Also called total acidity.

training and trellising – process of making the vine conform to a desired shape or trellis system.

thrips – tiny insects of the Family *Thripidae* that feed on grapevine shoots, leaves, and fruits and cause a netting and scarring of fruit that constricted growth.

variety, varietal – a specific type of grape.

veraison (French: *véraison*) – the change the grape growth cycle from berry growth to berry ripening

Vitis – the genus to which all grapes belong.

Vitis labrusca - native North American grape species used for juice, jelly, and occasionally for wine; the most common variety is the Concord grape.

Vitis vinifera - native European and Central Asian grape species preferred for wine making; examples of *vinifera* varieties are Cabernet Sauvignon and Chardonnay

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DEDICATION

To friends, who did not find my starting a Ph.D. at age 55 chimerical.

To faculty, who freely shared their knowledge.

To my dear parents, for instilling the love of learning.

To my darling daughter, for constant encouragement.

To my beloved husband, for support *far* above and beyond.

The Science of Wine: Washington State University Scientists and the Development of the Washington Wine Industry, 1937-1992

Introduction

This study focuses on the work of the Washington State University scientists involved in grape variety trials, especially those dealing with *vinifera,* as well as vineyard cultural management, problems associated with grape growing, winemaking, and the ways those scientists passed on the benefits of their research to the citizens of the state. Significant factors were the *institution* itself, the *scientists* it employed, the *places* in Washington where grapes could potentially grow, the best *grapes* for the climate, terroir, and winemaking, the *problems* faced by viticulturists and enologists, and the *results* of over fifty years of research. The ultimate success of Washington's viticulture and enology industry owes a great deal to the investigations undertaken by faculty and staff from many WSU departments. Two faculty members in particular, Walter J. Clore and Charles W. Nagel, exemplify the importance of basic and applied research carried out by a public land grant institution in serving its constituency. They and their colleagues, working together with grape growers and wine makers, were essential to the development of premium wineries in Washington.

By 2007 Washington boasted over 500 wineries and some thirty thousand acres of wine grapes, producing 16.9 million gallons of wine a year.[1] The industry was valued at three billion dollars, and provided 19,000 jobs in the state.[2] While grape growing for home winemaking had begun in Washington Territory in the 1880s, it was almost a century before high-quality commercial wines were produced. As the reputation of Washington wines grew nationally and internationally during the second half of the twentieth century, the grape and wine industry expanded to become an important part of the state economy.

[1] http://winegrapes.wsu.edu (accessed 29 March 2008).

[2] "Economic Impact of Washington Grapes and Wine," http://www.washingtonwine.org (accessed 7 February 2008).

The Institution

As a land grant institution, Washington State University (WSU, formerly Washington State College, WSC) had a responsibility under the Morrill Act of 1862 to provide the citizens of the state education and training in the applied sciences. From 1887 onward agricultural experiment stations and other research efforts were added to the land grant mission, and in 1914 the Smith-Lever Act added a mandate to disseminate knowledge gained through research to citizens of the state, largely through cooperative extension services. The University was founded in 1892 at Pullman as the Washington Agricultural College and School of Science. In 1905 the name was changed to Washington State College as the school began to expand. Both the original Pullman campus and other sites throughout the state have been involved in the development of the wine industry. Much of the work that was done on grape culture and winemaking has taken place at what is now known as the Irrigated Agriculture Research and Experiment Station (IAREC, originally the Irrigation Experiment Station, IES) at Prosser in south central Washington. The Station was established in 1919 by the Washington State legislature and its mission then was the same as now: "to discover and disseminate scientific knowledge that enhances the competitiveness of Washington's irrigated agriculture." From 1939 to 1945 the station also conducted research on processing of fruits and vegetables and in 1951 the U.S. Department of Agriculture food processing laboratory was transferred from Pullman to Prosser, along with its staff, including George Carter, who would later play an important part in the winemaking program.[3] The Prosser station has continued to have a significant impact on viticulture and enology in Washington, documented in the short discussion on its website of the wine industry research that has been carried out.[4]

[3] Carter started with the U.S. Department of Agriculture Agricultural Research Service at the U.S. Fruit and Vegetable Products Laboratory in Pullman and at first was not allowed to work on wine research as it was against unit regulations. When the Lab closed, IAREC Superintendent Singleton recruited Carter to work on wine and horticulture. George H. Carter, interview by Gene Ford, 15 May 1992, typescript.

[4] " . . . Washington's wine industry is just one of the success stories that has roots at IAREC. The early viticulture work was done at IAREC and viticulture and enology research and extension efforts continue to lead the industry. A recent study found statewide the industry's economic impact nationwide was at $5.4 billion annually. Faculty at IAREC are conducting nationally-renowned research on such basic issues as vascular flow between vines and grape berries, the effect of pruning strategies for grapevines following cold injury, the effect vineyard location and cultural practices on the tannin content of grapes and resulting wines, the epidemiology and management of fungal diseases of grapes, and virus interactions in grapevines . . . Scientists at IAREC are actively engaged in Integrated Pest Management (IPM) research

The work was wide-ranging and included determining the most suitable grape varieties to grow, controlling pests and diseases, managing vineyards, and making and evaluating experimental wines. The faculty involved in these efforts were expected to have at least two projects in hand at any time, one concerned with basic scientific research and one related to industry problems, and were also to have responsibility for teaching and outreach. When Department of Horticulture Chair William B. Ackley sent a memo to "Tree Fruit and Grape Research Personnel" in 1969 regarding a "Research Review," his suggested research areas for grapes were typical of the work IAREC carried out: mechanical harvesting, vine vigor in relation to trellising systems, hardiness of *vinifera* varieties, certification of virus free stock, and expanded research on processing, including enology and handling for table grapes—all topics that had been put forth by industry representatives at a meeting in Wenatchee.[5] Grape growers and wine makers have worked closely with institution personnel on these and other topics since the early 1950s, and the support the industry has shown for research at Prosser and Pullman reflects the value those programs have supplied.

The scientists

Dozens of WSU scientists played significant roles in the development of the grape and wine industry of the state. During the years this study covers, 1937-1992, two in particular stand out: Walter J. (Walt) Clore and Charles W. (Chas) Nagel. Clore was born in Tecumseh, Oklahoma in 1911 and grew up

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and extension on 33 of Washington State's top 40 agricultural commodities . . . IPM scientists at WSU Prosser have had the following impacts on production agriculture and environmental quality from 2005 through 2007: 1) Researchers in wine grape have developed and implemented management strategies that reduced insecticide and fungicide use by 84 and 73 percent respectively, resulting in decreased input costs and improved production by over $6 million per year; . . . Faculty have developed oil-based fungicide programs that permit the management of powdery mildew on cherries and grapes using organic fungicides . . . IAREC recently received funds to significantly increase facilities at the Prosser Headquarters Unit. The irrigated agriculture industry, led by the grape and tree fruit industry, supported state legislation to build two new buildings at IAREC. In 2006, phase I of the Viticulture and Enology building was completed at a cost of $1.5 million. In 2007, phase I of the Agricultural Technology Building was completed at a cost of $2.5 million. In 2007, a $500,000 greenhouse was constructed for the Northwest Grape Foundation Service for the purpose of producing virus-free grape plants . . ." Irrigated Agriculture Research and Extension Center, http://www.prosser.wsu.edu/about.html (accessed 29 March 2008).

[5] William B. Ackley to department personnel, 16 April 1969, Walter J. Clore Papers 1961-1999, Folder 81, Box 3, Cage 668, MASC, WSU Libraries, Pullman. Ackley was Chair of the Department of Horticulture. He was active in the development of landscape architecture program at WSU as well as with Washington state's wine grape industry.

in Tulsa. He earned a Bachelor of Science degree in Horticulture from Oklahoma State University in 1933. He and his wife Irene came to WSC in 1934 with only $5.00 between them. He was a graduate student working under a fellowship in horticulture and spent his summers in Prosser and the school year in Pullman before being appointed as fulltime Assistant Horticulturist at the IES in Prosser in 1937.[6] As the product of a "teetotaling" Baptist upbringing, he later joked he had never even tasted wine before he began work at the IES.[7] There he was involved with research on apples, pears, cherries, peaches, asparagus, beans, corn, chrysanthemums, peonies, and roses, as well as grapes—anything that might grow in irrigated central Washington. He was also responsible for most of the landscaping that went on at the Prosser station over the next 40 years. It was Clore who worked with USDA Division of Food Research scientist Dr. A. M. Neubert to start research on the processing adaptability of experimentally grown fruits and vegetables.[8] With the Washington Agricultural Experiment Station at Pullman and labor from the Washington State Penitentiary at Walla Walla, IES began experimenting with vegetable crop varieties, fertilizer use, and management practices. Clore led the project, which continued for eight years. By 1950 he was working primarily with juice grapes and asparagus. He was one of the first to study the effects of insecticides, such as DDT, and herbicides, such as 2,4-D, on crops in the area, and he also worked on nutrient deficiencies in grapes.[9] He was the leading force in the transformation of vineyard practices—trellising, training, pruning, and watering in relation to mechanical harvesting, vine maturity,

[6] Harold P. Singleton, *The Irrigation Experiment Station, From the Beginning to July 1, 1965* (Prosser: no publisher, 1980?), 23.

[7] Nagel called Clore, who had never tasted alcohol before coming to Washington, the originator of pop wines: at first he would mix Grenache with Seven-Up. He learned to appreciate fine wines through enological judging. Charles W. Nagel, interview by author, tape recording, Pullman, WA, 25 July 2005.

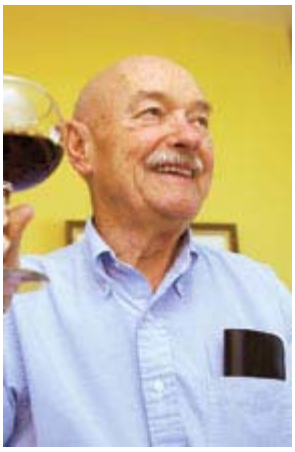
[8] Singleton, *The Irrigation Experiment Station,* 29-30.

[9] *DDT (*Dichloro-diphenyl-trichloroethane) was a synthetic pesticide that had been used since early in World War II to control mosquitoes. *2,4-D* (2,4-Dichlorophenoxyacetic acid) was a common systemic herbicide developed to control broadleaf weeds and increase crop yields during the War and released for general use in 1946. There had already been increasing health concerns associated with both substances, and DDT was targeted in Rachel Carson's 1962 classic work on ecology, *Silent Spring,* as causing the decline in bird populations and other deleterious environmental effects she observed and documented in eastern America. It was banned in the U.S. in 1973, and subsequently worldwide for agricultural work (but not for disease control). With the resurgence of malaria worldwide, the World Health Organization in 2007 came out in favor of using DDT to control mosquitoes, but not as a pesticide on crops. http://www.who.int/ipcs/capacity_building/who_statement.pdf (accessed 11 April 2008). Currently 2,4-D is the most commonly used herbicide in the world, according to the industry's website at http://www.24d.org/ (accessed 11 April 2008).

and cold hardiness—to suit the climate of the state. Most significantly, Clore's vision for the potential of premium *vinifera* grapes and fine wines led directly to field trials of varieties at many locations around the state and to the involvement of WSU in the production, evaluation, and amelioration of wines.[10]

Clore brought microbiologist Dr. Charles Nagel into the work in 1964. Nagel had been born and raised in the Napa Valley, where his father had worked for the Martini winery, and he himself had picked grapes and worked as a cellarman for Charles Krug.[11] He had a Ph.D. in Microbiology from the University of California-Davis, the center of wine and vine research in the United States, but he was not an enologist. He originally trained in bacteriology, took a semester of education courses but decided he did not want to be a teacher, and then worked at Dugway Proving ground before returning to Davis for graduate school. At the time it was not possible to get a Ph.D. in food science there, so he took his degree in Microbiology with a minor in food science, where he learned about fermentation and sensory evaluation. His greatest contributions to the development of the Washington wine industry were the introduction of trained wine tasting panels to evaluate wines from the educated consumer's viewpoint and his scientific work on identifying and correcting problems to improve the quality of the wines. Except for two years as Director of Research at United Vintners Inc. of Asti, CA, he spent his entire career from

Walter Clore



Charles Nagel

[10] In a short autobiography Clore predicted 20,000 acres of wine grapes in Washington by 2000. He underestimated. In 2007 there were 30,000 acres of wine grapes, plus 25,000 acres of juice and table grapes. Walter J. Clore Papers 1961-1999, Folder 48, Box 2, Cage 668, MASC, WSU Libraries, Pullman.

[11] Charles W. Nagel, interview by author, tape recording, Pullman, WA, 25 July 2005. Nagel also noted that as a graduate student he made his own beer, because you could do it for five cents a quart!

1960 on at WSU, and before retiring in 1992 was the advisor for almost thirty graduate students, including over a dozen who worked on wine.[12] In 2000, Nagel's WSU colleague and co-author Charles G. Edwards named a new bacterium isolated from wine, *Lactobacillus nagelii,* after him as a tribute to his many contributions.[13]

Besides these two leaders in viticulture and enology, there were many other faculty and staff involved in grape and wine research during the Clore and Nagel years, and their work was absolutely essential to the success of the program. George Carter started working for WSU in 1966 when the U.S. Department of Agriculture Agricultural Research Service's Fruit and Vegetable Products Laboratory at Prosser closed. He had a chemistry degree from the University of California-Los Angeles and had worked for the Laboratory when it was in Pullman. The Laboratory was moved to Prosser in 1951 and closed in 1965; IAREC Superintendent Singleton then asked Carter if he would like to do research on wine and horticulture for WSU. Carter conducted numerous experiments on grape varieties and winemaking and made all the WSU experimental wines from 1966 until his retirement in 1976. Carter noted in a 1992 interview that his first wines tasted "horrendous" but he eventually learned that winemaking was "75% sanitation and 25% know-how."[14]

Others who contributed a great deal to vine and wine research included entomologists Wyatt Cone and Larry Wright, who worked on insects, mites, and other pests such as mealybugs, leafhoppers, grape Phylloxera, and cutworms. A. Irving Dow of WSU Extension researched plant nutrition and deficiency diseases, including boron deficiency and iron chlorosis. Mohammed Ahmedullah studied the physiology of grapes as well as blackleaf, powdery mildew, crown gall, and trellising and training regimes.[15] Sara Spayd came to WSU-IAREC in 1980, when Washington had only 15 wineries and 4,500

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[12] See Appendix A for a list of Nagel's graduate students and their work.

[13] Edwards had been working on Lactobacilli because they can cause "stuck" or sluggish fermentation. It was the second novel bacterium he had discovered. "WSU Names Bacteria [sic] After Retired Enologist," http://cahenews.wsu.edu/reportertools/news/2000/names-bacteria-2000-07.html.

[14] George Carter, interview 15 May 1992, Washington Wine Commission Video Archive Project. Originally Carter did not ferment the wines to dryness, having a preference for sweeter wines. After Clore sent him to a winemaking course in California he learned to better determine sugar content and developed a palate for dryer wines.

[15] *Black leaf* is a potassium deficiency that causes the leaves on a vine to turn black as chlorophyll is lost, and means the vine cannot transmit sugar to the grape effectively. Cyril G. Woodbridge and Walter

acres of wine grapes, and undertook research in all aspects of viticulture, from growth in the field to processing at the winery. Edward L. Proebsting evaluated vineyard sites and cold hardiness. Joseph Powers specialized in wine chemistry. Several Extension personnel from Pullman and the county offices both carried out research themselves and conveyed research results to growers. Together, all these plus several other Washington State University scientists provided the essential background knowledge necessary for the state to become a major producer of quality wines.

The places

Washington State is divided geographically by the Cascade Mountains. To the west, the climate is heavily influenced by the Pacific Ocean and tends to be moist and cool. To the east, the Columbia Basin lies in the rain shadow of the Cascades and usually has dry and warm summers, with sometimes sub-zero temperatures during winters. During the growing season, nights tend to be cool, which encourages acidity in the grape to balance the sugars produced during warm daylight hours. The Columbia River runs north-south through the center of the state before turning west to form the border between Washington and Oregon. As in other great wine grape areas, the river has an ameliorating effect on vineyard climate. It also provides much of the water supply for irrigation via a system of dams, reservoirs, and canals. It was long held that Washington was too far north to grow good wine grapes, other than possibly some cool-climate white varieties, a belief that Washington State University scientists were able to dispel in the1960s and 1970s. (The state actually sits at approximately the same latitude, 46 degrees north, as the renowned French wine regions of Bordeaux and Burgundy.) Viticulturists and enologists from Sunnyside, Grandview, Prosser, Walla Walla, White Salmon, and the Puget Sound area have all learned over the years with much help from WSU to grow the best varietals for their geographic conditions, and have turned out some truly superb wines.[16]

J. Clore, "Black-leaf Condition of Concord Grapes in Washington," in *Proceedings of the American Society for Horticultural Science* (Geneva, NY: The Society, 1961), 115-119. Other grape problems include *powdery mildew*, a fungal disease that damages vines and gives wine a bad taste, and c*rown gall*, *Agrobacterium tumefaciens*, which weakens vines by plugging up the tissues that carry water and nutrients.

[16] *Terroir* is the term used to cover the climate, latitude, soil, and other factors influencing the growth of wine grapes. WSU geologist Larry Meinert described it as "the complex interplay of climate, soil, geology, and culture that influences the character and quality of wine. Although the term originated in France,

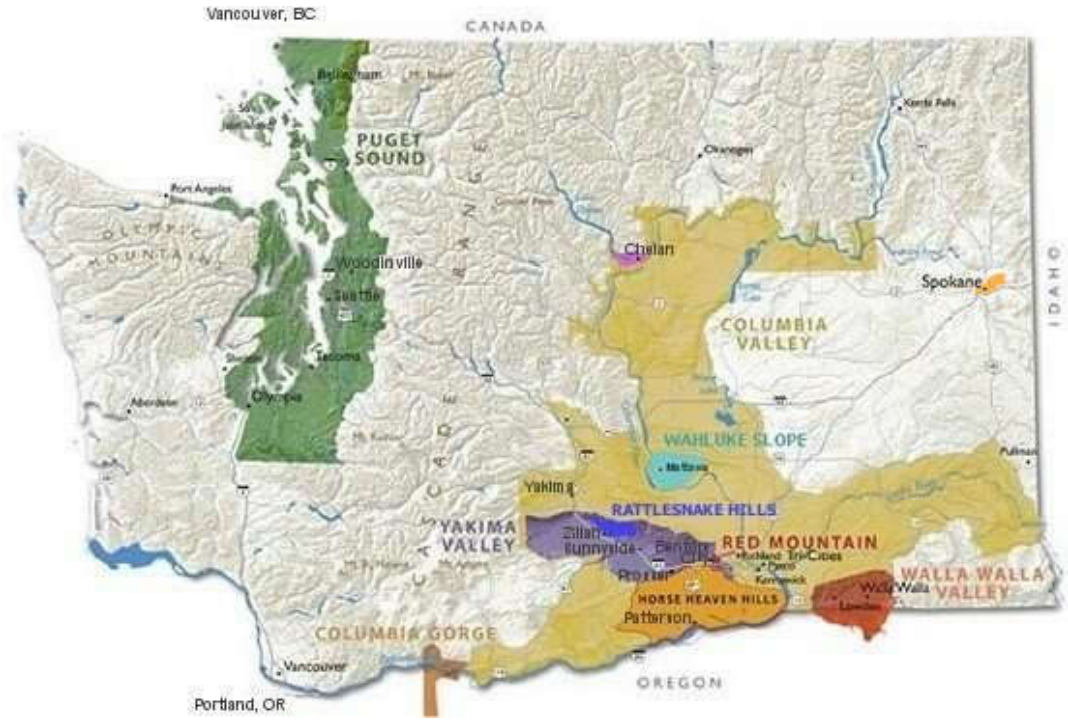

Figure 1. Washington American Viticultural Areas, 2008

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terroir increasingly is being used in other parts of the world to explore differences at the scale of appellations to individual vineyards to within-vineyard domains." Larry D. Meinert, "Terroir: What It Is and How To Use It," *WSU Grape Research News* 13 (2002): 2. For background information on the terroir of Washington, see John Baxevanis, *The Wine Regions of America, Geographic Reflections and Appraisals* (Stroudsburg, PA: Vinifera Wine Growers Journal, 1992), 216-237; Larry D. Meinert and Alan J. Busacca, "Geology and Wine 3: Terroirs of the Walla Walla Valley Appellation, Southeastern Washington State, USA," *Geoscience Canada* 27, no. 4 (2000): 149-171; Larry D. Meinert and Alan J. Busacca, "Geology and Wine 6. Terroir of the Red Mountain Appellation, Central Washington State, U.S.A" *Geoscience Canada* 29, no. 4 (2002): 149-168; Alan J. Busacca and Larry D. Meinert, "Wine and Geology - The Terroir of Washington State," in *Western Cordillera and Adjacent Areas* (Boulder, CO: Geological Society of America, 2003), 69-85; David K. Norman, Alan J. Busacca, and Ron Teissere, *Geology of the Yakima Valley Wine Country-- a Geologic Field Trip Guide from Stevenson to Zillah, Washington* (Olympia, WA: Washington Division of Geology and Earth Resources, 2004); Larry D. Meinert, "Understanding the Mysteries of the Grape," *Geotimes* (August 2004), http://www.geotimes.org/aug04/feature_terroir.html (accessed 4.16.2008).

Appellation is the term for a designated viticultural region. In the U.S. the federal government establishes the rules and regulations for determining whether an area differs enough from its neighbors in the character of its wines to be given its own appellation name, or American Viticultural Area (AVA) designation. In Washington in 2008 there were nine AVAs: the Yakima Valley, established 1983, with 11,000 acres in production; the Columbia Valley, established 1984, with 16,600 acres in production; the Walla Walla Valley, established 1984 with 1,000 acres in production; Puget Sound, established 1995, with 80 acres in production; Red Mountain, established 2001, with 700 acres in production; Columbia Gorge, established 2004, with 400 acres in production; the Horse Heaven Hills, established 2005, with 6,000 acres in production; the Wahluke Slope, established 2006, with 5,000 acres in production; and the Rattlesnake Hills, established 2006, with 1,227 acres in production. "Washington's American Viticultural Areas," http://www.winesnw.com/wahome.html (accessed 4.16.2008).

The grapes

Of the many species in the genus *Vitis,* two in particular are of interest for the juice and wine industry. *Vitis labrusca* is a native North American species used for juice, jelly, and occasionally for wine; the most common example is the Concord grape. Much of the research carried out on Concords by WSU was also applicable to *Vitis vinifera*, which is native to Europe and Central Asia and is the preferred source of grapes for wines; examples are Cabernet Sauvignon and Chardonnay. Note that the wine names familiar to us are not species in their own right, but simply varieties of *Vitis vinifera*. Within a given varietal, sub-varietal clones may differ in their properties; for example, two Merlot vines may have different harvest times, or sugar levels, even if grown under identical conditions. Thus, grape trials usually kept track of the exact location of each individual vine in the vineyard, so promising clones could be identified and propagated. The same grape may be known by different names in different places, and it is only recently that DNA analysis has been able to prove, for example, that Island Belle and Campbell Early are synonyms for the same grape. There may be several thousand distinct grape cultivated varieties, called cultivars, around the world; Spain recognizes 600, the U.S. Bureau of Alcohol, Tobacco and Firearms about 260.[17]

The problems

Grape growers and wine makers were faced with a number of concerns that changed over time as the industry developed. The first question WSU researchers at the Prosser research station addressed was which varieties were suitable for irrigated central Washington and would survive the occasional sub-zero winter temperatures in the central regions. (WSU scientists at the Mt. Vernon research station and Western Washington Research and Extension Center in Puyallup faced a different set of conditions and would be more concerned with excess moisture than excess cold.) Once the grape industry was established, problems arose with pests and diseases, such as the sap-sucking Phylloxera insects[18] and powdery mildew. Management of these threats included quarantines on non-certified

[17] John Winthrop Haeger, *North American Pinot Noir* (Berkeley: University of California Press, c2004), Chapter 1, "The Basics." Haeger gives a very nice short introduction to wine overall.

[18] Grape Phylloxera (*Daktulosphaira vitifoliae*, also called *Phylloxera vitifoliae* or *Phylloxera vastarix,* dry-leaf devastator) was native to North America and became a worldwide pest of commercial grapevines

stock.[19] Questions about vineyard management included the best systems for trellising and training, irrigating, harvesting, and for maturing the vines for winter. The wines themselves presented problems in sugar-acid balance, color, aroma, and of course taste. These were some of the research areas WSU would address during the establishment of the premium wine industry for which Washington is now famous.

The results

In the seventy years between the time *vinifera* grapes were first planted as part of an organized, scientific research program at the IES in 1937 and the publication of the 2007 U.S. Department of Agriculture annual *Agricultural Statistics*, Washington went from not even being included in the list of grape growing states to being the second largest grape-grower in the nation. Its current ranking is based not just on juice and table grapes, but on the production of premium grape varieties that were formerly believed unable to survive in Washington's climate. In 2006 over a third of Washington's grape crop went into making wine, and there were over 500 wineries operating in the state.[20] WSU scientists and

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after it was accidentally introduced to England and France in the 1850s. It is a louse-like insect, related to aphids, and feeds on vine roots. European *vinifera* vines are often grown on American *labrusca* rootstocks because the *labruscas* have greater natural resistance to the pest. See John W. Watson, Wyatt Cone, and Mike Haskett, *Grape Phylloxera*, Extension Bulletin 1566 (Pullman: Washington State University Extension, 1990).

[19] *Certified* stock was grown from vines that had been checked and declared free of all known viruses and pests. The certification process was time-consuming, laborious, and costly, but the fear of introducing devastating viruses made growers support the state-mandated *quarantine*, which kept non-certified stock out of the state. A concomitant of the quarantine, *indexing* refers to the process of checking each variety prior to certification and dissemination to make sure it is disease-free. *Heat treatment* was one of the ways viruses were eliminated from a clone of a variety, and had an incidental effect of increasing growth vigor. IAREC initially got most of the certified stock for its foundation planting from New York and California. It then grew the vines and distributed cuttings to certified nurseries in the state, which propagated the large numbers of plants needed by grape growers. Depending on the distance between rows and between vines in a row, an acre of vineyard may require up to 5000 plants.

[20] Table 5-44, p. V-21, "Grapes: Production and Utilization, by States, Crop of 2006 (preliminary)" gave Washington total grape production at 316,000 tons, of which 120,000 went to wine. For comparison, California produced 5,695,000 tons, of which 3,040,000 went for wine. Figures for other states gave only the total tonnage produced: New York, 155,000; Pennsylvania, 82,000; Oregon, 34,000. Table 5-42, p. V-20 "Grapes: Production and Marketing year average price per ton by States, 2004-06" gave figures for Washington wine grapes in tons with cost per ton: 2004, 107,000 tons at $925 a ton; 2005, 110,000 at $930; 2006, 120,000 at $942. By comparison, California produced 3,040,000 tons of wine grapes in 2006 at an average price of $559. The price per ton differentials between Washington and California reflect the concentration of Washington growers on high-quality wine grapes. United States Department of Agriculture, *Agricultural Statistics* (Washington, D.C.: The Department, 2007).

researchers were the main force behind creating the knowledge base necessary for the Washington grape and wine industry to grow from a few hundred acres of vines, producing undistinguished grapes for undistinguished wines, to a major state industry. Today Washington's vineyards and wineries are known internationally for award-winning premium vinifera wines and contribute over three billion dollars yearly to the state's economy. Horticulturists, plant pathologists, entomologists, food microbiologists, enologists, climatologists, soil scientists, agricultural engineers—they came from many disciplines across the University—worked to solve the problems of cold hardiness and efficient vineyard management, trellising and mechanical harvesting, certification of virus-free stock and testing of hundreds of grape varieties, balance of sugars and acidity in wines, and consumer preferences. Their research results were shared with growers, processors, and winemakers in several ways: they corresponded with individual viticulturists and enologists, they spoke at local luncheons, state conventions, and national meetings, and they published their results in scholarly journals, popular magazines, newspapers, conference proceedings, and through the University's outreach and Extension programs. This intersection between basic research and practical application was the crux of the University's obligations to the citizens of the state, and testament to the value WSU added to their lives.

A Note on Sources

Primary source material

Walter Clore's letters from 1969 until his retirement in 1976 are a particularly rich source for understanding how a working scientist interacted not only with scientific colleagues, but also with private citizens and with industry organizations. Since it is obvious from lacunae that not all letters written or received by Clore are in the archives, it is even more evident that a great deal of his time must have been spent on correspondence dealing with his many horticultural responsibilities.[21]

Charles Nagel's papers overlap Clore's and focus on the enological side of his work for WSU. They include numerous files of raw data on wine analyses and tasting panel results.[22] Interestingly, some of Clore's letters and other papers are found only in Nagel's files, and vice-versa. This points up the dangers of relying only on what an individual has saved himself to give an accurate picture of his activities. Additionally, Clore seems to have tried to save nearly all his own letters from 1969-1976, but not those sent to him, sometimes leaving the researcher to extrapolate. Nagel often kept both the original sent to him and his response.

Many papers in the Clore and Nagel archives refer to work done by Dr. Raymond Folwell and his WSU Department of Agricultural Economics colleagues on the economics of vineyard and winery establishment and maintenance. These economists also gave numerous presentations and published many papers and reports on finance and marketing.[23] The work they did helped convince banks to loan money to grape growers, despite the several years between and planting and profits. Their importance in the development of the wine industry in the state is beyond the scope of this study, which focuses on agricultural and food science, but will provide a fertile field for investigation in the future.

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[21] Walter J. Clore Papers 1961-1999, Cage 668, MASC, WSU Libraries, Pullman. http://www.wsulibs.wsu.edu/holland/MASC/finders/cg668.htm

[22] Charles W. Nagel Papers 1964-1991, Cage 639, MASC, WSU Libraries, Pullman. http://www.wsulibs.wsu.edu/holland/Manuscripts, Archives, and Special Collections/finders/cg639.htm#s1

[23] Between the time he was hired by WSU in 1968 and his retirement in 2007, Folwell authored or co-authored over 100 professional articles, WSU publications, and conference papers. He was originally hired to do livestock marketing research, but soon became involved with the economic development of the wine industry. Along with John Baritelle he conducted a landmark national study of consumer behavior related to wine. Before he retired he was named Director of the WSU Viticulture and Enology Program.

Besides the Clore and Nagel papers, the Manuscript, Archives and Special Collections (MASC) unit of the Washington State University Libraries in Pullman, Washington, includes other sources relating to the growth of the wine industry in Washington. The grape and wine subset of the records from the WSU research station in Prosser covers correspondence, memoranda, reports, and test and research data, and provides amplification of information in the Clore and Nagel papers.[24] Other original source materials investigated for this study included the records of the Washington State Grape Society.[25]

The author had the privilege of visiting with and interviewing Charles Nagel before his death. These interviews and their transcriptions have been deposited with the Manuscripts, Archives, and Special Collections unit of the Washington State University Libraries in Pullman. Transcripts and summaries of other oral interviews of significant figures in Washington's wine history, collected in the early 1990s under the aegis of Washington Wine Commission and listed in the attached bibliography, were also consulted.

Published primary source material

In order to evaluate the importance of WSU's work to the development of the grape and wine industry, the author of this study has undertaken a thorough survey of the published literature. This includes the many WSU-sponsored publications issued as Extension Bulletins, Circulars, Mimeos, irrigation and pesticide guides, and other reports. Professional journals were searched through the *Agricola*, *Biosis*, *Web of Science*, *Chemical Abstracts*, *Vitis*, and other databases. By far the most important journal for WSU grape and wine researchers was the *American Journal of Viticulture and Enology*.

Non-scholarly publications were often useful avenues for distributing information. Articles in trade magazines, such as the *Goodfruit Grower*, were a way for WSU's scientists to share their research results

[24] Washington State University. Agriculture Research and Experiment Center (Prosser), *Grapes/Wine Research Records, 1940-1984,* Archives 214, MASC, WSU Libraries, Pullman, http://www.wsulibs.wsu.edu/holland/Manuscripts, Archives, and Special Collections/finders/ua214.htm.

[25] Washington State Grape Society, *Records, 1972-1981*, Cage 464, MASC, WSU Libraries, Pullman, http://www.wsulibs.wsu.edu/holland/masc/finders/cg464.htm; Washington State Grape Society, *Records, 1971-1991*, Cage 178, MASC, WSU Libraries, Pullman, http://www.wsulibs.wsu.edu/holland/masc/finders/cg178.htm.

informally.[26] Local newspapers, especially those of Prosser, Yakima, and Grandview, ran hundreds and hundreds of articles of interest to their readers dealing with the grape and wine industry and the work WSU was doing.

The annual meetings and subsequent published proceedings of professional groups were another way WSU research was transmitted to other scientists and to the industry. Among these were the *Proceedings* of meetings of the Washington State Horticultural Association, the Washington State Grape Society, and the American Society for Viticulture and Enology, all of which were consulted for the period covered by this study.

The author has compiled the above mentioned publications, with the exception of newspaper articles, into a database entitled *WSU Viticulture and Enology*. It is a web-searchable bibliographic database of citations with abstracts, covering scientific journal articles, books, proceedings, conference abstracts, dissertations and theses, and reports dealing with grape growing and wine making by Washington State University faculty, researchers, and students. This database was designed as a permanent research tool covering the work WSU has done in the fields of viticulture and enology, and currently includes publications up through 2008. It is accessible through the WSU Libraries at http://lib4.wsulibs.wsu.edu:808/rmwp?&func=advSearch, or through online catalog under its title. As of June 2008 it included over 960 entries – truly a remarkable record of production by WSU's viticultural and enological researchers.

[26] This publication and its quarterly supplement the *Goodgrape Grower* have operated under a number of title variations over the years: *Good Fruit Grower*, *Goodfruit Grower*, *GoodFruit Grower.*

A Note on Organization

This study employs several approaches to exploring the role Washington State University played in the development of the wine industry in the state. As noted above, it uses the papers of Walter Clore and Charles Nagel extensively.

- Chapter One gives some background on the wine industry in Washington State up to 1960.
- Chapter Two discusses the research Washington State University faculty and staff in the sciences did on viticulture and enology in the 1960s, and the ways in which they disseminated the results of their work.
- Chapter Three takes one year, 1970, of Walter Clore's surviving correspondence, showing the range of grape and wine interests and contacts he dealt with, and uses it as a means of exploring the overall development of the industry in Washington.
- Chapter Four uses the ever-present problem of obtaining adequate research funding to show how various agencies and overlapping projects enhanced and augmented one another during the 1970s.
- Chapter Five focuses on how the important grape and wine publications WSU produced in the 1970s addressed the specific needs of the industry with regard to the major problems noted above: varieties, hardiness, pests and disease, vineyard management, and the wine itself.
- Chapter Six deals with the maturing of the industry in the 1980s and the ways in which Nagel and other WSU workers continued the work that Clore, who retired in 1976, had begun.
- Chapter Seven covers the period to Nagel's 1992 retirement and talks about the enduring legacy he and Walter Clore gave the University and the Washington Wine Industry.

Chapter 1

Grapes and Wines in Washington From 1937 to 1959

> With a wise long range program we believe that out of the industry's present travail a sound and expanding wine industry may develop in this State.
> William B. Bridgman[1]

Historical background

Grape growing in what would become the state of Washington was first documented at Ft. Vancouver on the Columbia River in the 1820s, when it was a factory of the Hudson's Bay Company under John McLoughlin.[2] Missionary Narcissa Whitman noted grapes growing there in 1836, apparently from seeds that had been brought over in the mid-1820s. For the next century individual winemakers and small wineries operated in the state with varying success.[3] An undated draft of a talk by Clore claimed that a single vine of the first planting (a *labrusca* called Worden) on Stretch Island in Puget Sound in 1872 still survived, and that a very old abandoned planting of *vinifera* in the Tampico area west of Union Gap had been brought to his attention.[4] These remnants of some of the earliest efforts at grape growing in the

[1] Bridgman, William B. "Brief Relative to the Development and Condition of the Grape Wine Industry of Washington State," (February 1948), Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 236, Box 4, Archives 214, MASC, WSU Libraries, Pullman.

[2] "Cultural Landscape Report, Fort Vancouver, WA," Walter J. Clore Papers 1961-1999, Folder 232, Box 5, Cage 668, MASC, WSU Libraries, Pullman. Whitman was quoted in Katherine Stanley Nicholson's *Historic American Trees* (New York: Frye Publishing Co., 1922), 99, as claiming a gentleman at a dinner party in London in 1824 had absent-mindedly put the seeds in his jacket pocket, and so brought them to America. McLoughlin, sometimes spelled McLaughlin, was Chief Factor or Governor of the Hudson's Bay outpost at what is now Vancouver, Washington, from 1824 to 1846, and endeavored to grow locally as much as possible of the supplies necessary for his fur traders and trappers.

[3] For an extensive chronology of grape growing and wine making in Washington State, largely compiled by Clore, see Ronald Irvine and Walter J. Clore, *The Wine Project: Washington State's Winemaking History* (Vashon, WA: Sketch Publications, 1997), 405-427. There are many drafts of this chronology in Clore's extant papers.

[4] Walter J. Clore, "A Brief History of Washington Grape and Winemaking With Special Emphasis on the Variety Cabernet Sauvignon," undated draft, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 58, Box 2, Archives 214, MASC, WSU Libraries, Pullman.

state barely hint at the importance the industry would come to have. A commercial juice grape industry had evolved in eastern Washington during the early years of the twentieth century, but winemaking was mostly done domestically. In 1920 the eighteenth Amendment, known as Prohibition, went into effect, shutting down the few commercial wineries operating in Washington; in 1933, Washington became the 24th state to vote to repeal the Amendment. The next few years saw a spate of new wineries, most of which were short-lived. In 1937, after three years in Pullman as a graduate student, Walter Clore was appointed as an Associate Horticulturist at the Irrigation Experiment Station at Prosser to study varietal characteristics and fertilizer needs of truck crops and small fruits. There he established a plot for grape trials on a fifth of an acre. The plot had three or four vines each of American (*Vitis labrusca*), American hybrid, French hybrid, and European (*Vitis vinifera*) varieties. At the 1937 Prosser Station Annual Field Day, when IES held an open house for visitors to show off the work being done there, he already had 24 grape varieties on trial.[5] By 1938, just five years after the Repeal of Prohibition, there were over three dozen wineries in the state, and Clore was well embarked on grape trials.

When he began his research into grapes there was already an established if small commercial Concord grape industry in the state. M.H. Church had processed the first unsweetened Concord grape juice in the West from naturally high-sugar grapes he grew near Kennewick in 1913, 22,000 gallons that year; previously western grapes were shipped to the East for making into juice.[6] In 1937 the Church Grape Juice Company added more acreage, and by 1942 it was the largest owner of Concord vineyards in the nation.[7] His business was later bought out by Welch's. In 1938 vines were planted at Maryhill along the Columbia River to supply grapes for some of Washington's 42 licensed wineries. The Washington Wine Producers Association was established in 1935 and reorganized as the Washington Wine Council in 1939, with the intent of promoting the industry. At this time there were only a few people interested in premium *vinifera* grapes for high quality wines; one was William B. Bridgman, a local attorney and

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[5] *Grandview Herald*, 17 June 1937, 24 June 1937.

[6] Church developed a major grape juice processing firm at Kennewick. Legend has it that it was *Mrs.* Church who first canned some of her husband's Concord grapes as juice, giving him the idea for the processing plant. Mary Trotter Kion, *Kennewick, Washington* (Chicago, IL: Arcadia Publishers, 2002), 27.

[7] Walter J. Clore Papers 1961-1999, Folder 1, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

founder of Upland Winery in Sunnyside.[8] Much of Clore's experimental work on grape varieties during this period involved Bridgman, who was a proponent of fine wines and had great faith in the potential for *vinifera* grapes in Washington, despite the fact that in 1938 about 90 percent of Washington wine sales were of sweet or fortified (with added alcohol) wines made from native American *labrusca* grapes.[9] Clore claimed many of the post-Prohibition wineries in the state failed because they used poor winemaking techniques and poor quality fruit to turn out low quality wines which were often spoiled or even contaminated with molds and arsenic. Bottles of incompletely fermented wine sometimes exploded on the shelves of grocers.[10] The concentration on lower-end wines would continue until the 1969 Wine Bill eliminated the protection from competition Washington wineries had enjoyed. Bridgman imported premium grape varieties from Europe and California, often providing cuttings to IES, which was still concentrating on *labruscas* and hybrids. A list titled "Fruit varieties added to the trial plots of the IES in 1939" included Muscat of Alexandria, Dunkirk, Hector, Yates, Hanover, Urbana, Watkins, Brighton, Early Golden Muscat, Iona, Hubbard, Muscat, and Black Hamburg; only the Muscats and Hamburg were *vinifera*.

The 1940s

In 1940 Bridgman provided IES with 11 more *vinifera* varieties for testing; the Station's report that year listed a total of 26 varieties and 13 rootstocks being tested for their ability to survive and thrive in Washington's conditions.[11] A section of the state Liquor Control Board 1940 report waxes almost poetic over wine grapes and their potential in Washington, saying:

[8] According to a typescript autobiography, Bridgman was born in Ontario and at age 16 went to live with an uncle who was President of Hamline University in St. Paul, MN, where he took degrees in both Science and Arts within three years. He then taught school before studying law and "emigrating" to the Yakima Valley where he specialized in irrigation law. "Notes on Life of W. B. Bridgman, and on the Upland Winery," undated, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 236, Box 4, Archives 214, MASC, WSU Libraries, Pullman.

[9] "The Washington Wine Market," *Wines and Vines,* August 1938, 8-9.

[10] Walter J. Clore, "A Brief History of Washington Grape and Winemaking With Special Emphasis on the Variety Cabernet Sauvignon."

[11] Walter J. Clore Papers 1961-1999, Folder 1, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

> "The state generally is well adapted for the growing of wine grapes, and it has been found that on the eastern side of the Cascade mountains certain areas are especially well adapted because of the soil and climate for the growing of European types of grapes. A large proportion of the grape wine produced in this state is made from native types such as the concord [sic] and [Belle] Island, which are grown successfully in both Eastern and Western Washington. However, in the Yakima Valley, and a few other localities, are to be found vineyards of foreign wine grapes - - Muscats from the banks of the Nile; Casba [sic], or Hungarian Muscats; blood-red Alicante; the Zinfandel; the Red Gutadel, native of Saxony; the Johannesburg Reisling [sic]; the Black St. Laurent, of Northern France, and vineyards of many other foreign types. It takes years to develop vineyards and as more are planted the domestic wine grape industry will become increasingly important. The consuming public wants high quality wines made from the best grapes procurable."[12]

The report went on to claim that one Yakima Valley vintner (Bridgman) had found that "European types of grapes will grow as well, if not better, than they do in their native localities." Wishful thinking! As was a later sentence in the report: "The Board is continually carrying on its policy of urging domestic wineries to produce wines of the highest quality." While that may not have been exactly true in the 1940s through the 1960s, ultimately the touching faith in the potential for quality wines was borne out—largely through the efforts of WSU researchers working together with the industry in the state throughout the middle years of the century to improve both *vinifera* grape culture and the making of fine wines in Washington.

Clore planted more premium *vinifera* in 1941, this time supplied by Specialties Nursery of Vernon, British Columbia.[13] IES had at this point about an acre of experimental vineyard, and the local newspaper reported that 74 varieties of grapes were to be shown at the annual Field Day tour of the work being done at the Station.[14] This was only four years after Clore had started his trials. Also in 1941, Schoonmaker and Marvel published *American Wines,* in which they presciently predicted that "…Washington, sooner or later, will produce fine wines and will rank among the best viticultural regions of the United States."[15] This

[12] Washington State Liquor Control Board Report of Operations, October 1, 1939 to September 30, 1940, 20-21.

[13] Vernon is located in the Okanagan Valley of British Columbia, the earliest grape growing region of Canada and still the largest. For many years growers in British Columbia favored American and hybrid grapes, but since the 1980s the area has become known for some very good *viniferas*. The spelling Okanagan is used in Canada, and Okanogan in the U.S.

[14] *Grandview Herald*, 10 July 1941.

[15] Frank Schoonmaker and Tom Marvel, *American Wines* (New York: Duell, Sloan, and Pearce, 1941), 117-119. Schoonmaker was an American wine writer and merchant who was trained in France. His 1934 *Complete Wine Book* and 1964 *Encyclopedia of Wine* were classics in the field. He promoted the idea of labeling wines with the specific varietal name, such as Riesling or Cabernet Sauvignon, instead of generic descriptions such as Rhine or Burgundy. Marvel was a travel and wine writer. Frank J. Prial, "Wine Talk, *New York Times*, 20 March 1991 (accessed 2 May 2008).

was a remarkable statement, as to that point there was little to indicate the state could grow *viniferas* at all, and the wines being made were certainly mediocre. Despite the low quality of Washington winemaking, 1943 was significant for the infant wine industry in several ways. Bridgman and Clore coauthored an article on growing grapes in Eastern Washington that for the first time pointed out the substantial potential of the area.[16] On the negative side, the insidious grapevine pest Phylloxera was found in Washington in a Vashon Island vineyard, leading to the state-wide Phylloxera Quarantine Order No. 25 and setting a precedent for regulations ensuring growers planted only certified stock.[17] Finally, still more premium wine grapes, supplied by Bridgman and Specialty Nurseries, were planted at IES as Clore began to see the possibilities for premium wines. There were some 22 wineries in the state in 1944-45, fewer than before the War, but still indicative of the market potential.[18]

By 1947, IES was growing a total of 126 varieties, 72 American (*labrusca*) and hybrid plus 54 European (*vinifera*); it was an indication of future trends that the proportion between the two types of grapes was changing, with juice-producing *labruscas* declining in favor of *vinifera* grapes which could be made into fine wines. Most of the grape stock that had not come from William Bridgman or from British Columbia was obtained from the New York Agricultural Experiment Station. Clore drew up a report noting the state had 3600 acres in American varieties, with Concord the most important and Campbell Early (often known in Washington as Island Belle) in second place. There were 400 acres of European varieties, all in irrigated areas east of Cascades: Muscat, Zinfandel, Csaba, Alicante Bouschet, Thompson Seedless, Golden Chasselas, Chasselas Rose, Carignane, Franken Riesling, Malvoisie, Gray Riesling,

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[16] William B. Bridgman and Walter J. Clore, "Grape Culture in Irrigated Eastern Washington," *Arboretum Bulletin* [University of Washington], 6, No. 3 (March 1943): N.p. Another article in the same journal by University of Washington professor Henry K. Benson discussed "Grape Growing in the Puget Sound Region," *Arboretum Bulletin* [University of Washington], 5 (September 1942): 26-28.The Puget Sound area was the early population center for the state and thus also where commercial grape growing was first established, but it has always been marginal for wine grape production, despite the best efforts of researchers to overcome the difficulties of excess moisture and associated diseases. Most grapes originally grown in the region were *labruscas* or hybrids. In 1945, 93 percent of all grapes grown in the state were from eastern Washington; the figure today is much higher. Many contemporary wineries are located in the western population centers, but their grapes come from east of the Cascades.

[17] John W. Watson, Wyatt W. Cone, and Mike Haskett, "Grape Phylloxera," Extension Bulletin 1566 (Pullman: Washington State University Extension, 2002).

[18] *Wines and Vines Yearbook of the Wine Industry, 1944-1945* (San Francisco: Wines and Vines, 1944).

Johannisberg Riesling, and Mataro were all in production. (Interestingly, the published version of this report gave much higher acreages.)[19] Clore quoted the 1946 *Agricultural Statistics Yearbook* as saying Washington had been third in the nation in grape production in 1945, producing 19,400 tons of grapes (of which nine percent were sold fresh, nine percent frozen as berries, 43 percent crushed for juice, 36 percent crushed for wine, and three percent "other.") IES had 12 different rootstocks being tested for adaptability as understocks for the American varieties Concord, Campbell Early, and Delaware, and for resistance to chlorosis brought on by nutrient deficiencies.[20] Funds and personnel were inadequate to evaluate fully all varieties, but the program was gradually being expanded. Among American and hybrid grapes used for wine were Campbell Early (the most important wine grape in the state in the 1940s), Delaware, Niagara, Diamond, Brilliant, Diana, Brighton, Norton, and Worden. European varieties grown on their own rootstocks were protected from low temperatures by covering the bottom few inches of the canes with soil in late fall, as it was believed they would not otherwise survive. Clore's work over the next several years would prove this labor-intensive practice was unnecessary if other cultural practices were carefully observed. The yield per acre and sugar content of Washington *viniferas* were lower than those obtained from California grapes (not necessarily a bad thing: too high a yield per acre can mean bland grapes lacking in varietal characteristics of aroma and taste, and too much sugar in the grapes makes for mediocre wines). Clore reported that Kennewick-Pasco and the lower Columbia Basin were even better for *vinifera* than the Prosser area; varieties with satisfactory yield, sugar, or both included Alicante Bouschet, Black Hamburg, Black Monukka, Chardonnet, Chasselas Rose, Csaba, Franken Riesling, Golden Chasselas, Gray Riesling, Malaga, Muscat of Alexandria, Panarita, Ribier, Rose of Peru, Sauvignon Vert, Semillon, Sultanina Rosea, Thompson Seedless, and Zinfandel. Few of these are now grown in the state, as those less suitable have been abandoned for varieties proven capable of producing good crops for good wines.

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[19] Walter J. Clore, "final copy submitted 7-10-47," Walter J. Clore Papers 1961-1999, Folder 58, Box 2, Cage 668, MASC, WSU Libraries, Pullman. Also Walter J. Clore, "Grape Varieties in Washington," *Grape Grower* 1, no. 4 (1947): 24-25. The printed version put American variety acreage at 10,000 and European at 2,000, far higher than the draft version.

[20] After the New World insect pest Phylloxera had devastated European vineyards in the late nineteenth century, many *vinifera* were grown on pest-resistant *labrusca* rootstocks. In Washington state, the preference was to grow *vinifera* on its own roots, so that if it was killed back to ground level by harsh winter temperatures any new shoots would still be the desired *vinifera*.

Despite the efforts of Bridgman and Clore, the winery business in Washington was by no means thriving. In 1942, during World War II, the number of licensed wineries in the state had dropped to 26, and by 1946 the post-war slump had put many more out of business. In 1948 Bridgman submitted a "Brief Relative to the Grape Wine Industry of Washington State, and Measures Needed to Protect It" at the request of the Agriculture Committee of the Yakima Chamber of Commerce.[21] One of the protective measures he advocated was the continuation of the restrictions on sales of out-of-state wines in Washington, as he felt Washington-made wines could not compete. Still, the grape industry overall was not entirely moribund; during the 1940s the National Wine Company (Nawico) had been purchasing vineyards, and in 1946 a farm in Kennewick was already experimenting with sprinkler irrigation in a vineyard. Then nature stepped in: during the winter of 1948-1949, below freezing temperatures (minus 8° Fahrenheit at IES) and bare soil with no snow cover led to the loss of some American and many European cultivars. Hardiness was a major concern and Clore's "Grape Variety Trials" 1949 Progress Report discussed the varieties most likely to survive, along with production, quality, and uses. The report gave harvest dates, yield in tons per acre, and percent soluble solids for outstanding varieties, the latter along with acidity and pH being prime indicators of must quality and wine potential.[22] Many of the names of grapes in the earlier trials are unfamiliar today, having proven less suitable for Washington's situation. Of the 13 European reds included, only Barbera and Zinfandel are still being much planted. Of the 15 whites, Chardonnay, four different Rieslings, and Semillon are still familiar. Clore used four categories to describe injury suffered during the hard winter of 1948-1949 (killed, killed to ground level, some damage,

[21] William B. Bridgman, "Brief Relative to the Development and Condition of the Grape Wine Industry of Washington State," February 1948, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 236, Box 4, Archives 214, MASC, WSU Libraries, Pullman.

[22] In winemaking, *soluble solids* or SS refers to the total sugars, salts, and tannins in the juice and is often measured in degrees *Brix*. Sugar is the largest component of the soluble solids and in effect Brix is a measure of sugar level. *Tannins* are the source of the bitterness or astringency sometimes found in wines; they are plant polyphenols. *Titratable acidity* or TA is the amount of grape acids, and *pH* measures the strength of the acidity. Acidity in wine gives it crispness, but too much acid means a sour or overly tart wine; too little makes the wine taste flat and uninteresting. It is the ratio of sugars to acids that is most important in determining when to harvest wine grapes. The term *pH* describes a measure of acidity. Generally, the lower the pH, the higher the acidity. Nagel's work on the anomalous problem of high acid, high pH wines is discussed in Chapter 6. *Must* refers to freshly pressed juice including solids such as the skins, stems, and seeds. How long the juice is allowed to remain in contact with the solid matter affects the wine quality.

little or no winter injury) and emphasized how the condition and maturity of the plant determined to a large degree how it responded to cold. This was an early indication of the attention he would pay to the effects of vineyard management on vine survival. Other factors contributing to the degree of cold weather damage included yield (how many tons of grapes per acre were taken from the vines), vigor (some grapes grow much faster than others under similar conditions, or put too much of their energy into producing abundant foliage), soil texture (which affects the way roots develop), soil moisture (when was irrigation begun and stopped, and how much moisture was still available to the vines), cover crop (often deliberately used to pull nitrogen *away* from the vines so they will not put too much energy into canopy development), date of harvest (a late harvest meant less time for the vines to mature before winter), diseases, and insect injury.[23] The next winter, 1949-1950, saw the lowest temperature recorded at IES: minus 20° Fahrenheit in February. In November of 1955, early in the season before the vines had time to mature and harden off, there was another very damaging freeze; those *vinifera* vines that survived bore no crop in 1956. These damaging freezes plus the lack of interest in fine wines on the part of the buying public finally discouraged Bridgman, who sold his vineyards. The winter temperature problem influenced Clore's long-term work on cold hardiness of *vinifera,* as the need to educate the public influenced his focus on the importance of growing only high quality grapes for wine.

Washington State had an established table and juice grape industry, largely in Concords, long before it began any concerted planting of *vinifera* varieties. WSC research reflected this throughout the 1940s and 1950s, and most publications and presentations at the time focused on *labrusca* grape varieties. Besides the yearly Field Days at Prosser, when visitors were invited to tour the facilities, and talks with local civic groups, information on grape care and culture began to be spread through a few University publications, still focused primarily on Concords but beginning to shift to *viniferas*.[24]

[23] Walter J. Clore Papers 1961-1999, Folder 59, Box 2, Cage 668, MASC, WSU Libraries, Pullman

[24] Walter J. Clore, *Increasing the Production of Fredonia Grapes in Irrigated Central Washington*, Station Circular 68 (Pullman: Agricultural Experiment Stations, Institute of Agricultural Sciences, 1948); Chester L. Vincent, Walter J. Clore and Chester D. Schwartze, *Small Fruit Varieties for Home and Commercial Gardens in Eastern, Central and Western Washington*, Popular Bulletin 168 (Pullman: State College of Washington, 1943).

Additionally, there were already graduate students at WSU working on grapes.[25] These trends would accelerate during the 1950s.

Emerging problems in the 1950s

During the 1950s several long-term studies relating to both Concords and *vinifera* took place. In 1950 Dr. Nelson J. Shaulis, viticulturist at the New York Agricultural Experiment Station in Geneva, New York, spent a six month sabbatical at Prosser studying Concord grape culture and establishing pruning level experimental plots in the Church Vineyards in Kennewick. The same year saw the first documentation of severe poisoning of grapes from the herbicide 2,4-Dichlorophenoxyacetic acid (2,4-D) that was used on nearby wheat fields to control broad-leafed weeds.[26] To make matters worse, the first grape mealybugs were discovered in the state,[27] and a threat from California to boycott Washington apples and beer if Washington's legal restrictions on out-of-state wines were not lifted caused much concern. These and other problems led to Clore taking a trip in the fall of 1952 to learn more about grape production techniques in Oklahoma, Arkansas, Missouri and New York.[28] By 1953 Clore and Drs. Glenn Huber and Earle C. Blodgett[29] were conducting formal surveys of 2,4-D damage in the lower Yakima and Kennewick-Pasco areas,[30] and research by Clore and Victor F. Bruns had determined that Concords were especially sensitive to the increasingly common herbicide.[31]

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[25] Zakaria Ismail Ragab, "A Comparison of Nutrient Levels in Concord Grape Vineyards" (M.S. thesis, Washington State College, 1948).

[26] *Grandview Herald,* 9 July 1950.

[27] *Grandview Herald,* 24 August 1950. There are three species of grape mealybugs (*Pseudococcus)*, all of which damage grapes by contaminating clusters with cottony egg sacs, larvae, adults, and honeydew. Often the honeydew is covered with a black sooty mold. To make things worse, mealybugs can transmit grape viruses; they are serious pests.

[28] Walter J. Clore, "Grape Production in the Midwest and East," Walter J. Clore Papers 1961-1999, Folder 252, Box 5, Cage 668, MASC, WSU Libraries, Pullman.

[29] Dr. Glenn Huber received his Ph.D. in Plant Pathology at WSU in 1931 and served as Instructor until 1934 when he went to Puyallup as Plant Pathologist. He worked extensively with fungicides on ornamentals. A leading tree-fruit pathologist, Earle C. Blodgett was hired in 1946 jointly by the Washington State Department of Agriculture (WSDA) and WSU to work primarily on virus-free fruits at Prosser. He supervised the virus-free Plant Introduction and Quarantine Station at Moxee, several miles west of Prosser. http://plantpath.wsu.edu/aboutplantpath/History.pdf (accessed 4.22.2008).

[30] Walter J. Clore Papers 1961-1999, Folder 1, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

Other problems, such as the severe cold of the winter of 1955 and subsequent crop reductions, emphasized the need for research on cultural practices to increase hardiness, along with the ongoing trials to determine the best grape varieties for Washington.[32] White Riesling, often grown in the colder areas of Germany, survived the hard winter best, and it was long believed that the only *viniferas* that could do well in Washington were the German whites, because the state was so far north and experienced such low temperatures. *Vinifera* grape acreage was nonetheless increasing, which meant increasing grape pest problems and the need for more information, and several WSC studies initiated by a 1959 request from the Washington Wine Commission looked at insect infestations and ways to control them. Regarding the wines themselves, those being made in the state were still primarily sweet, after-dinner types or cheap, fortified wines of no distinction. By 1959, when the State Department of Commerce and Economic Development published "The Grape Industry in the State of Washington,"[33] there were only nine licensed wineries left in the state, although wine was of course being made by individuals.

Some of the early problems of the industry were solved in the next decades. The law limiting sales of non-Washington wines was finally changed in 1969, opening the state to competition and forcing wineries to improve their product or go under, and Clore's work on cold hardiness would ultimately transform the way *vinifera* grapes were grown in the state, but the 2,4-D problem continued for decades,

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[31] Walter J. Clore and Victor F. Bruns, "Sensitivity of the Concord Grape to 2,4-D," in *Proceedings of the American Society for Horticultural Science* (Geneva, NY: The Society, 1953), 125-143. Bruns was employed by the USDA Agricultural Research Service at IAREC and retired in 1975.

[32] *Cultural practices* is a catch-all term used to describe activities within the control of the grape grower, such as setting out the vines; trellising, training, and pruning; managing the amount and timing of water the plants get; spraying and other pest and disease control measures; fertilizing; controlling the crop load physically or chemically; and preparing the vines for winter. Other phrases important to understanding viticulture include *crop load*, the amount of fruit the vine produces, which is partially controlled by pruning or fertilizing. It is important because a vineyard can have a high *yield* (measured in tons per acre) of mediocre berries if the load has not been controlled, and the desirable varietal characteristics may be too diluted to make good wine. *Cold hardiness* is the ability of the vine to survive low temperatures and is affected not just by the absolute temperature, but also by whether there is snow cover on the ground, how much moisture is in the ground and the plant tissues, how much time the vines had to mature after harvest, whether they were stressed by disease, pests, or other factors, and in the early years in Washington by whether dirt was mounded up around the vines each fall. Even when all these factors are controlled, different varieties show differing levels of cold hardiness.

[33] R. K. Fox, Industrial Analyst, "The Grape Industry in the State of Washington" (Olympia: Washington Department of Commerce and Economic Development, 1959), 18, Walter J. Clore Papers 1961-1999, Folder 27, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

and new troubles arose every few years. One positive trend was an emerging core of interested amateurs who were seeking to produce quality *vinifera* wines. Chief among these were the men, mostly University of Washington faculty, who came together in the mid-1950s to share what they knew and learn more about winemaking. In 1958 they organized into a semi-formal group and began buying grapes from eastern Washington, and in 1962 they incorporated as United Vintners (now Columbia Winery) under the leadership of Lloyd S. Woodburne.[34] These wine enthusiasts were early advocates for research which could lead to badly needed improvements in the state's wine production.

Wine and grape industry associations in the 1950s

These years also saw the emergence of the Washington Wine and Grape Growers Council (WWGGC) as an active advocate for the industry. In their meeting minutes from 1949-1959 there was much discussion of varieties, yields, cold damage, pesticides, laws, and regulations, but nothing on involving WSC in research. Clore spoke at the WWGGC Annual Meeting in December 1959, although there was nothing said about a formal grape research agenda.[35] The WWGGC minutes reflected little concern with improving the quality of Washington wine, yet since Washington's sweet, cheap wines were often sold in taverns, there was discussion of the effect of a legal prohibition against women sitting at bars![36] The Council did pass a resolution of support in 1954 for a Washington State Department of Agriculture quarantine on vines that might carry Phylloxera, the root-sucking insect that had virtually wiped out European vineyards before the turn of the twentieth century. The group remained small compared to apple and wheat grower associations—just 58 members in 1958[37] —but it had begun to realize it needed help in addressing the problems the industry faced and to turn to the State College for

[34] Woodburne was a dean of the University of Washington's College of Arts and Sciences who took up winemaking as a hobby in the early 1950s. In the early days he made wine in his garage. He was quoted in his 1992 obituary as having said "We decided that for the price of joining a good country club, we could start a winery." *Seattle Times*, 4 July 1992, http://seattletimes.nwsource.com/cgi-bin/PrintStory.pl?slug=1500464&date=19920704.

[35] Walter J. Clore Papers 1961-1999, Folder 2, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

[36] Minutes of the WWGGC, 4 December 1963, Walter J. Clore Papers 1961-1999, Folder 5, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

[37] List of members, 26 December 1958, Walter J. Clore Papers 1961-1999, Folder 5, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

scientific expertise and advice Other groups were taking an interest in growing grapes for wine; around 1960 an inquiry from the Land Development Committee of the Bridgeport, WA Chamber of Commerce stimulated a state study on grape industry needs that included the objective of "Requesting and partly financing Washington State University to make studies of soils, climate, cultivation methods, land use, control, etc., and varietal development."[38] (The institution's name had been changed from Washington State College to Washington State University in 1959). Agriculturists and businesses in the state were beginning to see the value of involving scientists in solving the problems they faced in developing viticulture and enology in Washington.

Conveying research results to growers before 1960

One of the most important means of conveying the knowledge WSC researchers had accumulated to those in the industry was through talks given at the Washington State Horticultural Association Annual Meetings, followed by subsequent publication in its *Proceedings.* Presenting papers at these and other meetings gave the scientists from Prosser and Pullman the chance to share their findings and also to discuss directly with growers what problems were of most importance. The later publication of their talks spread the information to those who had not been at the meetings. From 1904 to 1947 the *Proceedings* had included only seven articles on grapes, but that was to change soon thereafter. There were two articles in 1948, one saying no more grapes should be planted as there was already plenty of acreage to meet the demand, and the other talking about the problem of getting labor when it was needed. The first time a WSC scientist contributed on a viticultural topic was in 1950, when Clore wrote on the effect of the herbicide 2,4-D on grapes.[39] Then there was a gap until 1956, when presentations were given by William O. Pruitt[40] and Clore on irrigating Concords, horticulturist John C.

[38] R. K. Fox, "The Grape Industry in the State of Washington," 18.

[39] Walter J. Clore, "2,4-D on Grapes," in *Proceedings, 46th Annual Meeting - Washington State Horticultural Association* (Yakima, WA: Washington State Horticultural Association, 1950), 195. There was widespread damage to grapes in the Yakima valley during the 1950 growing season from 2,4-D used for weed control, mostly on nearby grain crops. Next to cotton, grapes were the plant most sensitive to the herbicide. WSC began a study in spring 1950 on management of injured vines.

[40] William O. Pruitt earned his M.S. in agricultural engineering from the State College of Washington in 1951 with a thesis on sprinkler irrigation.

Snyder[41] on winter damage overall, and Clore and L.R. Bryant[42] on the response of Concords to cold.[43] In 1957, Clore and Bryant wrote about the effect of climate on Concords.[44] In 1958 there were three grape related presentations from WSC faculty: Clore and Bryant on the 1958 growing season, Clore on fertilization and fruit quality, and James E. Middleton[45] on irrigating Concords.[46] In 1959 Clore talked about the responses of Concords to the growing season and Calvin B. Skotland[47] about sooty mold fungi on grapes.[48] This gradual growth in the attention paid to problems of grape production indicates

[41] John C. Snyder earned his Ph.D. at Iowa State 1932 and began work at the State College of Washington in 1934 as a horticultural specialist. He retired in 1965. He wrote many horticultural articles for popular periodicals in addition to his more academic work.

[42] L. R. Bryant was a professor of Horticulture at Pullman in the 1940s and 1950s.

[43] William O. Pruitt and Walter J. Clore, "Irrigating Concord Grapes in South Central Washington," in *Proceedings, 52nd Annual Meeting - Washington State Horticultural Association* (Yakima, WA: Washington State Horticultural Association, 1956), 174-178. The authors discussed over- and under-irrigation, drought, and sunburn of grapes. Elsewhere in the *Proceedings,* John C. Snyder spoke on "Winter Damaged Fruit Trees," 147-173, which included a section on "Injury to grape vines and pruning suggestions for 1957," 152-155. Clore and L.R. Bryant addressed the "Response of Concord Grapes to Cold Injury," 180-183, and gave the percent of vines killed during the winter of 1955-1956 by location and the yield for surviving plants by different pruning methods.

[44] Walter J. Clore and L. R. Bryant, "Effect of Certain Climatic Factors on the Growth, Production and Maturity of the Concord Grape, in *Proceedings, 53rd Annual Meeting - Washington State Horticultural Association* (Yakima, WA: Washington State Horticultural Association, 1957), 92-94. The article discussed the effects of the 1955-1956 winter injury on the 1957 crop, berry maturity, yield, and hail damage.

[45] James E. Middleton was a WSU agricultural engineer who specialized in irrigation.

[46] Walter J. Clore and L. R. Bryant, "Some Effects of the 1958 Growing Season on Concord Grape Production," in *Proceedings, 54th Annual Meeting - Washington State Horticultural Association* (Yakima, WA: Washington State Horticultural Association, 1958), 187-189. The authors included a table of heat unit averages for 1924-1957 and a discussion of maturity at various harvest dates. In "Fertilization and Fruit Quality of Grapes," 149, Clore found Concords to be used for juice needed to test 15 percent or higher in soluble solids. Nitrogen was easily controlled by the grower, there was no observable response from phosphorus or potassium fertilizers in central Washington, and no zinc was needed unless deficiency symptoms were very severe, such as where grapes were planted on abandoned corrals. James E. Middleton in "Irrigating Concord Grapes," 190-192, gave data on seasonal water use derived from research at IES.

[47] Calvin B. Skotland worked on plant diseases such as dying arm and sooty mold.

[48] Walter J. Clore, "Some Responses of Concord Grapes to the 1959 Growing Season," in *Proceedings, 55th Annual Meeting - Washington State Horticultural Association* (Yakima, WA: Washington State Horticultural Association, 1959), 103-105. Clore discussed production, heat units, maturity, and pruning. In the same volume Calvin B. Skotland wrote "Sooty Mold of Grapes in the Yakima Valley," 133, and identified *Cladosporium* sp. as the principal sooty mold fungus on grapes in the Yakima Valley. In 1957 and 1959 processors rejected considerable grape tonnage because it was contaminated with sooty mold.

increasing interest in the state. The few scholarly publications produced by WSC personnel during the 1950s dealt with Concords and their problems,[49] while the institution's own publications covered grape varieties for home vineyards, insect pests, and zinc deficiency in Concords.[50] The significance of these publications and presentations lies in their responsiveness to the needs of growers and winemakers, commercial and domestic, and the College's growing role in research that would shape the development of the industry in the next three decades.

Summary: The Washington wine industry before 1960s

Despite Washington's early start on grape growing and small-scale wine making, its wine industry before 1960 was miniscule. Those wines being produced were generally of low quality, and protective legislation meant there was little impetus to improve. The climate was generally regarded as too harsh for *vinifera* grapes, although there was commercial production of *labruscas* for juice and jelly. Yet under these conditions, one WSC scientist—Walter Clore—had the idea that better grapes could be grown and better wine made, and as a faculty member he had both the freedom and the obligation to pursue research that would ultimately prove of great value to the state of Washington.

[49] Victor F. Bruns and Walter J. Clore, "Response of Certain Crops to 2,4-Dichlorophenoxyacetic Acid in Irrigation Water. Part III. Concord Grapes," *Weeds* 6, no. 2 (1958): 187-193; Walter J. Clore, "Factors Affecting Yields of Concord Grapes and Petiole Composition in Some Vineyards in the Yakima Valley," in *Proceedings of the American Society for Horticultural Science* (Geneva, NY: The Society, 1959), 151-155; Roderick Sprague, "Field Rots of Grape in North-Central Washington," *Northwest Science* 27 (1953): 1-16.

[50] Kenneth E. Frick and John Keene, *Control of Insects Attacking Grapes*, Extension Mimeo 1895 (Pullman: Washington State College, 1958). Clore's *Grape Varieties for the Home Vineyard In Washington*, Stations Circular 283 (Pullman: Washington State College, 1956), gave directions on planting, fertilizing, irrigating, controlling powdery mildew, and pruning for Early Giant, Csaba, Van Buren, Interlaken Seedless, Schuyler, Weingarten, Seneca, Buffalo, Romulus, Delaware, Black Monukka, Chasselas Ciotat, Bronx, Steuben, and Concord; only the Csaba and Black Monukka were *vinifera*.

Chapter 2

A Growing industry: The 1960s

Published information will be considered public property.
Memorandum[1]

Overview: the Washington wine and grape industry in the early 1960s

Wine and grape research by WSU scientists experienced tremendous growth in the 1960s. In 1960 the grape growing industry first formally requested that WSU (the name changed from WSC in 1959) undertake a long-term grape research project. The request (and funding) came from the Washington Wine and Grape Growers Council (WWGGC), as the reorganized Washington Wine Council was then known. There were at this time 73 commercial Washington wine grape growers. Clore and his associates began their wine grape (as opposed to Concord grape) research at IES in earnest, and were frequent speakers on topics such as pest control, diseases of vines, propagation, and grape production at WWGGC meetings. Already in 1961, IES horticultural aide Vere Brummund was encouraging WWGGC members to plant only premium *vinifera* varieties and to eschew *labruscas* and hybrids if they were interested in fine wines.

Also in 1961, IES obtained *vinifera* material to help meet its research agenda from the Foundation Plant Materials Service at the University of California-Davis, the major academic force in the development of the wine industry in the western United States, (Clore was at this time on a one year sabbatical in Japan studying grapes for juice and wine, asparagus, and other horticultural crops. He would continue a close association with Japanese viticulturists and enologists to the end of his life.) Subsequent WWGGC meeting reports reflect increasing contributions from WSU personnel.[2] One of the perennial problems the

[1] "Memorandum of Understanding between the Washington State University and Washington Wine and Grape Growers Council . . . concerning Research on Wine Grapes," 1964, Charles W> Nagel Papers 1964-1991, Folder 130, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[2] "We also had the opportunity for the first time of hearing Vere Brummond [sic] who represents the Experimental Station at Prosser, Washington. Mr. Brummond works very closely with Dr. Clore who has always been most able and willing to meet with us and discuss grapes. We were particularly happy with

industry had was obtaining an adequate seasonal labor force, and by 1963 the IES was conducting mechanical pruning experiments to reduce dependence on hand labor in Concord vineyards. Mechanical harvesting and later mechanical pruning would greatly reduce the need for seasonal workers, but not until after the trellising and training systems for the vines were revamped for the use of machinery. WWGGC meetings during 1964 included tours of the IES, guided by Clore and Brummund, to show members the many varieties being tested, different pruning methods and their results, ground covers for moisture and erosion control, and field trials of fertilizer and irrigation regimes. Such tours were an important means WSU personnel used to convince the industry of the value of basic research to solve basic problems. While the connection seems obvious today, in the middle of the 20th century there was still a residual sense among some farmers that science was fine in its place, but that place was not *their* fields. Persuading people to risk their livelihoods by trying new crops or treatments required a solid foundation of proven results and the ability to work together with growers and processors. WSU scientists built up such a foundation over many years through individual contacts, the printed word, and interactions with industry associations. In 1964 the WWGGC noted how pleased it was with the interest shown by IES personnel in the growing and processing of wine and grapes, and it accepted a proposal from WSU-IES to help finance a vineyard for testing new wine-grape varieties.[3]

Charles Nagel had joined the WSU faculty in Pullman in March of 1960 after taking a doctorate in microbiology at the University of California-Davis. WSU plant nutritionist Cyril Woodbridge suggested to Clore that Nagel was the person who could make wines of the grapes being grown at IAREC.[4] Originally,

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M. Brummond's remarks on grapes that he himself had been particularly interested in, also to show us in the State of Washington that we could produce a table wine grape that was superior to the Northern part of California and various parts of France, Germany, and Italy. Your Secretary most assuredly expects to spend more time with Mr. Brummond and to discuss these particular varieties at some length. I failed as your Secretary to find out just what they were, whether they were predominantly red or predominantly white, but after I gain this information it certainly will be passed along to you at the earliest date." Ivan Kearns, WWGGC Executive Secretary, to "All Grower Trustees" reporting on the 10 December 1969 meeting, 17 January 1962, Walter J. Clore Papers 1961-1999, Folder 5, Box 1, Cage 668, MASC, WSU Libraries, Pullman. Vere P. Brummund was a Research Aide at IAREC and wrote or collaborated on over 24 publications.

[3] Walter J. Clore Papers 1961-1999, Folder 3, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

[4] Charles W. Nagel, interview by author, tape recording, Pullman, WA, 25 July 2005. Nagel went on to say "In those years I had a technician and we also had some discretionary money so we could work on something we thought was important."

California-bred Nagel did not think it was possible to grow wine grapes in Washington because of the cold hardiness problem; he later said "I'd been brainwashed by Davis." Clore took Nagel to show him William Bridgman's vineyard with its old, thick Cabernet Sauvignon vines, and Nagel agreed to spend ten percent of his time on making and evaluating wine. The work was partly supported by state funds and partly by the Washington Wine and Grape Growers Council. An IES presentation to the industry group[5] on the results of its 1964 work included the usual topics such as a summary of heat units[6] and maturity measurements, experiments with gibberellins[7] and their effect on wine grape varieties, and cold injury from the freeze of 17 December 1964, plus something new: the results of tasting trials. Nagel reported on the taste tests he had run on wines made from *vinifera* grapes, with a description of the methods used in making the experimental wines and early indications from the panel members as to which varieties they preferred.[8] Clore was also there to report on innovations in grape growing, developments in mechanical harvesters, and pruning practices suitable for mechanical harvesting.

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[5] WWGGC Ninth Annual Meeting, 9 January 1965, Walter J. Clore Papers 1961-1999, Folder 3, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

[6] *Heat units* were calculated as the difference between the average of the daily maximum and minimum temperatures and a basal threshold temperature, which for grapes was 50 F, during the growing season of March to October. In other words, it was not just how hot it got, but the difference between high and low temperatures in relation to the base.

[7] *Gibberellins* are plant hormones that regulate growth and affect developmental processes such as dormancy, flowering, and maturity. They were an area of considerable research in the years after World War II. For the seminal role of the University of California–Davis on their application in grapes, see Bill Peacock, "Gibberellin and Flame Seedless Grapes," Cooperative Extension Publication TB 14-00 (Davis: University of California, n.d.).

[8] *Tasting panels* were a new way to look at the wines and wine potential of the region. Rather than hiring professional enologists highly trained in the subtleties of the art of winemaking, these panels recruited non-specialists who learned to recognize around 20 significant factors that they could then use to compare the wines they were tasting. Cornelius S. Ough and Maynard Amerine developed this approach from a French idea at the University of California-Davis, where Nagel had studied. Cornelius S. Ough and G. A. Baker, "Small Panel Sensory Evaluation of Wines By Scoring," *Hilgardia* 30 (1961): 587-619; Maynard A. Amerine and Edward B. Roessler, *Wines, Their Sensory Evaluation* (San Francisco: W.H. Freeman, 1976). The tasting panels Nagel brought together and trained in Pullman were not a cross section of the entire population of the state, but they were a good representation of the consumers who might be expected to be interested in fine wines. According to Nagel "There are two ways you can go . . . you can train a professional panel, but the problem with that I thought was you tend to instill in them your prejudice . . . The other choice was a consumer panel where you have minimally trained people . . . and I thought that would make more sense because you are trying to expand the industry and you want to put out wines that people will buy." Charles W. Nagel, interview by author, tape recording, Pullman, WA, 25 July 2005.

In 1962 the total Washington grape acreage of producing (as opposed to planted, but not yet bearing fruit) vines was 6,343 acres, of which only 280 acres were *vinifera.* American (*labrusca*) and European (*vinifera)* grape production in the state together totaled 44,762 tons.[9] The following year Clore estimated Washington had around 7,700 acres of grapes, mostly in the irrigated central region. He said "To me, some of the reasons why the grape industry has expanded in this area has [sic] been the adaptability of the Concord variety to eastern Washington conditions, the marked increase in population growth in the west and the search for profitable crops for the new lands that are continually being developed here. The indirect or direct control of the processors in limiting the contract acreage is the main factor that keeps growers from planting Concords extensively. He went on to say, "When a high quality table wine industry can be developed, that is distinctive for this area, then there will be a greater future for grapes for making wine."[10] The time for *vinifera* was coming.

Local news sources and civic boosters were very interested in developments in the grape industry, whether for juice, table, or wine. A 1963 report in the Prosser newspaper, headed "Big grape crop predicted by IES men at field day," pointed out the variety of disciplines represented by WSU scientists working with grapes.[11] Reporter Helen Willard said there were over 100 growers present to hear Clore discuss maturity and the use of gibberellins as plant growth regulators. He noted they were useful to advance vine maturity, ripen berries evenly, and reduce seeding, but that the timing of application was crucial. D. W. James[12] spoke on fertilizer recommendations, saying usually grapes did not absorb enough phosphorus or potassium to deplete the soil, but occasionally they did need supplemental nitrogen. Entomologist Wyatt Cone talked about how insect problems were changing: black vine weevils had been controlled with the application of aldrin before bloom, but thrip injury was showing up.[13] The

[9] Walter J. Clore Papers 1961-1999, Folder 30, Box 2, Cage 668, MASC, WSU Libraries, Pullman.

[10] Walter J. Clore to Lynn Bartter, Department of Agricultural Economics, Cornell University, 25 January 1963, Walter J. Clore Papers 1961-1999, Folder 44, Box 2, Cage 668, MASC, WSU Libraries, Pullman.

[11] This is an important point; it was not just horticulturists who contributed to the development of the grape industry, but economists, engineers, entomologists, microbiologists, plant pathologists, and others.

[12] David W. James was a WSU agricultural engineer specializing in fertilizers and irrigation.

[13] Grape *black vine weevils* (*Otiorhynchus sulcatus)* were vineyard pests the grubs of which fed on grapevine roots for nearly a year before emerging as adult beetles. According to Edward Proebsting, the weevils could be controlled in Concord vineyards with a single pesticide treatment, and since they are

grape mealybug, a top problem in the past, had not been a serious pest in the first half of 1963. Cone said eleven insecticides were currently being evaluated, and 5000 soil samples were being studied at WSU to determine the amount of insecticide residue from last year.[14] In another newspaper article titled "Station has top research site," IES Superintendent H.P. Singleton was quoted as saying he knew of no place with better research facilities. The library facilities were the "best in the state outside of WSU, to which they [researchers] have access." The Station at this time had 114 fulltime staff, 38 of them faculty.[15]

One year later, in 1964, another local newspaper reported that 255 growers had heard Clore predict a record crop—if the weather cooperated—as growth and buds were sufficient for excellent yield. WSU Agricultural Extension agents John Keene of Yakima County and Frank Anderson of Benton Country were in charge of the Prosser Field Day program, where Cone urged growers seeing new insect or disease damage to report it to a county Extension agent or directly to the Prosser station, as increased importation of grape plants from other parts of the country (due to shortages of planting stock in the Yakima Valley) had increased the hazard of new bugs and diseases.[16] The ability of the University to respond to situations as they developed, especially insects and diseases, was one of the benefits its scientists provided the industry.

Overview: the Washington wine and grape Industry in the late 1960s

On July 1, 1965, the Irrigation Experiment Station became the Irrigated Agriculture Research and Experiment Center (IAREC). Worries over plant contamination were increasing, and IAREC was fortunate to receive virus-free cuttings from the University of California-Davis of Chenin Blanc, Grenache, White

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flightless, re-infestation is slow. Edward Proebsting, *A History of Accomplishment* (N.p., 2003), 19. *Aldrin* was an organochlorine insecticide. It has been classified as a carcinogen, mutagen, and persistent organic pollutant, and is no longer manufactured or used in the United States. *Thrips* were insects of the Family Thripidae that fed on grapevine shoots, leaves, and fruits. They caused a netting and scarring of fruit that constricted growth; DDT was useful in their control**.**

[14] Prosser *Record Bulletin*, 15 August 1963, Walter J. Clore Papers 1961-1999, Folder 8, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

[15] Walter J. Clore Papers 1961-1999, Folder 8, Box 1, Cage 668, MASC, WSU Libraries, Pullman. The University of Washington, of course, had a larger library, but lacked materials dealing with agriculture, which was the responsibility of WSU.

[16] *Yakima Herald,* 15 January 1964, Walter J. Clore Papers 1961-1999, Folder 8, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

Riesling, Gamay Beaujolais, and Pinot Noir to add to its certified foundation plantings. It established a 1.5 acre vineyard for replicated varietal trials with Cabernet Sauvignon, Chardonnay, Chenin Blanc, Gamay Beaujolais, Pinot Meunier, Pinot Noir, Semillon, and White Riesling, most of which are still being used for premium wines today. At Pullman, seventeen grape varieties were made into wine by Nagel and evaluated by 40 trained testers.[17] The following year, 1966, George Carter became the winemaker at IAREC after retiring from the closed-out U.S. Fruit and Vegetable Products Laboratory at Prosser. This meant wines could be produced on-site while the grapes were still fresh from the vine, instead of after being shipped to Pullman with the delay and damage such delay entailed. The finished wines were then sent to Pullman for analysis and evaluation. That year WSU produced wines from the premium *vinifera* varieties Zinfandel, Barbera, Lemberger,[18] Royalty, Calzin, Nebbiolo, White Riesling, Helena, Delight, and Chardonnay. The Chardonnay was rated the highest by the tasting panel.[19]

By this time WSU was already developing a reputation for wine grape research, and in 1967 Dr. Nada Arnautova, a viticulturist from Skopje, Yugoslavia, visited Prosser for grape studies. Wine industry leaders such as André Tchelistcheff[20] and Washington growers and vintners Victor Allison, Howard Somers, and Lester Fleming[21] of American Wine Growers in Seattle were impressed with IAREC's experimental wines; they found the Grenache and Cabernet Sauvignon the best, with the Barbera and

[17] Walter J. Clore Papers 1961-1999, Folder 1, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

[18] "Lemberger" is now the more common term for this grape in the Pacific Northwest and will be used in this study except in direct quotations. In the 1950s and for some years thereafter it often appeared as "Limberger" and there was considerable discussion over possibly negative associations with the high-smelling cheese of the same name. It is also sometimes spelled Limburger and is known elsewhere as Blauer Fränkisher, Blaufränkisch, and Kékfrankos.

[19] The consistently high taste panel ratings for Chardonnays may have reflected the preference of non-professional tasters for slightly sweeter wines, or may have genuinely been due to the quality of the grapes and wines themselves.

[20] André Tchelistcheff, born in Russia in 1901, was a renowned winemaker who was brought to the U.S. by Georges de Latour of Beaulieu Vineyards in California in 1938. He died in 1994. In his 7 April 1994 obituary in the *New York Times* he was quoted as saying "Wine begins in the vineyard and always, always, we must come back to the vineyard." He consulted for several Washington state wineries.

[21] Allison, Somers and Fleming were all important in the development of the Washington wine industry through their association with American Wine Growers, which became Chateau Ste. Michelle.

Meunier promising.[22] The Gewürztraminer and White Riesling they thought too low in acidity. IAREC established variety trials behind the Paterson city well and tested a prototype mechanical harvester for the first time in 1967. A less auspicious first was the recognized occurrence of boron deficiency, resulting in total crop loss in a three year old Concord vineyard in Pasco. Research on the boron problem would continue through the 1970s and into the early 1980s.

In 1968 William Bridgman died at the age of 90. (George Thomas, the then-current owner and manager of the Santa Rosa Winery which had grown out of Bridgman's Upland Winery, died ten days later.) Bridgman's long-standing faith in the potential for growing vine grapes and producing fine wines in Washington had fallen before the economic realities of his era and the absence of enough varietal and cultural information on how to grow *viniferas* in Washington. Also in 1968 Raymond Folwell joined the WSU faculty and started nearly four decades of research on the economics of grapes. He and other WSU agricultural economists would help translate the faith Bridgman had once had, and the work of scientists such as Clore and Nagel, into a vibrant and productive industry in the state. The succeeding chapters of this study will focus on WSU's role in scientific investigations and the ways results were shared with the state's grape growers and wine makers.

Science applied: Working with the vines

There were many considerations involved in planting and operating a wine grape vineyard. Careful selection of the site was critical, as was selection of which of the hundreds of grape varieties to plant. Pests, diseases, and quarantines affected growers as much as did changing vineyard management techniques for irrigation, training and trellising, and harvesting. All these questions had to be addressed before any grapes could be crushed for making into wine, and in the 1960s WSU was already the state leader in researching the answers.

[22] Beer merchant Charles Finkel related a story involving Somers from the early days of Washington wine. Finkel discovered Ste. Michelle wines In a Corti Brothers warehouse in Sacramento. "Tasting the wines, he was amazed at their quality, especially considering the state's poor reputation for fortified fruit and berry wines like Haddasim and Pomerelle. 'The Johannisberg Riesling was the best American white wine I'd ever tasted,' Finkel remembers. He called Victor Allison at Nawico in Seattle immediately and got an unforgettable response: 'I can't give that goddamn stuff away!' Finkel flew to Seattle and became the exclusive agent for Set. Michelle in the United States, which along with Associated Vintners (later Columbia Winery) became the pioneer premium variety wineries in the Pacific Northwest." Alan Moen, "The Merchant of Beer," http://www.realbeer.com/library/authors/moen-a/finkel.php (accessed 17 June 2008). "Pomerelle" is sometimes spelled "Pommerelle."

Working with the vines: siting the vineyard

Selecting the best site for a new vineyard was a non-trivial matter. Clore and other WSU personnel were sometimes called on to give an opinion on the suitability of a parcel for grape growing. Grapes generally do well on soils most other crops would find marginal (such as those of much of central and eastern Washington, which had been largely stripped of topsoil during the recurrent Missoula Floods),[23] but different varieties can have their own soil requirements. Recognizing this, Clore proposed a series of "Land classes for grapes" focused on the differences in vigor among grape varieties that could make different soils more or less desirable. Information compiled by other WSU researchers such as Ronald Tukey in a draft "Economic land classification for tree fruits in central Washington" took into consideration location as related to services and transport, information that was also useful to potential grape growers.[24]

Other factors viticulturists needed to consider included topography (was the land flat or sloped? If it sloped, in what direction?), prevailing winds (which influenced moisture requirements and the direction the rows should be planted), soil texture and drainage (sandy or clay), soil pH and trace nutrients, and the two major limiters: water and temperatures. Water in central and eastern Washington is scarce, while in western Washington it is often overabundant for grape growing. Irrigation water could be taken directly from rivers, from wells, or from reservoirs. The accessibility and cost of water played a large part in determining the suitability of a parcel for grape growing, as did the soil characteristics that influenced how the vines would react to moisture levels. The amount of water needed, how it should be applied, and when it should be cut back to allow the vines to harden off were areas of research where WSU scientific investigations helped growers adapt to the prevailing conditions. Useful work had already been done on

[23] J. Harlan Bretz had first postulated the Missoula or Spokane floods as an explanation for the topography of eastern Washington and the Columbia Gorge along the lower Columbia River. These recurrent floods, caused when ice dams holding back huge glacial lakes in Montana broke, stripped much of central and eastern Washington of topsoil and resulted in the region now called the Channeled Scablands. They also reshaped the course of the Columbia and other rivers. Geologists now estimate that the cycle of flooding and reformation of the lake lasted on average of 55 years, and that the floods occurred approximately 40 times over the 2,000-year period between 15,000 and 13,000 years ago. U.S. Geological Survey, http://vulcan.wr.usgs.gov/Glossary/Glaciers/IceSheets/description_lake_missoula.html (accessed 4.17.2008).

[24] Unpublished proposals by Clore and Tukey dated 15 May 1967, Charles W. Nagel Papers 1964-1991, Folder 24, Box 1, Cage 639, MASC, WSU Libraries, Pullman.

grape irrigation during the 1950s, and of course IAREC was founded and predicated on the search for ways to apply the bounty of irrigation water produced by damming the Columbia; grapes were only one of the varied fruit and vegetable crops included in work done at the Center in the decades following its establishment in 1917.[25] A related factor was the climatic effect of the proximity of the Columbia River to the main wine grape growing areas.

Temperature, as measured in heat units, was the other major factor in determining varietal suitability. Picking a place for a *vinifera* vineyard required careful consideration of the heat units available. In the late 1960s Clore wrote the Atomic Energy Commission in Richland to get weather records for regions that had been under their jurisdiction (for example, parts of the Wahluke Slope, which has since proven to be prime vineyard land.)[26] Temperature was also important in calculating whether a vineyard could survive the very cold winters that occasionally occur in central Washington, although other factors also played important roles. Conventional wisdom had long held that Washington State was too far north and too cold to grow most *vinifera* varieties, and the grape industry in the state had grown up around production of *labrusca* or hybrid types. Especially before Clore did his research on the best varieties and cultural practices for *vinifera*, knowledge of minimum temperatures was critical to vine survival. Of course, temperature and water conditions varied widely between dry and often cold central Washington and the area around Puget Sound, where winters were milder but where overabundant rainfall made raising *viniferas* very difficult.

Information compiled by WSU climatologists, soil scientists, and agricultural engineers and subsequently disseminated through presentations, proceedings, and other publications was essential in helping evaluate the many factors involved in locating a vineyard, and growers were eager to take

[25] James E. Middleton, "Irrigating Concord Grapes," in *Proceedings, 54th Annual Meeting - Washington State Horticultural Association* (Yakima, WA: Washington State Horticultural Association, 1958), 190-192; gives data on seasonal water use derived from research at IES. William O. Pruitt and Walter J. Clore, "Irrigating Concord Grapes in South Central Washington," in *Proceedings, 52nd Annual Meeting - Washington State Horticultural Association* (Yakima, WA: Washington State Horticultural Association, 1956), 174-178; discusses over and under irrigation, drought, sunburn. Walter J. Clore, *Increasing the Production of Fredonia Grapes in Irrigated Central Washington,* Station Circular 68 (Pullman: Agricultural Experiment Stations, Institute of Agricultural Sciences, State College of Washington, 1948); Fredonia is a blue *labrusca* table grape. Bridgman, "Grape Culture in Irrigated Eastern Washington," N.p.

[26] Letter from Clore to the Atomic Energy Commission, 3 March 1969, Walter J. Clore Papers 1961-1999, Folder 81, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

advantage of the research results. Once a location was selected (and sometimes drained, leveled, and fertilized), the next problem to be solved was what to plant.

Working with the vines: selecting the varieties

It took years of testing to determine which grape varieties were best suited for the different areas of Washington. What was discarded was as important as what was accepted, and many grapes were listed for removal from the variety plots after a few years as it became apparent they were less desirable. It was important that WSU's many grape publications included these failed varieties, so that commercial and home growers were kept informed of which ones had been unsuccessful. The vineyard at Prosser was very important for varietal trials, but it was only one place, and the interrelationships among WSU scientists and Extension agents and private grape trial cooperators (commercial or home growers who were willing to plant vines supplied by the University and maintain records on them in return for the produce of the vines) were crucial to compiling a body of information widely applicable throughout the state. As examples, in 1969 IAREC provided grape grower Don Graves, from Dallesport on the lower Columbia River, which was in a climatic region quite different from central Washington, with 13 premium varieties for testing. WSU County Extension Agent Richard Adlard wrote Clore in January of that year requesting shipment of the balance of the grape varieties Clore wanted tested by cooperator grower Charles Henderson at White Salmon, which was yet further down the Columbia and had a different microclimate. Adlard noted that the vines provided last year had done very well, but that Henderson needed help on how to trellis and prune, and asked Clore when he might be able to pay a visit. Clore responded that he would come over the following month.[27] Like many other WSU agricultural personnel, Clore spent a great deal of time on the road visiting growers and investigating problems—in the days before cars had air conditioning!

General publications and presentations produced by several WSU scientists during the 1960s included the results of years of varietal trials, although only two titles focused solely on *vinifera* varieties.[28]

[27] Richard Adlard to Clore, 16 January 1969; reply from Clore to Adlard, 7 February 1969, Walter J. Clore Papers 1961-1999, Folder 81, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[28] Walter J. Clore, Charles W. Nagel, Vere P. Brummund, and George H. Carter, *Grape Variety Responses and Wine Making Trials in Central Washington,* Circular 477 (Pullman: Washington,

The best-known publications on varietal suitability for Washington State would not be published until the 1970s. Most publications still dealt with Concords, which were the primary grape grown in the state and the object of much general research that would also prove applicable to *viniferas*.[29]

Working with the vines: quarantines and certification in the 1960s

Keeping viruses and Phylloxera out of the state remained of great concern to scientists and certain growers, although others did not see the problem and simply wanted to get stock to plant. A manuscript from the mid-1960s titled "Virus-free wine and table grape varieties, Irrigation Experiment Station, Prosser, Washington" listed almost 50 certified varieties and gave information on which were recommended or highly recommended for central Washington, the best use of the grape, and the year cuttings would be made available.[30] The demand for new varieties to try, and for sufficient planting stock of those that had proven to be successful, meant increasing worries about the accidental introduction of viruses or pests into Washington vineyards as unwelcome hitchhikers on planting stock. Early in 1966 the WWGGC took up the situation in earnest:

> The President then turned the meeting over to Dr. Clore and Dr. Robins[31] and their assistants to explain the program on the certification of grapes and also inform us of what virus free varieties they now had and will have available for our consideration. It was felt by Robins and Clore that in order to protect the industry for virus free plantings that it was highly necessary for us to have regulations established and the Department of Agriculture to control the mother blocks and certify

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Agricultural Experiment Station, 1967); Walter J. Clore, "Grape Varieties in the Pacific Northwest," *Fruit Varieties and Horticultural Digest* 22 (1968): 68-70.

[29] D.W. Ingalsbe, A. M. Neubert, and George H. Carter, "Concord Grape Pigments," *Journal of Agricultural and Food Chemistry* 11 (1963): 263-268; Walter J. Clore and Vere P. Brummund, "Effect of Vine Size on the Production of Concord Grapes," in *Proceedings of the American Society for Horticultural Science* (Geneva, NY: The Society, 1961), 239-244; George H. Carter, "Pectic Substances in Concord Grapes with Relation to Maturation in 1963," in *Proceedings of the American Society for Horticultural Science* (Geneva, NY: The Society, 1968), 319-322; D.W. Ingalsbe, Walter J. Clore, and Wyatt W. Cone, *Measurement and Removal of Dirt on Concord Grapes Grown in Central Washington in 1967*, Circular 485 (Pullman: Washington Agricultural Experiment Station, 1968); Jean H. Dawson, Walter J. Clore, and Victor F. Bruns, *Response of Concord Grapes and Weeds to Six Annual Applications of Monuron, Diuron, and Simazine*, Bulletin 680 (Pullman: Washington Agricultural Experiment Station, 1967); Walter J. Clore, A. M. Neubert, George H. Carter, D. W. Ingalsbe and Vere P. Brummund, *Composition of Washington-produced Concord Grapes and Juices*, Technical Bulletin 48 (Pullman: Washington Agricultural Experiment Stations, 1965).

[30] Walter J. Clore Papers 1961-1999, Folder 62, Box 2, Cage 668, MASC, WSU Libraries, Pullman.

[31] John S. Robins was Superintendent of IAREC before becoming Director of Research for the College of Agriculture and then Dean of Agriculture in Pullman.

> disease free plants. Dr. Robins stated that the experiment station staff would be most happy to help us establish a guide of regulations.[32]

The well-established program in California served as the model for Washington's certification program. "Discussion of certification of plants as inspected" was still on the agenda at the WWGGC annual meeting in January of 1967, when the group decided it was necessary to set up a nursery. Clore was to make the final decision on which growers would get certified plants, an indication of the confidence the industry placed in the expertise of WSU personnel. The Council accepted "the program of grape plant certification as presented by the Experiment Station." Other topics discussed by IAREC and Pullman personnel at that meeting illustrate industry interests. Paul Mowry spoke on "Grape Field Problems," Ronald Tukey on "Promising New Growing Areas for Wine Grapes," Vere Brummund on "Varieties, Culture and Maturity of Wine Grapes in 1967," George Carter on "Wine Making Characteristics of Grape Varieties in 1967," Clore on "Evaluation of 1966 Wines," and Clore and Carter on "Wine Display and Demonstration."[33] Clore sent a memo in mid-1969 to Victor B. Allison, Otis B. Harlan, Kermit Dorsey, and WSU scientists Gaylord I. Mink, Lindsey R. Faulkner, Earle C. Blodgett, and Murit Aichele regarding the upcoming first meeting of the new grape certification committee; they were asked to make recommendations regarding the grape foundation block at IAREC. Clore was expecting USDA plant pathologist Dr. Austin C. Goheen, from UC-Davis, to attend to answer questions on grape virus diseases and how the foundation block was handled in California's certification program.[34] There were naturally numerous questions from growers about how the certification program would affect them, and Blodgett wrote up a summary for distribution through WSU Extension.[35]

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[32] Minutes of the WWGGC, 11 March 1966, Walter J. Clore Papers 1961-1999, Folder 4, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

[33] Walter J. Clore Papers 1961-1999, Folder 4, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

[34] Walter J. Clore to grape certification committee, 4 June 1969, Walter J. Clore Papers 1961-1999, Folder 81, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[35] Earle C. Blodgett, *Certified Grape Planting Stock for Washington Vineyards,* Extension Mimeo 3050 (Pullman: Cooperative Extension Service, 1969). The increase in acreage of virus-susceptible *vinifera* grapes in the state created concern over the possibility of introducing disease-carrying stock from outside. The move to quarantine plants and cuttings unless obtained from a certification program such as that at University of California-Davis made sense to WSU scientists, but they were in a delicate position, even after the Washington State Department of Agriculture had issued the quarantine order.

One incident in particular illustrates the difficulties of a publicly funded research scientist whose work directly affected growers and processors in and outside the state. Among those most angered by

Other pests and problems under investigation by WSU during the 1960s included work by Cyril G. Woodridge and Clore on black-leaf, a physiological condition that affected some grape varieties including Concords. Entomologist Wyatt Cone was focusing on black vine weevils.[36] WSU research on such problems which appeared in scholarly journals almost invariably was first shared at Washington's Grape Schools[37] and through WSU publications, as will be discussed below under "Disseminating Information."

Working with the vines: vineyard management in the 1960s

Grower interest in mechanical aids to vineyard management had increased throughout the post-war years as acreage expanded and seasonal labor became harder to find. At the 1966 Grape School,

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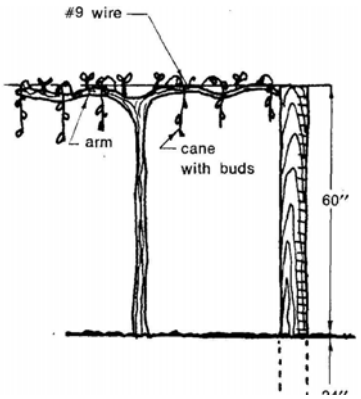
Washington's quarantine against non-certified planting stock was Paul Stark, Jr. of Stark Bros. Nurseries and Orchards in Louisiana, Missouri, who felt there was no real disease risk basis for the rules and that the ban was economic rather than scientific. He wrote to Clore in September of 1971, saying he was coming to Washington and asking for a copy of a recent Washington State University report on legislation and table wine. In December he wrote again, with copies to several others, laying the blame for the failure of a proposed resolution against the quarantine at the Washington State Horticulture Association meeting at Clore's feet ("Latest reports have it that you torpedoed our resolution at the Hort Convention . . . "). One of those copied on the letter was John M. Bloxom, Jr., Assistant Manager of the Washington Fruit and Produce Company in Yakima and President of the WSHS, who replied that he appreciated getting a copy of letter to Clore, but that the decision to kill the resolution was made by the Resolutions Committee after consulting with people other than Clore, and the responsibility rested with the WSHS.

Clore himself wrote Stark saying he regretted being brought into the problem over the virus quarantine. He did not deny the science behind the quarantine ("I am in agreement with my pathology and nematology coworkers that some control is needed over introduction of planting stock that could carry pathogens"), but noted he was not there when the resolution opposing the quarantine was first read, and that it was not his place to say whether it was a good or bad action. "They asked if I knew of any factual information that would change my thinking on the value of quarantine, which I don't." Clore had suggested referring the resolution to the new state grape organization (formed 15 December 1971) and continued his letter to Stark with the statement that "To my knowledge and understanding the virus quarantine was not intended as economic blockage of stock from outside the state." Clore to Stark with copies to several, 21 December 1971, Walter J. Clore Papers 1961-1999, Folder 216, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

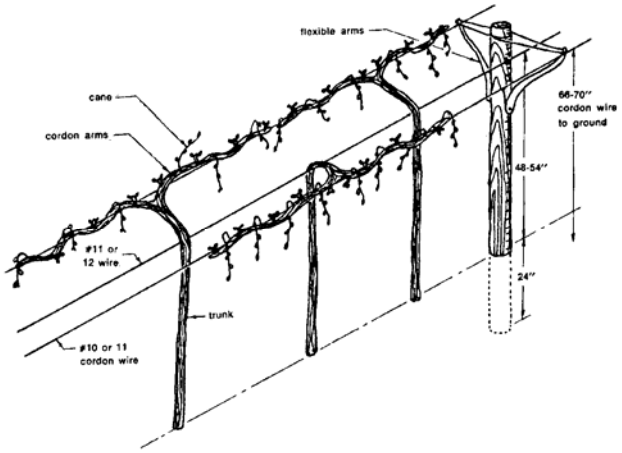
[36] Wyatt W. Cone, "The Black Vine Weevil *Brachyrhinus sulcatus* as a Pest of Grapes in South Central Washington," *Journal of Economic Entomology* 56, no. 5 (1963): 677-680; "Control of the Black Vine Weevil *Brachyrhinus sulcatus* on Concord Grapes in Central Washington" *Journal of Economic Entomology* 58, no. 1 (1965): 155-119; "Black Vine Weevil Larval Damage to Concord Grape Roots at Different Larval Densities" *Journal of Economic Entomology* 61, no. 5 (1968): 1220-1224. Cone also wrote one general report: *Control of Insects on Commercially Grown Grapes*, Extension Mimeo 2089 (Pullman: Cooperative Extension Service, 1967).

[37] Grape Schools, later called Grape Seminars, were one- or two-day meetings where growers came together with scientists to talk about grape problems and practices. They were normally held once or twice a year in Washington, often but not always in conjunction with the annual meeting of the horticulture or grape societies. They were social as well as professional gatherings, and a good place for WSU scientists to meet with growers to talk about what research was needed.

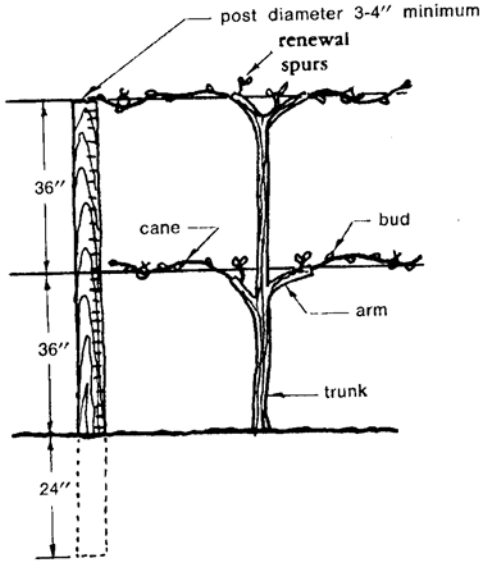
growers were shown a double curtain trellis system intended for machine harvesting.[38] Clore reported in an article in the trade publication *Wines and Vines* that Washington had produced its second largest crop in 1967, estimated at 72,500 tons. Along with information on the growing season, variety trials, and labor, he provided advice on converting to the Geneva double curtain (GDC) trellis system. This system, in



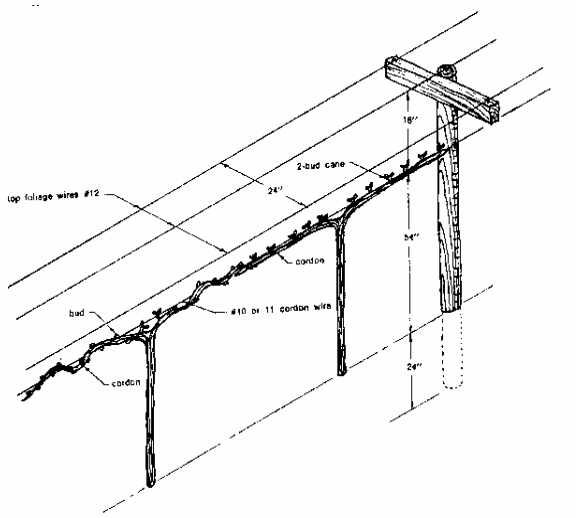
Single wire system



Geneva double curtain system



Two-wire vertical trellis



"T" trellis, bilateral cordon trained

Figure 2. Examples of trellis systems. From Mohammed Ahmedullah, *Training and Trellising Grapes for Production in Washington* [Pullman]: Washington State University, Cooperative Extension, [1996].

[38] *Yakima Morning Herald*, 9 December 1966. Trellising systems in common use were the Kniffin and the Geneva Double Curtain (GDC).

contrast to arbors or single wire trellising, made mechanical harvesting possible.[39] Clore and others were also investigating plant growth regulators such as gibberellin for control of vine growth and maturity.[40]

The area where vineyard management techniques would prove to be most effective in helping to develop the wine industry in Washington was cold hardiness, which had been an area of research for Clore and others since 1937. The problem had begun to be addressed at meetings of the Washington State Horticultural Society (WSHS) in the 1960s,[41] although the main research in Washington State did not begin until the 1970s when the surge of interest in *vinifera* plantings made it more critical. Throughout the 1950s and 1960s the WSHS meetings, despite the strong tree fruit emphasis of the organization, had served as a means of disseminating work being done at WSU on grapes. Fertilization, fruit quality, sooty mold, virus diseases, yield, weather, and cultural practices were all occasionally discussed at WSHS meetings until the Washington State Grape Society (WSGS) was formed in 1971.[42] After that the new group's annual meetings and grape schools or seminars became the preferred setting for informing the industry about WSU research on cold hardiness, vineyard management, and other wine-related issues.

Science applied: working with the wines in the 1960s

Until 1964 WSU's research on grapes had been very much centered on Concords, which were primarily grown for juice. Clore's work with *vinifera* had fostered his growing belief in the potential of the

[39] Walter J. Clore, "Regional Agricultural Authorities Report on Last Year's Grape Growing Season in States Other Than California," *Wines and Vines*, no volume or date, 22, Walter J. Clore Papers 1961-1999, Folder 53, Box 2, Cage 668, MASC, WSU Libraries, Pullman.

[40] Walter J. Clore, "Responses of Delaware Grapes to Gibberellin," in *Proceedings of the American Society for Horticultural Science* (Geneva, NY: The Society, 1965), 259-263.

[41] Walter J. Clore and Vere P. Brummund, "Cold Injury to Grapes of Eastern Washington 1964-65," in *Proceedings, 51st Annual Meeting - Washington State Horticultural Association (*Wenatchee, WA: Washington State Horticultural Association, 1965), 143-144; Walter J. Clore and L. R. Bryant, "Response of Concord Grapes to Cold Injury," in *Proceedings, Annual Meeting - Washington State Horticultural Association* (Yakima, WA: Washington State Horticultural Association, 1956), 180-183; John C. Snyder, "Winter Damaged Fruit Trees," in *Proceedings, 52nd Annual Meeting - Washington State Horticultural Association,* (Yakima, WA: Washington State Horticultural Association, 1956), 147-173; includes section on "Injury to grape vines and pruning suggestions for 1957," 152-155.

[42] The organizational meeting was held at IAREC. The intent of the founders was to "facilitate the flow of information from researchers to growers, to record and publish this information for future reference and to include all segments of the industry." According to the Society, in 1971, at the beginning of the era of mechanical harvesting, there were 9,700 acres of Concords and 200 acres of vinifera grapes in the state. http://www.grapesociety.org/about/history.html (accessed 22 August 2007).

state for producing fine varietal wines, but there was an important question beyond what grapes would grow: what would consumers actually drink? Charles Nagel had joined WSU in Pullman in 1960 as a food microbiologist, and Clore soon had him involved in making wines from IAREC grapes that Nagel then evaluated using his trained tasting panels as noted above.

Nagel had the advantage of using data already available from earlier analyses of factors influencing wine quality and acceptability (such as soluble solids, titratable acidity, pH, etc.) that had been carried out on some 30 varieties grown at IAREC from 1958-1963.[43] In 1964 and 1965 grapes were shipped from Prosser to Pullman for Nagel to process into wine, but thereafter the winemaking was done in Prosser under the supervision of George C. Carter, which meant the grapes were fresher when they went into the vat. Unfortunately, both vines and wines were hedged about with state and federal government regulations, and complying with them ate into a researcher's time. In making wines Carter and Nagel did not have to deal with plant quarantines, but as seemingly simply a matter as transporting the young wines from WSU-Prosser to WSU-Pullman involved complying with complicated federal regulations on how and how much wine could be shipped.[44]

WSU scientists also needed to employ standardized practices and procedures to ensure comparability across years and varieties, and to refine those procedures over the years.[45] Failure to do

[43] Charles W. Nagel Papers 1964-1991, Folder 5, Box 1, Cage 639, MASC, WSU Libraries, Pullman.

[44] A. Douglas King, Jr. Microbiologist, USDA Processing Technology Investigations, Fruit Laboratory, Albany CA to Nagel, 3 April 1968; William B. Ackley to the Asst. Regional Commissioner, Alcohol and Tobacco Tax Division, Seattle, 26 December 1968, Charles W. Nagel Papers 1964-1991, Folder 68, Box 1, Cage 639, MASC, WSU Libraries, Pullman. King's letter was in regard to a permit to transport not more than 50 gallons per year of experimental table wines from Prosser to Pullman and gave the Experimental Wine Permit number as required by the wine regulations in Chapter 26 of the Code of Federal Regulations.

[45] Letter from Nagel to George Carter, 5 April 1966, on procedures used for analysis of juice and wine samples. Carter would need a colorimeter, pH meter, steam distillation apparatus, distilling flasks, condensers, and a refractometer, and was to figure out what glassware he needed. Nagel went on to give supplies and equipment needed for fermentation and culturing yeasts. Another letter from Carter to Nagel, 12 July 1968, discussed the necessity for standardized procedures for wine variety evaluation; Carter thought WSU's procedures were superior to those of Cornell. He noted the main problem with the wines of the past season was the browning of some of the whites and suggested alternative procedures. Another letter from Nagel to Clore, Carter, and Brummund, 19 December 1969, discussed harvesting procedures and which varieties to test in the future based on the past five years. Nagel thought the soluble solids of whites should not be allowed to exceed 225 ppm in order to avoid the problem of residual sugar in wines and suggested two amelioration procedures for lowering acidity. He also made suggestions for technical changes in wine making and noted it was important to track the soluble solids and acid content of all varieties during the season. Carter's response discussed acidity, color

so would have meant the relative ratings of two wines, for example a 1967 and a 1969 White Riesling, could be attributed to a difference in fermentation temperature rather than the differing irrigation regime that was under study, or that a Lemberger might rate higher than a Cabernet, not because it was a truly better variety for central Washington, but because the Cabernet had not been allowed as much time on the skins.

Besides the usual considerations of sugar and acidity, color was another aspect of wine acceptability addressed by Carter and Nagel. Procedures for determining color values by variety were drawn up and tested against 23 red 1968 wines. Included were Cabernet Sauvignon from three vineyards, Lemberger, Merlot, Nebbiolo, Buffalo, Tannat, Royalty, Calzin, Concord, Schuyler, Petite Sirah, Foch, Trousseau, Meunier, Chauche Noir, Gamay Beaujolais, Blauer Portuguese, Eumelon, Grenache, Zinfandel, and Pinot Noir.[46] All were evaluated for varietal color and clarity, properties that added to the enjoyment of wine just as aroma and flavor did. Most of the characteristics by which wine is evaluated were subject to augmentation and amelioration during winemaking and aging, and these procedures were the focus of Nagel's work.[47] During the 1960s the science and art of enology were just beginning to be studied at WSU; the real push for research on wines would come later in the 1970s and 1980s, once the questions of suitable varieties for Washington and their care were well in hand.

Working with wineries and wine experts in the 1960s

Besides commercial grape growers, individual cooperator growers, and trade groups, WSU scientists (and economists) worked directly with the few established commercial wineries in the state throughout the 1960s. A 1966 letter from Ivan Kearns, Executive Secretary of the WWGGC, to Nagel with a list of wines made by Washington wineries gave the more substantial operations in the state: Alhambra

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measurements, slow fermentation of white wines, and the effect of agitating the wines two times a week for three weeks on such slow fermentation; he agreed with Nagel's suggestions for amelioration. He had not been getting enough color or tannin with some varieties, but thought as a general rule for red wines fermenting for five days on the skins should work. He also noted that Clore had additional data on varieties not used for wine making that should be added to the proposed WSU *Circular*. All letters, Charles W. Nagel Papers 1964-1991, Folder 91, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[46] Charles W. Nagel Papers 1964-1991, Folder 11, Box 1, Cage 639, MASC, WSU Libraries, Pullman.

[47] As examples of *amelioration* techniques, wines may be left on the must for longer or shorter times, put through a secondary fermentation, fined with bentonite, aged in oak, etc.

Wine Co., Selah; American Wine Growers, Seattle; Associated Vintners, Seattle; Old West Wines, Renton; Santa Rosa Winery, Sunnyside; Weberger Winery and Distilling Co., Shelton.[48] These vintners would have been major beneficiaries of the work being done at Prosser and Pullman.

Close cooperative relationships benefited both the wineries and WSU researchers. Carter wrote to Howard Somers of American Wine Growers in 1968 to find a source for 300 coated 1.75 or 2 inch corks so he could age some reds for several seasons; he also needed to find a hand corker that would not leave a crimp on one side, a reminder that WSU personnel did not always have the best or most up-do-date equipment to work with.[49] An important facet of this cooperative work was the wine tastings involving acknowledged outside experts such as Louis Martini, President of Louis Martini Wines. He wrote George Carter in early 1969 with appraisals of some of the IAREC wines that had been sent him for evaluation. Three people at his establishment had independently tasted and commented on them; they found the wines not bad, but lacking full varietal aroma, flavor, and body. He and his colleagues had rated the 1967 Helena the best of the lot, and the 1966 Lemberger as best of the reds.[50] The whites wines in general were faulted for low varietal characteristics and for "coarseness." The reds were regarded as quite good, but also somewhat lacking in varietal characteristics and body. Martini noted he had tasted other 1966 and 1967 Washington wines and found the same faults, and Carter replied that he was glad their evaluations coincided with some his own, agreeing that cooler fermentation for the whites would help preserve the grape aroma.

Later in the year another tasting was held, this time at IAREC, with wine professionals Brother Justin and Rollin Wilkinson of Christian Bros., Dr. Lloyd Lider and others from the University of California-Davis, and Dr. Nelson Shaulis of Cornell University's New York State Agricultural Experiment Station at Geneva, New York. They tasted 18 Washington State *vinifera* wines, and rated most of them only fair to

[48] Ivan Kearns, Executive Secretary, WWGGC to Nagel, 8 June1966, Charles W. Nagel Papers 1964-1991, Folder 69, Box 1, Cage 639, MASC, WSU Libraries, Pullman. Note that several of the wineries were on the west side of the state, although almost all the grapes used came from central Washington.

[49] George Carter to Howard Somers, 15 July 1968, Walter J. Clore Papers 1961-1999, Folder 5, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

[50] According to Nagel, he and his colleagues thought Lemberger was well adapted to central Washington, but it was not until the early 2000s that people were turning out "respectable" Lemberger wines. Charles W. Nagel, interview by author, tape recording, Pullman, WA, 25 July 2005.

poor. [51] Paul Osteraas, Vice-President of Vineyard Operations for Gallo Winery Ranch, also wrote with results from a taste panel. Again, the 1967 Helena was rated the best; most whites had a high titratable acidity and were judged good for blending, but not on their own. Osteraas thought the Gewürztraminer, Chardonnay, Muller, Melon, Merlot, Lemberger, Cabernet Sauvignon, and Foch all showed potential, and recommended keeping production of premium varieties to eight to ten tons per acre or less with an early cut off for irrigation (to mature the wood), followed by a late fall irrigation (to weather the vines through winter.) Of the red wines, he thought some would make good blending wines, and that overall the wines were promising, with the whites better than reds.[52] Such expert opinions, combined with the tasting panel results, were important because they gave a good sense of where researchers and growers should concentrate their efforts.

In fall of 1969 a wine evaluation was held at the American Wine Growers plant in Seattle. Present were AWG's Howard Somers, Ivan Kearns, and Victor Allison; Drs. Peck and Woodburne of Associated Vintners; Brummund and Carter; and wine author Leon Adams, who implied Washington could produce better wines than it had in the past. Also present was the very well-respected and outspoken French-trained Russian vintner André Tchelistcheff of Beaulieu Vineyards in California. Tchelistcheff's opinions were highly valued in the wine world (although Clore thought him overrated) and his recommendation was that Washington concentrate on Chardonnay, Gewürztraminer, White Riesling, Grenache, and Cabernet Sauvignon; he failed to recognize the real potential of the state for producing the top-quality reds for which it is known today.[53]

Adams later sent Clore a letter saying the manuscript of his "Complete Book of American Wines" was nearly done and asking for copies of grape or wine publications dealing with Washington since 1966. He also wanted a good deal of other information: a detailed status report on the varietal trials, information on any new wineries, thoughts on whether Seneca Foods might be planning on producing

[51] "Wine evaluations, August 16, 1969," Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 237, Box 4, Archives 214, MASC, WSU Libraries, Pullman.

[52] Paul Osteraas to Clore, 7 October 1969, Walter J. Clore Papers 1961-1999, Folder 7, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

[53] Charles W. Nagel Papers 1964-1991, Folder 109, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

wine in the state, interesting visitors who had been looking over vineyard potential, new developments at Prosser since 1966, the status of the grape certification program, trends in grape planting and wineries since the removal of protective legislation, and information on attitudes toward the prospects for Washington wines. Clore sent him the recent publications and answered the questions: Yes, Seneca had indicated interest in grapes for wine in Washington, and Philip Wagner was probably the best source of information. Ernest Wente and the Gallo wine people had been recent visitors. There were probably enough cuttings of *vinifera* in the state to plant 400 acres, but state wineries had been non-committal on future programs, and some grapes were being sold to British Columbian wineries, Seneca Foods Corporation, and home winemakers. In 1968 Cabernet Sauvignon grapes had brought $225 a ton, and the higher prices paid in New York that year for wine grapes were exciting for Washington growers as an indication of the potential for the industry. The grape certification program had been approved 2 May 1968, but only one nursery was active in the program, the Olwell Ranch in Wapato. Clore's opinion was that the potential for fine wines in the state was great, and that they could be made without amelioration, but the greatest concern was winter hardiness.[54] Adams seems to have incorporated some of this information into a short summary titled "Wines of Washington" in which he noted that WSU economists predicted Washington would displace New York as the 2nd largest grape-producing state by 1980. In regard to the role of the University in the wine industry, he said Washington wineries in 1965 "saw that their protective law was about to be changed. They then persuaded the State University to start a research program on wine grapes at its Prosser Station in the Yakima Valley." Adams mentioned Clore, but not the fact that he had started work on grapes at WSU-IES in 1937, almost thirty years before.[55]

Much wine expertise pertinent to the needs of Washington State was to be found in Europe, and Clore wrote to the superintendent of IAREC in 1969 about a trip he wanted to take. He requested permission to combine his 1969 and 1970 annual leave so he could travel to northern Europe in the fall of 1970 to visit outstanding wine institutions and growing areas where he could study techniques that

[54] Leon Adams to Walter J. Clore, 12 August 1969; Clore to Adams, 18 August 1969, Walter J. Clore Papers 1961-1999, Folder 81, Box 3, Cage 668, MASC, WSU Libraries, Pullman. Adams published no book titled *Complete Book of American Wine.* If what he refers to here is what became his *Wines of America,* it was not published until 1973.

[55] Charles W. Nagel Papers 1964-1991, Folder 113, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

promote hardiness in *vinifera*. (He was not asking for extra leave, just for permission to use two years worth of his own earned vacation to study vines and wines in regions that were like to practice techniques which would be beneficial to the Washington Wine industry.)[56] He and others from Pullman and Prosser also made fairly frequent trips to California, center of wine expertise in America, and occasional trips to other grape growing areas of North America such as New York, Pennsylvania, Arkansas, and British Columbia.[57]

Working with industry organizations in the 1960s

WSU scientists routinely worked closely with industry and trade organizations. In a talk titled "Why a late premium wine bloomer?" Clore noted that the Washington Wine and Grape Growers Council had recognized changing trends in consumer preferences for table wines, and in 1964 agreed to begin providing funding for a WSU grape and wine research project.[58] This project was a good example of the increasing interest in the industry in having the University apply its scientific expertise to solving grape and wine problems.[59] Its aim was to determine growth, fruiting characteristics, and suitability for wine production of certain *vinifera* grape varieties. Clore was to be responsible for establishing and maintaining the vineyard and collecting data on growth and fruit characteristics, while Nagel's job was analyzing the fruit, making the wine, and evaluating the final product. One very important clause in the agreement was that "Published information will be considered public property." This was at the essence of the land grant mission of the University: knowledge was created for public use, not just to benefit any one individual or group.

[56] Walter J. Clore to J. Lewis Allison, 24 November 1969, Walter J. Clore Papers 1961-1999, Folder 81, Box 3, Cage 668, MASC, WSU Libraries, Pullman. He was allowed to use his vacation for the trip.

[57] One example of what was learned on such trips is a six-page travel report on a trip Tukey, Clore, and Extension economist Samuel Doran took to Davis and the Napa Valley in California, 22-23 August 1968, regarding the potential for *vinifera* in Washington. Charles W. Nagel Papers 1964-1991, Folder 37, Box 1, Cage 639, MASC, WSU Libraries, Pullman.

[58] Walter J. Clore Papers 1961-1999, Folder 38, Box 2, Cage 668, MASC, WSU Libraries, Pullman.

[59] "Memorandum of Understanding between the Washington State University and the Washington Wine and Grape Growers Council …concerning Research on Wine Grapes," 1964, Charles W. Nagel Papers 1964-1991, Folder 130, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

A memo from Harold P. Singleton, Superintendent of the IES, to Director of the Washington Agricultural Experiment Station M.T. Buchanan and Chair of Horticulture Ackley asked them to check over the project Memorandum of Understanding (MOU), noting "As soon as the Memorandum is signed the first grant of $800.00 for the calendar year of 1965 will be sent to us by the Washington Wine and Grape Growers Council." Buchanan had reservations and quoted (without attribution) a comment he had received: "One comment is, for example 'I doubt that we can afford to accept this grant. The budget attached appears unrealistic in that it lacks funds to establish and care for vineyards.' In view of this, it is my suggestion that we discuss this when you are here." Nagel's feeling was that it was a "Rather modest amount of money but why look a gift horse in the mouth if we're going to do the work anyhow." [60]

The project called for nine-to-ten of the most promising *vinifera* grapes from the trials at Prosser to be propagated for setting out in the spring of 1965 in plots of 24 vines, replicated four times and randomized, with two different training treatments per plot. They were to be trellised at the close of the first season; the second season they would receive only cultural care and vine training. Some fruit was expected by the third year, but not enough to make and evaluate wine. WSU, through the Irrigation Experiment Station, agreed to provide the necessary personnel, erect the trellises, and plant and care for the vines; to furnish the land, irrigation, and laboratory facilities; and to make an annual report on results to the Council. The Council agreed to provide annual support (the grant was $800 for 1965, with WSU contributing $1,214 in salaries, supplies, materials, and indirect costs), and to determine in advance the amount of support which would be available in future years. The university would furnish a report of expenditures on request. Representatives of the Council, the Chair of the Department of Horticulture, and the Irrigation Experiment Station Horticulturist were to be in charge. Research was to be conducted within the same framework as that used for the earlier Project 1617, "Varietal Investigations of Small Fruits for Irrigated Central Washington." Any publication of results was to be determined by the university and submitted to the Council for review and suggestions, but the names of the university or its departments were not to be used in advertising in connection with this work without permission of the university president. Equipment purchased with grant funds was to be the property of the university. A

[60] Note from Nagel to "Bill," 8 November 1964, Charles W. Nagel Papers 1964-1991, Folder 130, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

planning group was to prepare the annual budget showing the breakdown of funds needed for the coming year. The MOU included a proviso that the cooperative agreement would continue indefinitely, but might be modified or discontinued at the request of either party.

As a typical sample of agreements between the university and industry groups, this memorandum gives a sense of what a research project entailed and the obligations of both parties. When the new IAREC Superintendent John S. Robins wrote to the WWGGC Executive Secretary Ivan F. Kearns in 1965 about a proposed research program on wine and wine grapes, he included a table showing WSU's investment over several years as justification for the difference in future budgets as compared to past.[61] Robins said he was "confident that this proposed increase and spreading of financial support across the entire program would do much to add impetus and stability to the total effort." The "Continuing Budget for Wine Grape Variety and Wine Production Studies" noted that a revision was necessary because of higher than anticipated costs in establishing and maintaining the experimental wine variety vineyard, supplemental travel and evaluation funds needed by Nagel for wine evaluation work, and the costs of the food processing work formerly funded by USDA. The increased funding requested would allow evaluation of three training and trellising systems on each variety, as well as studies of the effects of covering vines with soil for protection in winter, which was a labor intensive and therefore expensive process. Additionally, a chemist working at Prosser would be able to devote "nearly full time to wine making in the fall under Dr. Nagel's direction, adding stability to this part of the program and assuring the continuation of this work." The detailed budget gave the actual dollar figure for 1965 for the "Wine variety vineyard"—$1,018.80—right down to the staples and nails for 342 posts, and estimated costs for 1966-1969 (including $5.00 for twine in 1968, but excluding salaries) at $1,250 per year. It also included the projected expenses for 1966-1969 for grape processing and wine production, varietal wine evaluation and travel, and data analysis and publication costs (analysis and publication together were only $100 per year!) WSU's contribution was given as $11,960 per year for personnel and indirect costs (Clore's time was calculated at two months, Brummund three months, Carter two months, Nagel one month, day labor four months.) Just two weeks later Robins wrote again, to thank the Council for approving the 1966

[61] J. S. Robins to Ivan Kearns, 10 December 1965, "Continuing budget for the wine grape variety and wine production studies," Walter J. Clore Papers 1961-1999, Folder 24, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

budget at the higher level of $1,250. The program at the 1966 WWGGC annual meeting included several reports related to research done as part of this project: Robins on grape vine certification, Brummund on the 1966 experimental wines, Clore on producing grapes for yield and quality, and Nagel on experimental production and evaluation of wine grape varieties.[62]

An IAREC proposal from 1969 titled "Washington State University Proposed Research to Meet the Needs of the Grape industries of the State of Washington" described the situation faced by University researchers in most departments, not just the College of Agriculture. Funds available through state and federal appropriations barely met the maintenance expenses of facilities and personnel.[63] The situation had worsened recently; it was now "necessary for research needed in crop commodities to be supported in part by grant funds if the work of present researchers is to be effective." The proposal included lists of areas of research to help solve the most pressing grower, processor, and marketing problems, and gave cost estimates for four main areas. The first area included general management; trellising, training and pruning; fertilizer nitrogen levels; sprinkler irrigation; pest control for black vine weevil, grape mealybug, rodents, and cutworm (noting that grape leafhopper, stinkbug, cottony maple scale, and other problems could probably be handled using existing state-appropriated funds); plant diseases; and control of bindweed and Canadian thistle. The second area covered processing and culture-related problems of Concord juice: sugar-acid ratios, pH, and potassium bitartrate. The third area focused on the culture, handling, and marketing of Campbell Early grapes. The final area dealt with wine grape culture and wine making – varieties, evaluation and analysis, crop load, time of harvest, cultural practices for cold hardiness, fermentation temperatures, time on the skins, aging, and the economics of establishing a winery. The researchers named were Clore, Cone, Dailey, Dow, Middleton, Mink, Nagel, Ogg,[64] and Woodbridge. Unfortunately, 1969 was not a good time to be asking for funding from the WWGGC or any Washington wine grape grower or processor; as much as research was needed to carry the industry

[62] Letter from Ivan Kearns to members of the Washington Wine and Grape Growers Council, 4 November 1966, Walter J. Clore Papers 1961-1999, Folder 53, Box 2, Cage 668, MASC, WSU Libraries, Pullman.

[63] This was in the middle of the Vietnam War, when federal funds were being put to other purposes.

[64] Ogg was a USDA faculty member stationed at Prosser. He started as a Research Technician in 1963 and was later promoted to Plant Physiologist. Singleton, *The Irrigation Experiment Station*, 53.

forward, everyone was facing the implications of the passage of the bill removing special status for Washington wines (discussed below).

Probably in response to a WWCCG question, William Ackley wrote to Clore, Nagel, Carter, Woodbridge, and Dailey late in 1969 regarding the amounts spent or budgeted from state funds for research on grapes by the WSU Departments of Horticulture and Agricultural Economics for the fiscal year. Including salaries, wages, operations (contractual services, travel, supplies), and equipment, but not overhead (facilities, library materials, etc.), the figures for Horticulture were $11,478.60 and for Agricultural Economics $7,535, making the WSU total $18,833.60. Funding from the Washington Wine and Grape Growers Council had remained at $1,250 per year for four years.[65]

While most of the business of the WWGGC dealt with advertising, trade shows, vendors, conventions such as those of the Grocers and the Beer and Wine Wholesalers, unions, labor shortages, and public relations efforts such as production of a wine recipes booklet, WSU personnel were consistently invited to the annual meetings to give updates on their scientific work. The secretary's report from a meeting early in 1966 noted "the extension services[66] from Washington State University wanted to visit the wineries in the state in conjunction with their work. A program was presented which would raise the cost of our support from $800 to $1250." (The proposal had passed unanimously.) The secretary was instructed to notify the Experiment Station and invite "these gentlemen" to the next regular meeting of the trustees to explain their program. Regarding a proposal to raiser grower dues from 50 cents to $1 per ton, "It was brought out that the dollar would cover the Annual Meeting and the growers portion of the contract with Washington State University."[67] The afternoon session that year was devoted to panel discussions with IAREC personnel, where Brummund discussed the severe cold injury to grape varieties in 1964 and 1965, Cone spoke on insects of wine grapes such as the McDaniel mite and black vine

[65] William Ackley to WSU researchers, 22 December 1969, Charles W. Nagel Papers 1964-1991, Folder 130, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[66] It should be noted that the general public and indeed sometimes even WSU personnel were inconsistent about the use of names for the different University units involved with grape and wine work. Here "extension services" does not mean what used to be called Agricultural Extension or Cooperative Extension and is now called simply "Extension." It is clear the reference is to the work being done at IAREC in general.

[67] Minutes of the WWGGC, 8 January 1966, Walter J. Clore Papers 1961-1999, Folder 4, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

weevils, and Paul Mowry talked about pesticide problems and control. Clore covered innovations in trellising and mechanical harvesting of grapes for wine, while Nagel discussed the early results of experimental evaluations of grape varieties for wine, followed by a tasting session.[68] "This afternoon meeting certainly met with the approval of all those in attendance and much was learned from the remarks from these gentlemen."[69]

Throughout the mid-1960s the WWGGC was greatly interested in WSU's work on determining which wine grape varieties would do best in Washington. In 1966 Brummund advised the members that IAREC had some types of virus-free plantings going, although the overall program had had a setback due to the severe winter. He felt that further research could be facilitated by the council members deciding on what types interested them most. After much discussion the growers decided they would like the Experiment Station to expedite work on Grenache, White Riesling, Pinot Noir, Chenin Blanc, and Cabernet Sauvignon.[70]

For the 13th annual WWGGC meeting in 1968 in Yakima, WSU personnel once again presented the results of projects undertaken with financial help from the Council. Dr. Tukey officiated over the afternoon program and spoke on classification and adaptation of varieties. Brummund spoke on variety maturity and quality of the 1968 harvest, Samuel M. Doran (Extension Agricultural Economist, WSU-Prosser) on yields, Carter on wine making, and Atallah on evaluation of the 1967 WSU wines.[71] These were still early years in the development of fine varietal wines in Washington, and the program included a recommended food and wine pairing guide that was far different from what it would be today: for an

[68] Nagel suggested in a letter of 8 November 1966 to Howard Somers of the National Wine Co, Seattle, with a copy to Kearns as WWGGC executive secretary, that his [Nagel's] talk be brief so there would be more time for tasting both WSU wines and selected commercial products; like Clore and other WSU personnel, he understood the importance of working to advance the industry overall. Walter J. Clore Papers 1961-1999, Folder 5, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

[69] Walter J. Clore Papers 1961-1999, Folder 4, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

[70] "Discussion was held on the new grape varieties being sponsored by the Experimental branch of Washington State University, and since the growers are particularly interested in the progress reports on these [it] was suggested that we again present the group from the Experiment Station …The President directed the Secretary to contact the Experiment Station and make arrangements with them for the Annual Meeting." Minutes of the Washington Wine and Grape Growers Council, 24 September 1966, Walter J. Clore Papers 1961-1999, Folder 4, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

[71] Program, 13th Washington Wine and Grape Growers Council annual meeting, 8 November 1968, Walter J. Clore Papers 1961-1999, Folder 4, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

appetizer, well chilled sherry; with fowl or fish, sauterne or rosé; with game, beef or pork, burgundy or rosé. The list of some of the grapes being grown for wine in Washington included Golden Chasselas, Pinot Chardonnay, Grenache, Portuguese Blue, Semillon, Alicante, Muscat of Alexandria, Zinfandel, Pinot Noir, Delaware, Campbell Early, White Diamond, and Cabernet Sauvignon; note that there were *labrusca*s being used for wine, but no syrah or merlot.

The WWGGC had started funding WSU grape and wine making studies in 1964. By time of the final 1969 hearings on repealing the old protective taxes, the University was only in the sixth year of wine evaluations, but both production and quality seemed promising. Robins, J.L. Allison, Clore, Carter, Victor Allison, Ivan Kearns, and Howard Somers met at Associated Wine Growers in Seattle in January of 1969 to talk about further industry support. Robins noted that WSU had received no increase in its budget for wine work from state or federal sources between 1955 and 1967. The potential for making fine wines in Washington certainly existed and the research to make it happen was underway, but more support was needed. Kearns noted that the present market situation was that two large competitors controlled the market nationwide, making it hard for the industry to increase its funding. Superintendent J.L. Allison replied that IAREC was putting a disproportionate share of its funds into grapes ($47,000).[72] Afterwards Clore sent Victor Allison a letter enclosing the budget for the wine grape variety and wine producing studies since 1965, along with a sheet showing what was being contributed to wine research by WSU (which included 3 months of Clore's time, eleven months each for Brummund and Carter, two weeks for Mink, and one month for Nagel, plus labor, supplies, and operation and indirect costs for a yearly total of $38,570.20.) He said he realized the depressing effect a change in wine laws might have on present wineries, but noted that increased funds were needed to continue to develop information through research, especially for management techniques to minimize cold damage and for the indexing essential to the vine certification program. As proof of potential, Clore included a copy of Louis Martini's encouraging letter on evaluations of the experimental wines.[73] Victor Allison wrote back that he would

[72] Notes of meeting at Associated Wine Growers, Seattle, 6 January 1969, Walter J. Clore Papers, 1961-1999, Folder 5, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

[73] Martini to Carter, 22 January 1969, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 237, Box 4, Archives 214, MASC, WSU Libraries, Pullman.

send the first half of the WWGGC contribution soon, but he was so involved in legislative matters that they would have to postpone re-evaluation of the long-range program.[74] Howard Somers informed Nagel in the fall that there would be no 1969 annual meeting of the WWGGC; Ivan Kearns was planning to retire and financial problems resulting from the passage of HB 100 (see below, "Legislating competition") meant that there was doubt as to the future of the association. Personally, he wanted to talk with Nagel about the future of his premium varietal wine program. Nagel responded saying, "I am sorry to hear that the future of the trade association is in doubt."[75]

By the end of the year the WWGGC had disbanded and IAREC had lost that source of funding, but fortunately the WSU grape and wine research faculty, with the help of WSU's Research Director J.L. Robins, had obtained a grant for an initial three years through the USDA Western Utilization Research and Development Division in Albany, California. This project actually lasted until 1979. From 1972 through 1976, WSU winemaking studies also received support from Economic Development Administration funds. (Both of these grants are discussed in further detail below in Chapter 4.) By the end of the 1970s WSU scientists had published data on 150 varieties of grapes, 88 of which were used for wine, and had over ten years experience with wine making and evaluation.[76] The availability of that experience and knowledge to private citizens and the industry in the state was vitally important for the develop of the Washington wine industry.

Disseminating information in the 1960s

Varietal trials and tasting panels would have been of little use without the availability of an efficient means to convey the results. WSU's scientists employed four main approaches to reach their audiences: personal correspondence; presentations at professional meetings, often followed by publication in various *Proceedings*; the scholarly literature and to a certain extent popular magazines; and WSU-sponsored Bulletins, Circulars, Mimeos, and other reports.

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[74] Clore to Victor B. Allison, 29 January 1969, Walter J. Clore Papers, 1961-1999, Folder 81, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[76] Walter J. Clore, Charles W. Nagel, and George H. Carter, *Ten Years of Grape Variety Responses and Wine-Making Trials in Central Washington,* Bulletin 823 (Pullman: College of Agriculture Research Center, Washington State University, 1976).

"Professional meetings" could mean talks to local business clubs or industry groups, at annual statewide association conventions, or at national and international scholarly conferences. As noted above, WSU researchers regularly presented at the Washington Wine and Grape Growers Council monthly or quarterly meetings, such as the one held in Yakima in January 1966 where Brummund spoke on cold injuries to grapes during the 1964-1965 winter, Cone talked about insect pests on grapes, Clore reviewed trellising and mechanical harvesting for wine grapes, and Nagel presented information on evaluation of varieties for wine making.[77] Ronald Tukey contacted Clore in 1969 regarding plans for future Grape Schools and proposed they and their colleagues meet to talk about what growers and vintners needed by way of education on grape growing. These Grape Schools were to play an important roll in the 1970s; they drew a wide attendance and usually offered substantive sessions. Tukey saw a need to keep wine grape sessions separate from Concord or other juice or table grape sessions, as he felt they were as different as "apples and peaches." He thought a Concord school might concentrate on mechanical harvesting, while the wine school could focus on best *vinifera* varieties, certified disease-free stock, and preventing winter injury.[78]

On a different level, scholarly journals were the way WSU scientists kept in touch with wine researchers worldwide and learned of pertinent developments elsewhere. Faculty of course were expected to publish the results of their research in academic journals, but a number of publications on grapes and wine deriving from work by WSU personnel were solely or partly authored by non-faculty employees, men and women who were deeply involved in the intellectual work of devising and completing effective experiments and trials. Beyond the research itself, the process of preparing and submitting a scholarly paper was not at all simple; any proposed article had to be read and reviewed not just by the principals involved in the work, but also by the various superintendents, department chairs, and research offices in the academic line of command. Peer review involved a strenuous analysis of background knowledge, sound scientific procedures, and the logical conclusions of a research enterprise. When Clore at IAREC sent a manuscript on the use of the growth regulator ethrel on Concord grapes to his

[77] Charles W. Nagel Papers 1964-1991, Folder 25, Box 1, Cage 639, MASC, WSU Libraries, Pullman.

[78] Ronald B. Tukey to Clore 15 October 1969, Charles W. Nagel Papers 1964-1991, Folder 25, Box 1, Cage 639, MASC, WSU Libraries, Pullman.

Department Chair William Ackley in Pullman, he noted that his coauthor R. D. Fay[79] and colleagues Drs. Tom Toyama[80] and Edward L. Proebsting had already reviewed it. Ackley replied that he had sent it on to more reviewers, saying "If their comments are minor, I will put it in for a scientific paper number. Otherwise, I will return it for your redoing before it is submitted to Bowman." [81] A month later Clore sent Ackley a revised draft. Only after being vetted through this process could an article be submitted to a professional journal – which would then send it out to still other reviewers! The paper referred to in this exchange was finally published in 1970.[82]

WSU-sponsored publications were a mainstay of the University's commitment to fulfilling its land grant mission with regard to support for the agriculture and economy of the state. These ranged from formal *Circulars* and *Bulletins* (see Appendix B) to simple one-page information sheets such as one from IAREC, dated 1969, on "Washington's Potential for Growing Grapes to Make Fine Wines." It listed the most suitable varieties (Cabernet Sauvignon, Gamay Beaujolais, Kékfrankos [Lemberger], Pinot Noir, Merlot, Meunier, Chardonnay, White Riesling, possibly Gewürztraminer, Melon, Helena, and Chenin Blanc) with their advantages and disadvantages, plus tables of grapes grown 1968 at IAREC with harvest dates, must and wine analysis for titratable acidity, soluble solids, pH, alcohol, balling degrees, sugar, tannin, sulfur dioxide, pruning weights, tons per acre, and susceptibility to winter injury.[83] Such information sheets filled a need for a cheap, quick means of sharing information with growers.

The more permanent *Bulletins* and *Circulars* required a more formal preparation and dissemination process than Extension *Mimeos* and information sheets. They underwent a review and revision process almost as rigorous as that for professional journals. The sponsoring unit might be listed as IAREC, a particular department, the Research Station, or some version of Cooperative Extension.

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[79] R. D. Fay was a research technologist at IAREC who coauthored papers on cold hardiness, propagation, yield, and growth hormones.

[80] Tom Toyama was a noted U.S. Department of Agriculture Agricultural Research Service fruit breeder at IAREC who developed the Rainier cherry and the Rival apricot.

[81] George Bowman was a Research Editor for the College of Agriculture.

[82] Walter J. Clore and R. D. Fay, "Effect of Pre-Harvest Applications of Ethrel on Concord Grapes," *HortScience 5*, no. 3 (1970): 21-23. It dealt with using a growth regulator to advance maturity and bring about berry *abscission,* or separation from the stem, in order to simplify mechanical harvesting.

[83] Charles W. Nagel Papers 1964-1991, Folder 37, Box 1, Cage 639, MASC, WSU Libraries, Pullman.

Some WSU County Extension Agents can be considered to have been researchers themselves: Frank Anderson coauthored works on the costs of establishing Concord grapes on different trellising systems, and John "Jack" Watson in Benton County was extremely prolific in both presentations and publications. Other Extension personnel such as horticulturist Ronald B. Tukey in Pullman were quite active in work on grapes and wines. Extension horticultural specialist John C. Snyder had written a *Bulletin* on grapes for Washington as far back as 1941,[84] and A. Irving Dow has already been mentioned as the author of several reports on fertilizers and nutrition. In all cases, County Extension Agents and other Extension personnel were an essential element in the distribution network for these publications, as they were closest to the growers and processors. Frequently Clore's letters in response to queries referred the writer to the local Agent for information, or were sent directly to Agents enclosing the query along with suggestions on how to respond. IAREC and Pullman personnel kept the Agents up to date on research results in person and in print, and also often worked with them on setting up cooperator trials. Between 1937 and 1992 the University produced and distributed to the citizens of the state 60-some *Bulletins*, 20 *Circulars*, and dozens of lesser publications such as Extension *Mimeos* dealing with grapes and wine.

Legislating competition, developing quality

There had long been complaints both from within Washington and from elsewhere, California in particular, about the 1935 Washington State law that required all out-of-state wines be distributed only through the state Liquor Control Board, at prices set artificially high to "protect" Washington wines. It must be remembered that at this time Washington wines were generally of fairly low quality, and their producers feared competition from out-of-state companies. Following Repeal in 1933 the state had enacted a strict liquor control act, and in 1935 an amendment aimed at protecting the state's young wine industry.[85] In the 1950s and 1960s California, seeking outlets for its own products, had filed restraint-of-trade lawsuits and threatened to boycott Washington beer and apples if its restrictive laws were not

[84] John C. Snyder, *Growing Grapes in Washington*, Extension Bulletin 271 (Pullman: Extension Service, Institute of Agricultural Sciences, Washington State University, 1941, rev. 1961).

[85] Everett G. Roscoe, "The Wine Bill of 1969, an Unlikely Catalyst for the Washington Wine Industry," (M.A. thesis, Washington State University, 1994), 8.

repealed. It had even appealed to the U.S. Supreme Court in 1958 and 1967, but the 21st Amendment let states set their own wine regulations, and Washington was within its rights—if not its own best interests.

A *Prosser Record-Bulletin* editorial titled "Competition needed" started off by saying research scientists at the WSU research and extension center at Prosser were convinced that Washington could have a thriving industry in production of high quality wine grapes and fine wines, and went on to advocate an end to artificial protection of the wine industry.[86] (Apparently some people took this to mean WSU *itself* advocated the end to protectionism; a memo from IAREC superintendent J.S. Robins to various WSU personnel said he had talked with the *Record-Bulletin* editor who "firmly" indicated the editorial reflected his own thinking, not that of anyone at WSU. A public institution was always on the firing line from citizens who disagreed with its work.) [87] A bill to remove the special protections state-produced wine enjoyed was introduced into the Washington legislature in 1967, but failed narrowly. In 1968 a Research Analyst from the State sent Nagel a copy of the proposed legislation regarding the trade barrier against out-of-state wine and invited him to offer testimony in Yakima.[88] Hard as University personnel tried to limit their statements to unbiased fact, interest groups still construed statements as being for or against their particular stance; the President of the San Francisco Wine Institute wrote Nagel regarding his testimony at Yakima to thank him for supporting removal of "existing discriminatory trade barriers relating to out-of-state wines" and saying he appreciated Nagel's "time, effort and valued cooperation."[89] Obviously he believed that Nagel's testimony supported his cause.

The wine bill finally passed in 1969.[90] No longer would prices on out-of-state wines be kept artificially high, and no longer would Washington wine drinkers be so severely limited in their selection as they had been. The established Washington winemakers had been right to fear the immediate results of

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[86] Prosser *Record-Bulletin*, 16 February 1967.

[87] J.S. Robins memo to "files," 17 February 1979, Walter J. Clore Papers 1961-1999, Folder 53, Box 2, Cage 668, MASC, WSU Libraries, Pullman.

[88] James Guenther, Research Analyst, State of Washington Legislative Council, to Nagel, 3 June 1968. Charles W. Nagel Papers 1964-1991, Folder 68, Box 1, Cage 639, MASC, WSU Libraries, Pullman.

[89] Nagel underlined "support of removal" in this document and put a big question mark in the margin. Don McColly, President, Wine Institute, San Francisco to Charles W. Nagel 25, June 1968, Charles W. Nagel Papers 1964-1991, Folder 68, Box 1, Cage 639, MASC, WSU Libraries, Pullman.

[90] For further discussion, see Roscoe, "The Wine Bill of 1969."

the new situation as the consuming public reacted swiftly. In 1969 there were eight commercial wineries in the state; by 1971, there were just two, and consumption of Washington wine had dropped dramatically (although consumption of wine overall went up).[91] The quality of most Washington wines was simply not good enough to compete.[92] Far from negating the work WSU scientists had been doing on variety and winemaking trials, this crisis in the state's grape growing and wine making industry finally set the stage for the change to the premium *vinifera* grapes and truly excellent wines that Clore and others had long argued was the only long-term solution.

Summary: The Washington wine industry at the end of the 1960s

Thanks to the work done by WSU scientists at Prosser and Pullman, much had been learned by the end of the 1960s about growing grapes and making wine in Washington. The work that had been done on variety trials for cold hardiness and wine quality, on techniques for disease and pest control, and on best practices for vineyard establishment and management had answered many questions. Vineyard acreage had grown, as had industry support for WSU research, and the number of publications and presentations conveying the results of that research to the public. Experimental wine making and evaluation had illuminated consumer preferences and the potential for making better and better wines. Grape growers and wine makers were legitimately fearful of the immediate effects of the elimination of protective legislation on their sales, but they were soon to see the benefits of competition informed by scientific research in developing a fine wine industry in Washington State.

[91] The two wineries that survived were American Wine Growers, which later changed its name to Ste. Michelle Vineyards, and Associated Vintners, now Columbia Winery. Walter J. Clore, "Why a Late Premium Wine Bloomer?" n.d., 3, Walter J. Clore Papers 1961-1999, Folder 38, Box 2, Cage 668, MASC, WSU Libraries.

[92] See Roscoe, *The Wine Bill of 1969*, Ch. Three, for a discussion of what happened to individual wineries and changes in the market.

Chapter 3

Correspondence: a career in a year

> Now the secret to the success of this program, in my opinion, was that Walt was the eyes and ears…
>
> Charles Nagel[1]

The scientist as correspondent

Writing letters took up an enormous amount of Clore's time and was integral to the role he played in developing the Washington wine industry throughout his career. For the year 1970, by which time he had become well-known throughout the state and his profession for his work with *viniferas,* there are copies of some 100 letters he wrote still extant in his files (by no means his entire output for the year, as is evidenced by lacunae), and a closer look at these offers insights into the questions and situations WSU's scientists were called on to deal with almost daily. Oftentimes Clore received blanket requests for information from utter novices with no background in grape growing at all. Frequently these letters ask for "all information" on starting a vineyard. In one example the writer mentioned seeing Clore's name in a *Seattle Times* article, and asked for information on what grape varieties would be suitable for 80 acres of sandy loam, which would have been a very sizeable vineyard operation if it were ever established. Clore's typically patient response included information on the potential for wine grapes in the region, the suggestion to grow only early maturing varieties, given the location of the vineyard, and ideas for where to buy certified cuttings.[2] Another letter asked him where to look for information about *vinifera* in general, which varieties were winter hardy, how much land cost – and even where to get the money to invest! [3] Public expectations for what the University could or should do for them could be very high indeed.

Some examples of Clore's 1970 correspondence will serve to illustrate the range of subjects he regularly dealt with. (It must be remembered that he was responsible for more than just wine and grape

[1] Charles W. Nagel, interview by author, tape recording, Pullman, WA, 25 July 2005.

[2] George Barber to Clore, 2 January 1970, Clore to Barber, 20 February 1970, Walter J. Clore Papers 1961-1999, Folder 224, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[3] Charles Brothers to Clore, 16 August 1970 and 2 October 1970, Walter J. Clore Papers 1961-1999, Folder 224, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

work, and was very involved with the asparagus industry.) The topics covered in these letters included public relations for the University, obtaining cuttings of desired varieties for trials, working with Extension and state agencies, securing funding, shipping and storage problems, winter temperatures and cold hardiness including vineyard management, home winemaking,[4] industry relations, trellising and mechanical harvesting, the state quarantine on importing plants that were not certified as virus-free, and the ubiquitous variety trials that were the foundation of the Washington wine industry.

Public relations

Clore was always aware of the role and visibility of the University in the state, as illustrated in a letter he wrote to Horticulture Chair Ackley enclosing the highlights of research for which he (Clore) was currently responsible. He noted that whether or not the [University] administration wanted to take advantage of the wine work he and his colleagues were doing, it was something that stirred the interest of urban people. Clore made it clear that "Legislators in the state show more interest in this work than any other I know."[5] Early in 1970 he wrote to Donald M. Richardson of the Washington State Department of Commerce and Economic Development in Olympia enclosing copies of two articles on grapes in Washington and saying, "Dr Dailey and I will have several more that should be available in the next 2 or 3 months. We hope with this material and other information we will send you that you will be able to develop some kind of promotional publication for growing grapes in Washington for wine making." [6] When the Chair of the WSU Agricultural Economics Department James Nielson sent him a copy of manuscript on state laws affecting the movement of table wines by Folwell, Dailey and Bevan, Clore replied that he did not feel qualified to comment on the "appropriateness of this material for publication as I have little training in this area and have not concerned myself with this phase of the wine business." He

[4] It should be remembered that several of Washington's top wineries grew out of the work of home winemakers; according to Nagel, some of these were Rick Small of Woodward Canyon, Gary Figgins of Leonetti, and Alex Golitzen of Quilceda. Charles W. Nagel, interview by author, tape recording, Pullman, WA, 25 July 2005.

[5] Clore to Ackley, 4 November 1970, Walter J. Clore Papers 1961-1999, Folder 223, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[6] Clore to Richardson, 24 February and 7 April 1970, Walter J. Clore Papers 1961-1999, Folder 77, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

did, however, bring up a point of semantics: the wine industry resented use of the word "fortified" and preferred "dessert wines."[7] While Clore might not have felt ready to comment on legal or economic matters, Nagel at least felt he did a fine job with public relations, explaining that

> The nice thing was there was a good rapport with the small group of winemakers and vineyardists, and Walt was really the connection. He was the one they communicated with daily and he always kept us involved. And it's unusual for a scientist to be that unselfish. Of course, actually, when you think about it, it makes sense. If you're going to show how well these grapes do, had had to take in account all these aspects. You can make good wine, but if you don't have good marketing it doesn't do any good.[8]

Another example of the role Clore (and to a lesser degree, others) played in publicizing the burgeoning industry was his willingness to be interviewed—many, many times—on the future of wine grapes in Washington State.[9]

Public relations could also be internal, within the University itself: Clore took the time to write to the College of Agriculture Research Director J.S. Robins to apologize for being unable to come to Pullman for his farewell dinner, as the winemaking for the year was underway and he wanted to ensure the work was going well before leaving on his European wine region tour. Clore gave Robins credit for his help in getting an important grant, saying, "Personally, I feel that you have been largely responsible in helping get the cooperative work with the Western Utilization Research and Development Division [Project 0050, discussed below] reestablished at Prosser." Robins wrote back saying "I believe actions taken with the Western Utilization Research Division in the past 2 or 3 years have been most constructive . . . I believe you will make some good progress under the grape program under the cooperative agreement recently established."[10] Such non-technical but necessary correspondence among WSU personnel in Pullman and those in Prosser were a standard part of doing business in an era without email

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[7] Clore to Nielson, 7 May 1970, Walter J. Clore Papers 1961-1999, Folder 73, Box 3, Cage 668, MASC, WSU Libraries,

[8] Charles W. Nagel, interview by author, tape recording, Pullman, WA, 25 July 2005.

[9] E.g., a letter sent by Inez Potwin, Publications Director of Food Industries Research and Engineering, Inc., Yakima, to Clore on 28 December 1970 enclosing the first draft of a proposed article on the future of grape growing and wine making in Washington, which they planned to release to trade publications and newspapers in the near future. Since Clore was quoted at length, he was asked to review it for accuracy. Walter J. Clore Papers 1961-1999, Folder 75, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[10] Clore to Robins, 25 August 1970, Robins to Clore, 27 August 1970, Walter J. Clore Papers 1961-1999, Folder 77, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

or cheap telephone connections between field and administrative units, but they certainly took time away from research work.

Clore was frequently called upon to comment on drafts of work by WSU researchers other than his own collaborators. Horticulturist and chemist Cyril Woodbridge sent him for review the revised, "shorter and meatier" manuscript of "Effects of Pruning and Sampling Dates Upon Nutrients in Concord Grape Tissues" with revised data from the 1967 sampling analyzing clusters, petioles, and blades.[11] Clore's response included a good deal of pertinent recent information on nutrient levels and problems such as leaf scorch in vines showing potassium deficiencies. He noted that there were complete studies on Concords from New York, but not for the West, where soils were usually high in potassium, implying that Woodbridge's work would indeed be useful.

Cuttings and propagation

Another typical example of correspondence, this time between researchers at WSU and other institutions, is found in the frequent letters dealing with securing cuttings of particular varieties for trials. Clore wrote to Dr. C. J. Alley of the Foundation Plant Materials Service at the University of California-Davis in March of 1970, saying he realized it was late to be asking, but he would like to have up to ten cuttings each of Catawba, Seibel 5279 (Aurora), and Seibel 9110, and as many Helena as were available (all of these were *labruscas* or hybrids – Clore did not limit his varietal experiments to *viniferas,* even though he emphasized their importance for the future of the Washington wine industry). Alley replied a couple of weeks later, saying the cuttings had been shipped, despite the lateness of the season.[12] (Planting stock was often hard to find, and might be spoken for a year in advance, so Clore was lucky there were cuttings available.) Don K. Bridenbecker of WSU's western Washington Cooperative Extension Service wrote to Clore asking for some Perlette (a *vinifera* variety) plants; Clore was cautious in his response, saying he was wary of recommending varieties for western Washington as the conditions were so different from central Washington, but in his experience Delight did better in a maritime climate.

[11] Woodbridge to Clore, 7 July 1970, Clore to Woodbridge, 24 July 1970, Walter J. Clore Papers 1961-1999, Folder 80, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[12] Clore to Alley, 6 March 1970, Alley to Clore, 31 March 1970, Walter J. Clore Papers 1961-1999, Folder 223, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

Exchanges of varieties sometimes took place with researchers in New York, Michigan, Oregon, and Arkansas besides the frequent imports from the University of California-Davis viticulturists. Seemingly the search for suitable cultivars was one that would never end.

Extension

WSU Extension agents were the conduits between the growers who needed information and the scientists who produced it. Several were involved with coordinating times for growers to pick up varieties for trial from Prosser or with delivering the plants themselves, and the agents might have quite specific questions they needed to have answered.[13] For example, Grant and Adams County Area Extension Agent Raymond Hunter wrote to Clore in the fall of 1970 about a nurseryman who had 9000 Concord plants, grown from the previous spring's cutting, that would be transplanted into the vineyard in the spring of 1971. The grower wanted to know if he should dig and store the plants this fall, or cover with them for winter with mint hay or wheat straw. He also needed to know whether or not he should prune the vines back to just one or two of the strongest canes in fall. Clore answered with specific recommendations: pile dirt on the vines to cover the basal three or four buds for winter protection, do not dig them up until spring unless there is a demand for planting vines this fall, and prune just before digging, leaving 12" of the best cane.[14] This exchange is a reminder that the grape industry required frequent replacements for vines lost to weather or disease, as well as vines for new vineyards, and the nurserymen who provided those plants were just as dependent on help from the University as were the grape growers.

Extension agents were frequently called on for information on grapes for home winemakers, and Clore wrote several agents just before harvest August 1970, explaining that the demand for all types of grapes had been high that year. All the premium varieties had already been fully contracted for, so there would be none available for home winemakers to purchase after the harvest, but he thought there should be more premium grapes available in two years. However, since the demand for American, hybrid, and

[13] Raymond Hunter to Clore, 1 May 1970, 11 June 1970, 31 July 1979, Walter J. Clore Papers 1961-1999, Folder 70, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[14] Hunter to Clore, 8 October 1970, Clore to Hunter, 20 November 1970, Walter J. Clore Papers 1961-1999, Folder 70, Box 3, Cage 668, MASC, WSU Libraries, Pullman. Clore was in Europe for two months that fall, hence the delay in responding.

the *viniferas* used for dessert wines was less, there might be some of those available for purchase.[15] Information updates such this memo helped agents answer the flow of questions from their constituents.

Richard Adlard, County Extension Agent for Skamania County, corresponded with Clore frequently with regard to an increasing interest in grapes in his area, probably partly sparked by Charles Henderson's successful experimental plantings near White Salmon. In early 1970 their letters dealt with advice on trellising and with the necessity of ordering virus-free stock for next year now, since the current season's supply was already sold out.[16] Another agent, Frank Anderson, wrote to Clore, IAREC plant pathologist Earle C. Blodgett, Bill Wolfe of the State Pesticide Division, Jack van Horn of Seneca Foods, and Bob Fox of the National Grape Cooperative to ask them to meet with grape growers in Benton County about the 2,4-D situation.[17] Clore had been concerned about the effect of 2,4-D on grapes since 1950, and Extension agents often turned to him for assistance in balancing the needs of their grape and wheat growing constituencies.

There is an interesting insight into the relationship between Extension on the one side, and IAREC and the Pullman College of Agriculture departments on the other, revealed in a 1970 memo from Extension Horticulturist Ronald Tukey to several agents.[18] Tukey had met with Ken Severn, Manager of the Washington State Fruit Commission, and Cal Bosch, Editor of *Goodfruit Grower,* regarding adding a regular section on grapes (for some years, this would take the form of a quarterly insert called the *Goodgrape Grower*). They had proposed grape growers receive copies free for the first six months, and were looking for lists of names. Tukey's memo said that he could see benefits in developing a working relationship between Extension and *Goodfruit Grower*, and that there was a need to get information out to

[15] Clore to Extension agents Frank Anderson, Raymond Hunter, Donald Chaplin, and John Lange, 31 August 1970, Walter J. Clore Papers 1961-1999, Folder 223, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[16] Adlard to Clore, 15 January 1970, Clore to Adlard, 19 January 1970, Walter J. Clore Papers 1961-1999, Folder 223, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[17] Anderson to Clore et. al., 9 July 1970, Walter J. Clore Papers 1961-1999, Folder 223, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[18] Tukey to Frank Anderson, Richard Dailey, Samuel Doran, Donald Chaplin, Irving Dow, Art Retan, Raymond Hunter, Mel Hagood, Otis Maloy, with copies to Hank Wolfe, Clore, and Nagel, 31 January 1970, Walter J. Clore Papers 1961-1999, Folder 78, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

the industry and also to draw attention *away from* the Research Center in Prosser.[19] He believed a grape section in the *Goodfruit Grower* could help accomplish that through articles with Extension agent by-lines.

When Extension area agent Frank Anderson wrote to Tukey suggesting Bulletin 271, *Growing Grapes in Washington*, needed to be revised, Tukey's response was a bit touchy.[20] He pointed out there were other publications in the mill, and that Bulletin 271 had been primarily concerned with growing Concords for juice and needed more than simple revision. For some reason he did not mention Circular 524, *Grape Variety Responses and Wine Making Trials in Central Washington*, which had recently come out.[21] Tukey also wrote Clore about an upcoming Project 0050 Wine Grapes Research Review, wondering if more people should be invited and specifically suggesting Extension agricultural economist Sam Doran, Extension marketing specialist Tom Brewer, Paul Larsen of the Tree Fruit Research Center in Wenatchee; and Cyril Woodbridge, Department of Horticulture, along with people from British Columbia and Idaho.[22] He said "I hope that throughout your discussion a differential can be made between research developments and needs and those of Extension. There are reasons for this as you realize. It could help us more adequately outline our potential needs in Extension."

While these memos may indicate some rivalry between units, it is also true that Clore sometimes replied to letters from individuals by saying he had passed the query on to a local Extension agent, or by telling the writer to contact his county agent directly. It may have been that Clore found answering the constant stream of questions himself onerous, and was glad to pass them along to others, although such an attitude is never explicitly stated in his papers, or he may just have been trying to give Extension greater exposure. He was uniformly gracious in dealing with even very complex requests for help from all sources. Communications among IAREC, Pullman, and Extension personnel from other states were also frequent. Some grant proposals predicated cooperation across state borders, and there was also a good

[19] Emphasis added.

[20] John C. Snyder, *Growing Grapes in Washington.*

[21] Walter J. Clore, Charles W. Nagel, and George H. Carter, *Grape Variety Responses and Wine Making Trials in Central Washington,* Circular 524 (Pullman: Washington Agricultural Experiment Station, College of Agriculture, Washington State University, 1970).

[22] Tukey to Clore, 28 December 1970, Walter J. Clore Papers 1961-1999, Folder 78, Box 3, Cage 668, MASC, WSU Libraries, Pullman. It seems odd Tukey included Woodbridge, who was already directly involved with grape research projects and would surely have known about the update session.

deal of interaction between Washington and British Columbia on grape growing topics. University of Idaho Extension horticulturist Anton (Tony) S. Horn was very much interested in the possibilities for *vinifera* in his state, and in thanking Clore for information on pruning and trellising systems wrote saying, "Washington State not only has a team of horticulturists that are good researchers but also good fellows."[23] A commitment to sharing and helping comes through strongly in the work of many WSU researchers.

State agencies

Clore also collaborated with state agencies on viticultural matters. A letter from David M. Desmarteau, Market Research Analyst for the Trade Promotion Division of the Washington State Department of Commerce and Economic Development, pointed out that the recent economic development report on the Washington wine industry had made reference to the "extensive work you and your colleagues have done," and thanked Clore for the use of "this valuable information." Clore replied that the report was very timely, and asked for 100 copies to distribute.[24] The report itself said

> Because of the market's intensified interest in high-quality varietal and table wines, research into the potential for growing varietal wine grapes in Washington has been inaugurated by the Washington State University Irrigated Agriculture Research Center in Prosser (I.A.R.& E.C.). The research that they have completed in the past five years indicates that grapes with an excellent balance of sugar and acid can be produced for making fine varietal wines. Dr. W.J. Clore and his associates at the I.A.R.& E.C. have been instrumental for most of the research that has taken place on the feasibility of growing varietal wine grapes. In a 1968 report to the Washington Horticultural Association, Dr. Clore states, 'The future of such an (wine) industry in this state depends upon the varieties and where they are planted. However, most important is the techniques necessary to minimize low winter temperature damage to cold-tended varieties.' The advantages and disadvantages of potentially growing grapes in irrigated areas of Eastern Washington for making fine table wines were recently outlined by the I.A.E.& E.C.[25]

Obviously, the Department of Commerce and Economic Development was aware of the value provided by Washington State University.

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[23] Horn to Clore, 10 April 1970, Walter J. Clore Papers 1961-1999, Folder 70, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[24] Desmarteau to Clore, 24 February 1970, Clore to Desmarteau, 26 February 1970, Walter J. Clore Papers 1961-1999, Folder 226, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[25] David M. Desmarteau, *The Washington Wine Industry* **(**Olympia, WA: Business & Economic Research Division, Washington Dept. of Commerce & Economic Development, [1970]), 9.

Funding

The work done as part of several significant grant-funded projects in the 1970s will be covered in Chapter Four below, but it is worthwhile to note here that much of Clore's correspondence during 1970 dealt with preparing the cooperative proposal for the Western Utilization Research and Development Division. The proposal was ultimately accepted and led to several years of renewals. Once it was funded, Clore wrote Dr. Glenn Watters, a chemist at the USDA Agricultural Research Service Fruit Laboratory in California, about shipping wine for evaluation, spacing and pruning studies, and the berry analyses that would be part of the project work. (As an aside, he reported that while his European trip had been useful in developing the wine grape program, he was concerned over European beliefs that *labrusca* grapes were deleterious to eyesight, liver—and potency!)[26]

It seems it was never possible to find one funding source that would cover all needs, as later in the year Clore was writing to Robert Fox of the National Grape Growers Cooperative Association about what research would specifically benefit Concord growers in the state and how it could be funded. He proposed evaluating outstanding virus-free clonal selections of Concords grown on own-rooted vines against those grown on selected virus-free rootstocks for yield, vine maturity, and fruit quality. The proposed budget for one year would include a WSU contribution of $25,216 and a National Grape Cooperative grant of $10,400.[27] Letters to others dealt with an additional funding request for $2,500 needed for Clore's projects, which with his remaining grant balance would get him through the fiscal year. Clore pointed out that approximately $2,000 had been saved on his projects from a vacant farm laborer position salary accruals. Superintendent J. Lewis Allison at IAREC wrote to John S. Robins in Pullman complaining that the industry had not been providing its fair share, and unless substantial grant funds were soon made available from grape interests, Clore would be forced to curtail much of his research.[28] It

[26] Clore to Watters, 17 November 1970, Walter J. Clore Papers 1961-1999, Folder 80, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[27] Clore to Fox, 31 July 1970, Walter J. Clore Papers 1961-1999, Folder 228, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[28] Allison to Robins, 13 April 1970, Walter J. Clore Papers 1961-1999, Folder 223, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

is hard to estimate how much time WSU researchers and administrators had to devote to finding their own funding, but it is safe to say it was never a trivial amount.

Sometimes—rarely—money came looking for science. Grant H. Braun of the Great Salt Minerals and Chemicals Corporation wrote to Clore after visiting with Dr. Fielding Reed, President of the American Potash Institute, about Clore's work on potassium for grapes. Braun offered a $500 grant toward such work, to which Clore replied he could certainly use it to help with computer costs or analyzing grape petiole and soil samples.[29] Later he wrote he was still analyzing data from a 1969 soil, petiole, and fruit survey of 52 vineyards. As part of this he had been studying the distribution of potassium to a depth of six feet in Concord, Diamond, and Muscat vineyards in order to determine the uptake of the element and its effect on juice quality. The money offered would help with the sampling and analysis of two experimental vineyards that needed to be reexamined to determine the amount of potassium remaining in the soil and the pattern of extraction by the vines.

Shipping and storage

Not all Clore's grape correspondence dealt with wine grapes. Early in 1970 he was writing to Robert Hickenbottom with a detailed report on the packaging and storage responses of Campbell Early grapes for the table grape market, saying he hoped the information would have value in the "orderly marketing of high quality grapes." [30] There were critical questions to be answered, including the dosage of sodium bisulfite needed to keep the grapes fresh longer, and how to get rid of residual material (which, while not poisonous, was irritating). Clore corresponded with Dr. K. E. Nelson of the University of California-Davis on the same subject[31] and also with L. N. Andrus of Andrus and Roberts Produce Co., Sunnyside.[32] Table and juice grapes were always included in the research done by WSU, and until

[29] Braun to Clore, 9 September 1970, Clore to Brown, 2 November 1970 and 2 February 1971, Walter J. Clore Papers 1961-1999, Folder 224, Box 4, Cage 668, MASC WSU Libraries, Pullman.

[30] Clore to Hickenbottom, 21 January 1970, Walter J. Clore Papers 1961-1999, Folder 70, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[31] Clore to Nelson, 16 January 1970, Walter J. Clore Papers 1961-1999, Folder 73, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[32] Clore to Andrus, 21 January 1970, Walter J. Clore Papers 1961-1999, Folder 223, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

recently Concord juice was the number one grape product of Washington; the state still produces more Concords than any other state.

Temperature records and cold hardiness

By 1970, many trials of varieties for winter hardiness had already been run, but there was still a need for more information applicable to *viniferas.* Clore corresponded with Earl L. Phillips, State Climatologist at the U.S. Weather Bureau in Seattle, over data needed on mean temperatures, heat units, and total frost free days from April through October for areas suitable for wine grapes. Clore was expecting the wine industry in the state to double in the next five to ten years. He had enough information from stations at Kennewick and Prosser, but needed temperature data from the Dallesport, John Day, McNary Dam, Priest Rapids Dam, Ice Harbor, Royal City, Walla Walla, and Wenatchee stations, as the deviation from the norm was not given in the published monthly and annual reports. Phillips replied that most of the stations listed had records for only a short period, but the Bureau of Reclamation might have more. [33]

Sometimes gathering temperature data also involved area growers. Clore wrote Dorothy Prior, Vice President of Prior Land Company in Yakima, that he hoped to have his wine variety work ready for publication soon, but still needed temperature records from the Paterson store station for October through December of 1969. She sent him weather records and minimum temperatures, and asked whether he needed help with the grape trials on some lands bordering Prior property, which seemed to be inadequately cared for. In his note thanking her, Clore also mentioned that he had been asked by Dr. Arthur Peterson of the WSU Department of Agricultural Economics to get temperature records from different locations on the Horse Heaven slope for predicting crop adaptability,[34] and asked if she had

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[33] Clore to Philips, 19 January 1970, Phillips to Clore, 29 January 1970, Clore to Phillips, 10 February 1970, Walter J. Clore Papers 1961-1999, Folder 75, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[34] In writing Peterson, Clore stated he had found three reliable temperature stations for the Horse Heaven slope and gave heat units by elevation compared to Prosser. He said “I would judge that the entire slope should be more favorable for horticultural crops than at the Irrigated Agricultural Research and Extension Center” and it should have a more favorable growing season than anywhere in the Yakima Valley. Today the Horse Heaven slope has its own appellation. The same letter also contained advice on asparagus and other crops. Clore to Peterson, 4 February 1970, Walter J. Clore Papers 1961-1999, Folder 75, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

them for the ranch headquarters there. Clore believed certain varieties were going to be very successful on the Horse Heaven slope. As far as the neighboring grape variety trials not getting adequate care, he said the vines had been trained, trellised, fertilized, and cultivated the same as other experimental plantings. There had been trouble getting some of the sprinklers to turn properly, but the worst problem had been 2,4-D contamination, because of which planting at Prosser was probably a year behind in its grape trials. The December 1968 freeze had caused only minor damage to grape buds at Paterson, and he did not intend to cover the vines for the coming winter as he wanted to test them further for hardiness. When Prior sent the records for September, 1969, she apologized for the delay: formerly the postmistress at the store had mailed the readings in monthly, but she had gotten so busy that Prior had to send someone down to copy them off her calendar![35] This would not be the only time informally collected data provided needed background information for scientific research.

Home winemaking

Once it was generally known that a certain Walter J. Clore of the Washington State University Irrigation Experiment Station had started to work with growing wine grapes, he began receiving frequent letters from amateurs wanting to know how to grow grapes and make wine. These might be typed on professional letterhead (many come from doctors and lawyers) and reveal a solid acquaintance with viticulture and enology; they might equally be scribbled on lined sheets torn from notebooks and show little understanding of what went into planting a vineyard or turning its produce into a drinkable wine. Very often they were of the "please send me everything" type, and Clore was consistently helpful in his responses even when it was clear the writer had no idea how to proceed. As a representative of the state's land grant university, it was Clore's job to assist its citizens however he could.

One knowledgeable correspondent, Dr. Gerald D. Sparling of Bellevue, wrote to say he had been a hobby winemaker for ten years, and now wanted to grow own his grapes. He was aware that *viniferas* did not do well west of the Cascades, but hoped his microclimate would be suitable. He asked if WSU had plants for sale and for a list of current articles or books. Clore sent back what information he had and

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[35] Letters between Prior and Clore, 23 January 1970, 29 January 1970, 4 February 1970, 9 March 1970, Walter J. Clore Papers 1961-1999, Folder 75, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

suggested Sparling contact the Western Washington Research and Extension Center at Puyallup, where they had been working on wine grape research for a maritime climate.[36] Another Washington doctor with similar interests, Griffith E. Quinby, ended up helping Clore with the question raised during his European trip about the possible deleterious effects of *labruscas.* He had originally written to Clore about hobby wine making from home-grown grapes, as he was trying to upgrade his production; he also wanted information on virus quarantine regulations on the shipment of grape stock and cuttings.[37] When Quinby later was planning a trip to see the vineyards around Prosser, he brought up a concern over something he had read in one of Clore's reports about a filtration process involving asbestos fibers. [38] At the time, asbestos had only recently been implicated in causing cancer. Clore responded that in the filtering process, the wine was mixed with bentonite. After it passed through the bentonite process and an asbestos filter, it went through a high grade filter paper. He asked for data on the cancer studies, and then raised his own question: was there any evidence of possible deleterious effects American *labrusca* grapes might have on humans? Wine makers in Germany and Austria had told him that Concord juice damaged livers and caused blindness, and while Clore realized it was probably just a way of discouraging people from consuming foreign products, he had found one study indicating chickens fed hybrid grape juice laid aberrant eggs. Quinby responded that he knew of no literature on toxicity from American grapes. There were many articles on asbestos as a cause of cancer going back at least ten years, but none linking asbestos filtering of wine with cancer. (Cornelius Ough would later note that asbestos was probably superior to cellulose as a filtering material, but by then no California wineries were using it because of potential health risks to workers).[39]

[36] Sparling to Dean of Agriculture, 13 April 1970, Clore to Sparling, 3 June 1970, Walter J. Clore Papers 1961-1999, Folder 72, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[37] Letters between Quinby and Clore, 14 April 1970, 24 July 1970, 6 October 1970, 4 November 1970, Walter J. Clore Papers 1961-1999, Folder 76, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[38] *Filtering* wine is sometimes necessary to remove suspended particulates, such as yeast cells, resulting from the fermentation process. It can be important for the future clarity and stability of a wine.

[39] Cornelius S. Ough, *Winemaking Basics* (New York: Food Products Press, 1991), 156. For a review of studies on cancer and asbestos in food and drink, see "Report on Cancer Risks Associated with the Ingestion of Asbestos," *Environmental Health Perspectives* 72, (June 1987), 253-265.

The grape and wine industry

Clore's correspondence load was by no means limited to academic colleagues, state and University employees, and private citizens. He was in close contact with industry representatives such as Gallo Vice-President for Vineyard Operations Paul Osteraas, as noted in the section "*Working with the wineries and wine experts in the 1960s"* in Chapter Two above. Late in 1969 Clore had written Osteraas thanking him for his evaluations of Washington wines as well as for his production and culture suggestions. Clore noted that the wines sent were 100 percent varietals, with no amelioration, and enclosed a copy of WSU's taste panel evaluations from 1968. He also sent information on the 1969 wines and analyses of their musts, and promised more detail would be forthcoming on yields and quality as affected by different trellising systems. All this was necessary background to help Osteraas make useful comments on the wine Washington was then turning out. WSU's wine technology was not certainly not cutting edge: Clore wrote Osteraas early in 1970 about using a Waring blender, a common household appliance, to prepare grapes for analysis, and said that all but one variety showed an increase in titratable acidity when sampled from wine press juice as compared to blender juice, while pH went up in blender samples. Obviously at this point winemaking was not as scientific as it has since become. [40]

Clore and Lloyd Woodburne of Associated Vintners had been frequent correspondents since the 1950s, when Woodburne and his friends were still making their wine in garages before forming their partnership. In 1970 he wrote to thank Clore for sending a copy of *Grape Variety Responses and Wine Making Trials in Central Washington*, one of several influential wine grape reports that were beginning to come out of WSU.[41] He had been comparing the decline in Clore's post-1968 freeze crop figures with his Sunnyside experience. He wondered if the elevation and air drainage of his vineyards had saved them from the effects of the minus 11° Fahrenheit temperatures, as only his Riesling seemed to have suffered, while his Gewürztraminer, Pinot Noir, and Cabernet Sauvignon actually saw increases in yield. At this stage in the development of the Washington wine industry, there were more questions than answers, and the give and take between WSU's scientific staff and both individual and commercial grape growers was

[40] Clore to Osteraas, 27 October 1969, 10 January 1970, Walter J. Clore Papers 1961-1999, Folder 74, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[41] Woodburne to Clore, 4 September 1970, Walter J. Clore Papers 1961-1999, Folder 80, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

important for figuring out what worked best. Woodburne also noted that "Tasting panels are tricky" and said they were starting to educate a panel in what to look for in a young wine that would eventually mature well. In his response Clore talked about his tour of the wine regions of northern Europe, the coldest regions where viniferas grow, noting some areas had conditions worse than in eastern Washington and regularly saw temperatures of minus 14° Fahrenheit, but still were able to produce White Riesling, Pinot Noir, Sylvaner, Müller-Thurgau, Gewürztraminer, and others. Clore thought Woodburne's Sunnyside vineyard did indeed have more favorable conditions than Prosser, but there were of course many factors affecting hardiness, including maturity. Maturity of vines was a central research topic for Clore, who had come to believe that cold hardiness was largely a matter of proper vineyard management and giving the vines enough time after harvest to prepare for winter. As for the taste panels, Clore was sure they would be more discerning in the future; he was getting evidence from the Pullman panels that "our clean, higher acidity wines would have good consumer preference."[42]

Industry correspondents were not always seeking advice: sometimes they had something to sell. John G. H. Edwards of Okanagan Turbo Sprayers in Penticton, British Columbia wrote saying he had talked with Ronald Tukey several times about problems spraying grapes, and his company was very interested in determining the performance and effectiveness of its sprayers when used on grapevines. There were already some being used in California vineyards, where they had shown that the air blast did not cause a shingling effect (a tendency to mat together) on the leaves as had been feared, and also that the speed of travel could be safely increased without sacrificing coverage. Edwards offered a machine to the University for $2,800 for its trials and Clore replied that entomologist Wyatt Cone would like to see the technical data on the equipment.[43]

Sometimes determining which cultural practices were most effective in a given situation involved a synergistic relationship between researchers and industry. The advent of mechanical harvesters illustrates one such situation. Clore wrote to Darrell Horn of Up-Right Harvesters just before he left for Europe to ask for 20 copies of some Up-Right publications and brochures, including those concerning

[42] Clore to Woodburne, 20 November 1970, Walter J. Clore Papers 1961-1999, Folder 80, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[43] Edwards to Clore, 18 March 1970, Clore to Edwards, 31 March 1970, Walter J. Clore Papers 1961-1999, Folder 227, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

attachments for crushing and transporting musts, to distribute. On his return he wrote again asking if Up-Right machines had worked on any vineyards with fixed "T" trellises, and if so what were the results, noting that in Europe the trellises that exposed more foliage surface to the sun were more productive without sacrificing quality. The answer he got from Horn was that they had so far been able to harvest effectively only single and double wire vertical trellises with flexible crossarms up to four feet wide. They were working on the possibility of experimenting on fixed "T" trellises, and were shipping Clore a grape trellis crossarm that might meet the needs of Yakima Valley growers. Research in California had indicated the three foot wire spacing of this arm was ideal for machine harvest, leaf exposure, and trellis cost control.[44] Taking advantage of the company's experience, Clore later asked for information on how much sag could be allowed between posts with the single wire, the upright trellis, and the Geneva double curtain trellis systems if the grower wanted to harvest with the Up-Right harvester, as he was attempting to standardize the wire used in trellising in Washington. He also asked about post spacing for each of the trellising systems, and about the tensile strength of the 13 gauge wire used in California. [45] This was a case of industry and academia working together and sharing information on new approaches to viticulture that benefited growers in the state of Washington.

Of course, as a University employee Clore was precluded from favoring any single company. He corresponded with A. Lee Towson of the Chisholm-Ryder Co., Inc., in Niagara Falls, New York, which also made mechanical harvesters. Noting that Washington State was making an effort to standardize recommendations for the wire used in trellising Concord grapes, he asked how much sag was allowable for the Chisholm-Ryder machine to harvest efficiently from either a single trellis or Geneva double curtain trellis, whether the shaking head made a difference, and how far apart the posts had to be. Towson answered that sag in wires with the single trellis system was not too important, but in the Geneva double curtain system it was, and should not exceed four inches. He explained that post spacing did not matter much, but the posts should not exceed six feet above the vineyard floor, and grapes hanging below 21 inches would not be harvested. The shaker was used only for the single curtain system. Thus, without

[44] Robert Wilson, Factory Representative for Up-Right Harvesters, to Clore, 7 and 9 December 1970, Walter J. Clore Papers 1961-1999, Folder 80, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[45] Clore to Darrell Horn, 6 August 1970, 25 November 1970, 30 November 1970, 28 December 1970, Walter J. Clore Papers 1961-1999, Folder 70, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

having to test all these variables locally, Clore was able to gather information helpful to Washington vineyards. [46]

Clore's relationship with Philip Wagner of Boordy Vineyard in Maryland fell somewhere between the commercial and the collegial. Boordy was one of the most important grape nurseries in America and had long supplied WSU with varieties for test plantings. Wagner was editor of the *Baltimore Sun* and had written several books on wine, as well as a book on H. L. Mencken.[47] He contacted Clore in 1969 to inform him he had made an arrangement with Seneca Foods for the production of wine and hoped to involve wine grapes from Washington. He said he had long been aware of Clore's work with *vinifera* and the better French hybrids, and hoped to meet him when he was in Prosser in late May to talk and to taste his experimental wines. After the May meeting, he wrote again thanking Clore for his hospitality and iterating that he had found the Lemberger, Cabernet Sauvignon, second Foch, and Merlot samples most impressive, and that it was reassuring to see their hardiness under Washington's winter conditions confirmed. Wagner liked the Melon best of the whites for its balance and fruitiness; the others he felt had been somewhat "disfigured" by sulfur dioxide. He also hoped there would not be too much delay before enough cuttings to plant could be obtained, as Seneca was ready to produce Lemberger, Merlot, and Melon wines.[48] When Wagner visited Prosser again in the summer of 1970, Clore set up a wine tasting and invited others including the well-known food writer and wine aficionado Prof. Angelo Pellegrini of the University of Washington Department of English. [49] According to George Carter, it was this meeting that

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[46] Clore to Towson, 25 November 1970, Towson to Clore, 2 December 1970, Walter J. Clore Papers 1961-1999, Folder 78, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[47] Philip Marshall Wagner, *American Wines and How To Make Them* (New York: Knopf, 1933); *Wine Grapes, Their Selection, Cultivation and Enjoyment* (New York: Harcourt, Brace [1937]); *A Wine-Grower's Guide* (New York: A. A. Knopf, 1945, 1965, 1984).

[48] Wagner to Clore, 5 May 1969 and 29 May 1969, Walter J. Clore Papers 1961-1999, Folder 102, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[49] Clore to Angelo Pellegrini, 6 July 1970, Walter J. Clore Papers 1961-1999, Folder 75, Box 3, Cage 668, MASC, WSU Libraries, Pullman. Pellegrini was an interesting character. He had emigrated to the U.S. in 1904 at the age of ten, expecting to become a logger like his father. He excelled in debate in high school and ended up becoming an English professor at his *alma mater*, the University of Washington. His book *The Unprejudiced Palate* (New York: Macmillan Co., 1948) promoted simple cooking with fresh, local ingredients. His other books included *Wine And The Good Life* (New York: Knopf, c1965) and works on the immigrant experience. It was Pellegrini who introduced fellow UW faculty member Lloyd Woodburne to winemaking, when he dropped off some books for Woodburne to read while laid up with poison oak contracted on a camping trip. "New Wine, New Bottles" unattributed article, Irrigated Agriculture Research

forced Wagner to acknowledge how much inferior to *vinifera* were the French hybrid grapes he had been pushing for wine production on the east coast.[50]

More correspondence between Clore and Wagner dealt with matters of ampelography, or grape vine description and identification. Before DNA analysis it was often difficult to determine exactly which variety a given vine might be. Wagner had found a clue, in a book by two Hungarians who had settled in the Okanagan valley, to the identity of a Chardonnet [sic] in the Prosser collection that had puzzled Clore.[51] He also helped Clore get both a Swiss ELVA corking machine and an important reference source Clore wanted, the authoritative Viala and Vermorel *Ampélographie*. Wagner had found a set of unbound sheets from 1902 in Montpellier and offered to have them made up for Clore.[52] Similarly, Wagner asked Clore for help with an identification problem that Wagner had come across in Penticton, a variety called "Riesling" but lacking the typical Riesling leaf and wine character. Wagner also asked who had identified grower Clarence Rush's "Scheurebe,"[53] and if the "Gamay Beaujolais" in Clore's vineyard was the same as that grown in Napa. If so, he thought it was probably a clone of Pinot Noir, which would account for the paleness of the wine. Clore could not identify the Penticton grape, but wondered if it was the same as the variety called Missouri Riesling. He knew that Rush's Scheurebe came from stock

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and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 236, Box 4, Archives 214, MASC, WSU Libraries, Pullman.

Pellegrini was an original; in 1959 he addressed the Yakima Rotary club and said that children should be offered wine at the family dinner table, as "the enjoyment of wine [is] the answer to alcoholism." He stressed that American wines were as good as those of Europe. "Wine on Dinner Table A Must," Sunnyside Sun, 11 June 1959.

[50] George H. Carter, interview 15 May 1992, Washington Wine Commission Video Archive Project.

[51] Correspondence between Wagner and Clore, 1969, Walter J. Clore Papers 1961-1999, Folder 102, Box 3, Cage 668, MASC, WSU Libraries, Pullman. The book was: Virgil Rittich and Eugene Rittich, *European Grape Growing in Cooler Districts Where Winter Protection is Necessary* (Minneapolis, MN: Burgess Publishing Co., 1941). The book listed a White Burgunder with the synonyms of Morillon Blanc, Chardonnet, Weisser, and Claevner. The grape seemed to be a clone of Pinot Chardonnay, but there are references to the Chardonnet spelling more than once in Clore's papers, often along with separate information for Chardonnay.

[52] Pierre Viala and Victor Vermorel, *Traité général de viticulture. Ampélographie.* (Paris: Masson & Cie, 1901-09). The set was begun in 1883 but not finished until 1909; it included contributions from viticulturists around the world. Before the twentieth century it was common for printers to sell unbound works that the buyer could then have bound to order.

[53] German viticulturist Georg Scheu created Scheurebe in 1916 from a cross between Riesling and an unknown, probably wild, vine. William Bridgman's 1934 commercial planting of "Riesling" was actually Scheurebe.

brought to the U.S. by William B. Bridgman, who had labeled it Johannisberg Riesling, but it differed from true Johannisberg, or White, Riesling, and Dr. Austin Goheen of the University of California-Davis thought it really was Scheurebe. Clore's Gamay Beaujolais came from Davis in 1961; it behaved similarly to Pinot Noir but differed by producing larger and longer clusters. [54] These exchanges point out the difficulties of differentiating among grapes, which are not separate species, but merely varieties—varieties that differed greatly in their suitability for wine making.

Meanwhile, Clore was reporting to Wagner on the results of analyses of Washington grapes. Early in the harvest season he wrote saying the Foch grapes had come in at 24.5 percent soluble solids and 1.08 percent titratable acidity, and the indications were that most varieties would develop maximum sugar balanced with excellent acidity. Wagner, who was experimenting with concentrates of some of the Washington grapes, was anxious to know the breakdown of acid content between tartaric and malic acids, as total acid data was not enough. He wanted to degrade the malic to lactic acid, but needed to know what tartaric acid was likely to be left. (Charles Nagel was also working on malic and lactic acid in wine at this time.) On vines, Wagner wrote "Bill Wolfe of Seneca is certainly going to be after you for cutting wood [to start new plants], especially of Limberger [sic], Merlot, Meunier, and Melon," and said he himself would appreciate cuttings of the Lemberger. [55]

During March 1970 Clore and Wagner exchanged several letters.[56] Clore wrote that "Following the fabulous 1969 grape prices the interest in grapes both for juice and wine has been tremendous" and said he hoped to have information ready in a few weeks on the potential for fine wines from Washington grapes. Wagner was concerned that growers could not get cuttings of Lemberger and Melon, and asked if it would be possible to work out an arrangement to propagate cuttings this spring, in an isolated place under formal quarantine arrangements, even though they were not yet indexed. He thought Bill Wolfe (of Seneca Grape Company) would be happy with such a plan. Clore sent back data on varieties made into

[54] Wagner to Clore, 11 August 1970, Clore to Wagner, 18 August 1970, Walter J. Clore Papers 1961-1999, Folder 80, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[55] Clore to Wagner, 9 September 1969, Wagner to Clore, n.d., Walter J. Clore Papers 1961-1999, Folder 102, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[56] Wagner and Clore, letters March 1970, Walter J. Clore Papers 1961-1999, Folder 80, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

wine in 1969, but said they had not worked out a program for distributing cuttings outside of certification. He thought some varieties would be indexed and ready in 1970 and promised to try to work out some arrangement for propagating materials that would not be indexed out for a year or more. Clore also contacted Dr. D. H. Scott of the USDA in Beltsville, Maryland, to ask whether Boordy's French hybrids had gone through USDA quarantine; even though Wagner would have had time to ship his plants before the full Washington quarantine against non-certified out-of-state vines went into effect, Clore wanted to be sure there would be no problem with introduced viruses.[57]

In June, Clore wrote Wagner saying that until recently he had been pessimistic about continuing his wine work because of limited funds, increases in wages, and inflation, but that WSU had recently entered into a cooperative agreement with the Western Utilization Research and Development Division of the USDA at Albany, California to support two years of research (*See* Chapter Four below.) [58] The importance of such scientific research to the developing Washington wine industry was illustrated in an exchange between Clore and Wagner in late 1970. Wagner was concerned that for three straight years he had found wines from Yakima Valley grapes much harder to clarify than other wines. They did not settle swiftly, and showed hazes that resisted fining and filtration. He had checked for metal pick-up and bacterial problems but found none, and it seemed to him that the chemical composition of the must had to be different, perhaps with a higher salt content. One clue was that repeated additions of tartaric acid to a sample invariably gave a new precipitation of tartrate. Another puzzle was that musts showed good total acidity but also a high pH, which was not supposed to happen.[59] Willard Robinson of Geneva, New York,

[57] Clore to Scott, 17 March 1970, Walter J. Clore Papers 1961-1999, Folder 72, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[58] Clore to Wagner, 23 June 1970, Walter J. Clore Papers 1961-1999, Folder 80, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[59] Chemically, high pH and high acidity were supposed to be mutually exclusive: one should not have both at the same time. But Washington grapes and wines sometimes did, a problem Nagel would address. According to WSU Professor James Harbertson, high pH and high acidity is a problem that is found when there is a great deal of potassium in the wine. The pH increases but the amount of acid stays the same, because the potassium associates with the acid the same way a proton would. One way to fix the problem is use an ion exchange. (Personal communication between Harbertson and Dean of the College of Agriculture, Human and Natural Resources Daniel Bernardo, June 2008).

Additionally, two primary acids are responsible for titratable acidity in grapes, tartaric and malic acid. The ratio between the two acids is important as it influences pH. Although tartaric acid is normally the dominant acid in berries, in the early years musts from Washington grapes tended to have high amounts of malic acid. This resulted in wines with high titratable acidity but also higher pH, because malic is a

had agreed to work on these questions, but the grapes Wagner was concerned with were from Washington, not New York. A third puzzle was that the wines sometimes had an un-fruity and slightly salty taste. Clore forwarded this letter to Nagel, who responded he had not had such problems with most wines, but it might be that those wines made from hybrids had a carry-over of pectic materials and needed enzyme treatment to get rid of colloidal pectins. Another possibility was that there were often problems with very fine dust in the Yakima Valley, which might be hard to filter out. Nagel had noted the problem of a high pH when total acidity was good or even high, especially with reds, and was working on it. He ran a total potassium analysis of all varieties made into wine in 1969, as there seemed to be a loose correlation between pH and potassium. For whites, the range was from 360 mg/l to 1165mg/l. For reds, it was from 1010 mg/l all the way up to 2470 for Foch. Foch, a hybrid, tended to be high in pH naturally, and therefore might not be best choice for central Washington where there were other factors that increased pH. Nagel had evidence that pH and potassium were higher in wine kept longer on the skins, and was researching the varying rates of potassium in skins versus flesh. He too had noted a salty taste, but thought it was not surprising that adding tartaric acid to high pH wine brought on a new precipitation of tartrates, as the acid would lower the pH closer to the range where more tartrates existed in the potassium acid tartrate form, which was more insoluble than the free tartrate ion.[60]

There were many other industry experts with whom Clore (and other WSU scientists) carried on extensive correspondence. The importance of such exchanges to the development of the wine industry not just in Washington but also nationally was substantial, and the letters Clore received show the regard in which he and his colleagues were held professionally. Besides American viticulturists and enologists, he was also in frequent contact with associates in Japan, Canada, and Europe (the latter especially after his fall 1970 trip).[61]

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weaker acid than tartaric. One cause of excess malic acid was too much fruit shading in the vineyards, which led to less respiration of the malate by the plant. Tartaric acid is fairly stable once synthesized, but malic acid accumulation and metabolism varies depending on conditions such as temperature. See William Reynolds Bonorden, Charles W. Nagel, and Joseph R. Powers, "Adjustment of High pH/High Titratable Acidity Wines by Ion Exchange," *American Journal of Enology and Viticulture* 37, No. 2 (1986):143-148.

[60] Wagner to Clore, 31 December 1970, Nagel to Wagner, 7 January 1971, Walter J. Clore Papers 1961-1999, Folder 26, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

[61] The list of just the German-speaking vine and wine institutions he hoped to visit in fall was impressive:

John Vielvoye, Grape and Nursery Specialist at the British Columbia Department of Agriculture in Kelowna, British Columbia, was a frequent correspondent. He wrote Clore early in 1970 to say "I wonder if you could tell me what is going on in Yakima." A January Washington State newsletter had indicated that there was a substantial demand for Concord plants, and one he had just received said there were no more cuttings available. Was someone building a juice plant or winery? Or had many Concord plants been frozen out in 1968? Vielvoye proudly noted he expected the expanding Okanagan grape acreage to produce a 10,000 ton crop in 1970. Clore sent back copies of some Washington State Horticulture Association papers, newspaper clippings, and a "State report" (probably Desmarteau's *The Washington Wine Industry*), and explained it was the sudden demand from the nation's wineries for Concords to make Cold Duck wines that had caused many growers to expand their plantings, and nurseries to start propagating cuttings by the hundred thousand.[62] According to Clore, if all of them were to take root and

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Oberlandwirtschaftsrat Grosser Weinbauamt, Neustadt
Landes-Lehr-u. Forschungsanstalt für Wein und Gartenbau
Institut für Weinforschung an der Johannes-Gutenberg-Universität, Mainz
Landes-Lehr-u. Versuchsanstalt für Wein und Gartenbau
Landes-Lehr-u. Versuchsanstalt für Weinbau, Gartenbau und Landwirtschaft
Hessische Lehr-u. Forschungsanstalt für Wein, Obst und Gartenbau
Biologische Bundesanstalt Institut für Rebenkrankheiten
Weinbau-Abteilung d. Landwirtschaftskammer Rheinland-Nassau
Bundesforschungsanstalt für Rebenzuchtung
Lehr und Versuchsgut der Riedel-de Haen AG
Bayerische Landesanstalt für Wein, Obst und Gartebau
Staatliches Lehr-u. Versuchsanstalt für Wein, Obst und Gartenbau
Staatliches Weinbauinstitut
Institut für Weinbau an der Landwirtschaftlichen Hochschule, Hohenheim
Höhere Bundeslehr und Versuchsanstalt für Wein und Obstbau
Walter J. Clore Papers 1961-1999, Folder 229, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

On his return Clore wrote to Dr. Gerhard Götz of the Weinsberg/Weinbauschule, sending him WSU publications for his files and also slides showing how American grapes were grown. Clore to Götz, 14 December 1970, Walter J. Clore Papers 1961-1999, Folder 229, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

Clore also wrote Dr. Nelson Shaulis at Geneva, New York with his thanks for suggesting places to visit. Clore and his wife had been to 13 research stations, and in the short time since his return had already given a slide presentation to growers on what he had learned. He found the Institutions with conditions most similar to Washington were at Weinsberg, Wurzburg, Klösterneuburg, and Belgrad. It is interesting that Clore did not see a more of a correlation between Washington and the same-latitude French areas of Bordeaux and Burgundy. Clore to Shaulis, 26 January 1971, Walter J. Clore Papers 1961-1999, Folder 72, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[62] The German phrase "kalte ende," meaning "cold ends" or the leftovers from several bottles of wine mixed together, had been humorously changed over time to "kalte ente," meaning "cold duck." In the U.S. in the 1970s, semi-sweet and inexpensive cold duck wines were briefly popular. They were a step up from the low-quality tavern wines Washington had made in the 1950s and 1960s, but not a big step.

be planted out in 1970, Concord acreage in the state would double. He also noted the demand for *vinifera* grapes remained excellent, and he was much encouraged by regional prospects for fine wine.[63]

Extension horticulturist Ronald Tukey was also involved, writing Clore to say he had been in British Columbia and that Vielvoye had mentioned to him that there was a possibility they (the Canadians) might begin producing virus-free plant material for Washington, but they needed to know what cultivars were of particular interest. Tukey also wrote IAREC plant pathologist Gaylord Mink, asking about nurseries in Canada becoming involved in furnishing certified plants to Washington. (This seems not to have happened, at least not at that time.) [64] Clore and Vielvoye continued to write back and forth frequently throughout 1970 on topics such as grape varieties, bloom dates, thinning, frost injury, upcoming grape schools, the effect of sodium bisulphate crystals used in short-term storage of Campbell Early grapes in plastic bags, petiole analysis on Concords for critical levels of various elements, and the very worrying Phylloxera outbreak going on in Oregon.

Quarantine

Vielvoye's interest in virus-free plants was most apposite. Clore's 1970 correspondence contains several letters relating to the grape certification program. He asked Earle Blodgett to reply to Dr. Quinby's query on importing grapes from outside the U.S., which required a USDA plant quarantine permit.[65] (As noted above, Clore wrote himself to Dr. D. H. Scott at the USDA about Washington's quarantine and vines from Boordy Vineyards.) Wayne S. Anderson of Oregon State University in Corvallis had several questions: were there restrictions on the importation of rooted Concord vines? Were there any herbicides to aid in weed control in a nursery? What varieties would Clore recommend for the Hermiston region? Did he have certified virus-free wood of those varieties? What should he do about

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California bought Concords from Washington to make into cold duck type wines, as the grapes do not grow well in warmer climes.

[63] Vielvoye to Clore, 12 February 1970, Clore to Vielvoye, 7 April 1970, Walter J. Clore Papers 1961-1999, Folder 79, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[64] Tukey to Clore and Mink, 7 May 1970, Walter J. Clore Papers 1961-1999, Folder 78, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[65] Blodgett to Quinby, 2 March 1970, Walter J. Clore Papers 1961-1999, Folder 224, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

digging, holding, and shipping rooted plants? Anderson had 100,000 cuttings from the Prosser area and was working on Oregon nursery inspection and certification to meet the regulations for Phylloxera-free stock, as enthusiasm for the wine grape industry in Oregon was running high and growers there were eager to get mother-blocks started. In his answer Clore said that the Washington quarantine had gone into effect on May 4 and pointed out that the only state with propagation material meeting the requirements was California, so Anderson would have to sell his Concord plants in Oregon or Idaho.[66]

Quarantine regulations meant extensive dealings with both state and federal officials. IAREC Superintendent J. L. Allison had written to Art Mattig of the Washington State Department of Agriculture in Olympia in early April to confirm procedures relating to requests from WSU and USDA scientists at Prosser to import tree fruit and grape stocks. The old regulations had allowed bringing in propagating stock provided a permit was issued by the state Director of Agriculture, but henceforth the scientists would have to ensure either that the stock was already certified as virus-free or that they would contain such stocks under isolation until they were proven to be virus-free. Allison noted he had discussed the new procedures with the scientists at IAREC and they would adhere to them. With that understanding, he asked that Earle Blodgett's request of 16 March 1970 for Dr. Tom Toyama to import budwood be acted upon soon. [67] Inevitably, more regulations meant more paperwork, but it was imperative to keep both grape viruses and Phylloxera out of Washington.

Since nurseries had to be certified to grow and distribute grape stock, Clore received several letters asking how to get into the grape certification program. Carl Perleberg of Columbia Basin Nursery wrote to ask about procedures and to say that he and Paul Adams of Willow Drive Nursery would "appreciate receiving a start of foundation Concord grape as soon as it is available." He planned to be at the grape certification hearing to be held in Yakima December 16th.[68] Similarly, Frank B. Omstead of Grandview, Washington, wrote to Arthur Hurd of the Division of Plant Industry, Washington State Department of Agriculture in Olympia, about participating in the program. He had discussed the

[66] Anderson to Clore, 31 March 1970, Clore to Anderson, 15 June 1970, Folder 223, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[67] Allison to Mattig, copies to Clore and others 2 April 1970, Folder 223, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[68] Perleberg to Clore, 12 December 1970, Folder 75, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

possibility with Blodgett two years earlier and had been told the program was limited to just two growers because of the shortage of cutting material, but recently Clore and Dr. Murit Aichele at IAREC had suggested he apply.[69] Idaho, like Oregon, was interested in certification, and Clore also supplied information to R.R. Furgason of the University of Idaho. [70]

General inquiries.

Finally, there were the dozens upon dozens of letters with general questions, all requiring responses. Where should an attorney's clients buy land? Did Clore have slides of mechanical harvesters for a high school student to use in a talk? What about new varieties of grapes? Should vines be buried for winter? How should they be trained? What about prevailing winds? What would grow at 2700 feet with 120 frost free days? What about soil fertility, and irrigation, and training, and pruning? Over and over the same questions came up, not just in 1970 but year after year. It would be difficult to overestimate how important this part of the work of Clore, Nagel, and many other WSU scientists was to the infant wine industry in the state. Concords were being grown for juice decades before there was much interest in *vinifera,* but the need for information on grapes for fine wines was new when Walter Clore began his work on wine grapes in earnest, and seemingly unending. That he and his colleagues were able to carry on a world-class scientific research program while also serving as advisors to individuals, industry, government, and colleagues worldwide is as impressive as the Washington wine industry that grew out of their efforts.

Summary: Why this matters

It is not only the breadth of topics covered in Clore's 1970 correspondence that is significant, but the many and varying roles that he and other WSU scientists were expected to play. There was the role of researcher, working out answers to problems; that of administrator, hiring and supervising workers; of financier, looking for funding; of clerk, ordering and shipping materials; of public servant, advising

[69] Omstead to Hurd, 17 December 1970, Folder 74, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[70] Furgason to Clore, 29 January 1971, Folder 228, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

individuals and industries; of spokesman for the University, presenting papers at meetings and serving on boards and committees; and numerous others. Clore was not a member of the teaching faculty, so did not have formal responsibility for instruction or for advising graduate students, but Nagel and many others who played a part in WSU's wine work did. That they were able to balance so many competing, sometimes even conflicting, roles is a tribute to their competence and dedication.

Chapter 4

Grantsmanship in the 1970s

> You have to now be a grantsmanship expert,
> and to dig up money here and there.
>
> Charles Nagel[1]

Science is not free

Finding funding for extended research studies was (and is) a continual problem for academic institutions. State allocations provided the infrastructure of the University for its teaching and to a lesser degree its research responsibilities, but did not come near covering the actual costs of research and education, and University faculty in the sciences especially spent a good deal of time and effort finding and applying for grants.[2] If lucky enough to be funded, they then spent more time complying with sometimes onerous reporting requirements. The federal government and industry were the main sources of research grants in the 1970s, as they are today. Larger grower associations, such as the wheat and apple groups, had naturally been able to funnel more money into WSU projects that affected them directly, but there were not enough grape growers to provide really substantial support, although the Washington Wine and Grape Growers Council had assessed its members for grape research throughout the 1960s. The 1969 change in the law governing wine sales in Washington meant a steep drop in sales for state wine grape growers and winemakers, as the quality of most of what they had been producing was not high enough to attract consumers, who now had a choice. The WWGGC was forced to disband and by 1971 there were only two wineries left in the state – not coincidentally, the two that had been making better wine before the law was changed. With no funding coming in from the grape industry at

[1] Charles W. Nagel, interview by author, tape recording, Pullman, WA, 25 July 2005.

[2] Nagel, regarding finding funding and handling all the other faculty responsibilities such as teaching and committee work, said, " . . . that's what the industry didn't understand. They'd say 'Well, how come you're not doing this or that?' and we'd have to say "Well, we just don't have the funds or the time.' What was a great help was having graduate students who could concentrate on a particular problem and work it out." Charles W. Nagel, interview by author, tape recording, Pullman, WA, 25 July 2005.

precisely the time that research to develop better wines was most critical, it took a concerted effort on the part of many WSU scientists and administrators to fill the gap with other sources of support.

Project 0050, Production, Wine Making and Marketing of Wine Grapes in Washington: a long-term study

The United States Department of Agriculture (USDA) was interested in research projects that benefited agricultural industries, especially cooperative projects that affected more than one state. To this end WSU, with input from Oregon State University (OSU), prepared a joint proposal to the Western Utilization Research and Development Division (WURDD) located in Albany, California for help with grape research. It is worth carefully reviewing the Research Project Outline for what would become Project 0050, "Production, Wine Making and Marketing of Wine Grapes in Washington," because it gave a succinct overview of the situation in the state and the needs of the industry.[3] Under "Justification" it noted that Washington was the third largest producer of grapes in the United States, at 70,000 tons worth seven million dollars in 1969. Of this, 95 percent was in Concords for juice and jelly. Seventy percent of the wine being made in the state was of the sweet or fortified dessert types. Much of the land in central Washington that was irrigable was suitable for grape production, but the market for Concords was easily saturated because of competition with Midwestern and Eastern grape areas. The proposal went on to state "If it were shown that good quality wine grapes could be produced in the State of Washington, this would provide an alternate crop for the grape grower . . . [and] would allow for further diversification and add a crop that would increase income in the irrigated areas, and to the entire State." Only limited information on *vinifera* in the area was available, and grape production required a long-term commitment of capital on the part of growers. Because of the time required to establish a vineyard and bring the vines to bearing age, it would be several years before any returns could be realized. Winemaking, like grape growing, also required a longterm commitment. While consumption of table wines had gone up from 0.29 gal per adult in 1948 to 0.66 gal in 1967, more research was needed on the marketing situation and prospects, as well as on viticulture and enology.

The proposal included an "Evaluation of Information Available" by Clore that summarized pertinent research projects underway elsewhere on varietal testing, cultural practices, and production

[3] Charles W. Nagel Papers 1964-1991, Folder 126, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

techniques for cool climate viticulture. Research institutions at Vineland, Ontario, Summerland, British Columbia, and Geneva, New York, were evaluating American *labrusca,* American hybrid, French hybrid, and some European *vinifera* grapes for hardiness and wine making potential. New York was studying cultural techniques for maximum vine hardiness, a topic of particular interest to Clore. Additionally, the University of California-Davis (UC-Davis) was evaluating grape varieties for fine table wines and studying training, trellising, and pruning levels for their effect on production and wine quality. James E. Middleton wrote the proposal section on "Irrigation." Again, UC-Davis had done extensive furrow and sprinkler irrigation studies. Some work on furrow irrigation of Concords had been done at IAREC, and there had been studies in Washington on overhead irrigation of beans, potatoes, and plums, but not grapes. In the section on "Insects," Wyatt W. Cone noted that most pests of Concords (for example, grape mealybug, black vine weevil, grape leafhoppers, and climbing cutworms) were also found on *vinifera*. The McDaniel mite, for which no control procedures were available, was another *vinifera* pest and Cone thought controls might be adapted from available tree fruit data. In other regions and countries, Phylloxera was a serious pest of *vinifera* grown on its own roots (as most were in Washington); it had not been reported in the state since 1950, but was found in 1969 at The Dalles and Medford in Oregon, and its spread was feared.

Gaylord I. Mink noted in the "Diseases" section that almost nothing was known about grape virus diseases in Washington. A cursory survey in 1960 showed leafroll, fanleaf, and yellow vein viruses present in *vinifera*, but how they spread was unknown. It was not uncommon to observe severe leafroll, which led to a reduction in vine growth, fruit yield, and soluble solids, in vineyards in central Washington. Fanleaf too reduced yield and affected plant growth. In talking about "Soil, Fertilizer and Cover Crops," A. Irving Dow said studies on vineyards had been done in California, New York, and Michigan, but were limited in Washington. Observations, surveys, and field trials tended to confirm the results from elsewhere and showed a need for high rates of potassium for correction of blackleaf in Concords (later studies sometimes showed an excess of potassium.)

Nagel wrote the proposal section on "Wine Making and Evaluation." Evaluations were going on at UC-Davis, the New York State Agricultural Extension Station at Geneva, and at Vineland, Ontario and Summerland, British Columbia. The procedures for harvesting and processing grapes into wine for evaluation were fairly well standardized. California recommended grapes with a pH of 3.0-3.35, an acidity

of 0.65-0.9 percent, and sugar levels of 19-23 percent; these figure would be used as standards in much of Nagel's work on wine evaluation. In New York, sugar had to be added to bring the measurement up to 21 percent in order to counteract the high acid content problem common there and in other cool climate growing areas such as Washington and northern Europe. New York and California used different rating systems for taste evaluations, but Nagel thought the criteria devised by Ough and Baker more objective.[4]

Finally, the third facet of developing a thriving wine industry in Washington, after growing the grapes and making the wines, was marketing the product. Richard T. Dailey and Raymond J. Folwell pointed out there were currently no feasibility studies of a Washington *vinifera* wine-grape industry, although there were some sources on marketing and consumption. Information on the costs and returns of establishing and operating *vinifera* vineyards was essential to the development of a fine table wine industry in the state. Taken together, the summaries included in the "Production, Wine Making and Marketing of Wine Grapes in Washington" proposal gave a good overview of the state of the Washington wine industry.

The objectives of the proposed study were clear. WSU scientists sought to determine what varieties were best adapted to Washington, what cultural techniques were necessary for growing grapes for quality wine, what varieties made the best wines, what viral diseases of grapes were present in Washington and their distribution and importance, what insect and mite problems were peculiar to wine grapes and how they could be controlled, and what the economic feasibility of expanding the grape and wine industry in Washington was.

Procedures for accomplishing these objectives were outlined briefly. Three-to-four of the outstanding *vinifera* varieties were to be given a variety of trellising, training, pruning, and moisture regimes to determine the best practices for winter hardiness. Irrigation studies on various soil types would be run to determine the best moisture levels for growth and for vine and fruit maturity. Sprinkling (overhead) irrigation would be investigated for its effect on growth, production, and wine quality. Insecticides and acaricides were to be screened for effectiveness on McDaniel mite and grape leafhoppers, and biological control studies would be run to determine differences in varietal susceptibility to insects and the economic possibility of eliminating the use of chemical pesticides (this was an instance

[4] Cornelius S. Ough and G. A. Baker, "Small Panel Advisory Evaluation of Wines by Scoring," *Hilgardia* 30 (1961): 587-619.

of early interest in biocontrol at WSU). Surveys would be done of the types and distribution of grape viruses in Washington vineyards and whether natural spread occurred, and the foundation block for the grape virus certification program would be indexed. Soils would be analyzed with the intent of relating elemental content to the growth, production, and quality of the fruit, and cover crops would be studied for improving the soil, plant nutrition, and control of erosion. Selected grape varieties would be processed into wine by standard procedures, analyzed by standard methods, and evaluated by wine panels. The duration of the study was to be eight years. Finally, the project would look at estimated consumption of wines, long and short run cost estimates, including the optimum size of vineyards and capacities of wineries, the place of wine grapes in the cropping patterns of farms and the region, their competitive position relative to other crops, and the potential for a contribution to the economy of the community and State.

This was the gist of what would become Project 0050 and provide a wealth of useful information for the struggling wine grape industry in Washington. All the original project participants except Nagel, Dailey, and Folwell were located at Prosser. Early in 1970 Clore, Department of Horticulture Chair Ackley, Nagel, and Dailey were corresponding about the proposal, and in June Director of Research for the College of Agriculture J.S. Robins sent a memo on negations with the Western Utilization Research and Development Division (WURDD) to Superintendent Allison at IAREC and Ackley in Pullman, saying, "You may proceed to develop specific plans for expenditure of these funds," as he expected to have an agreement for signature in a week. The initial arrangements would provide WSU with $25,000 a year for two years in support of cooperative grape research. WSU would pay all indirect costs.[5] This funding meant that WSU research on *vinifera* for wine in Washington could proceed, and there was good reason to expect a great future: an encouraging letter from a California grape expert to Clore around this time said, "[My company is] involved in wine production in the Medoc region of France and have considerable interest in varietal vineyard development in the Columbia River Basin…I was recently talking to Mr. Andre

[5] The Western Division representative had asked for a general budget estimate including who would expend the $25,000 and what the WSU contribution would be, which Robins attached. Clore and Nagel were to consult with Allison and Ackley on more specific information. J. S. Robins to J. L. Allison and W. B. Ackley with copies to Clore and Nagel, 9 June 1970, Charles W. Nagel Papers 1964-1991, Folder 130, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[sic] Tchelistcheff and he was most enthusiastic about Washington State."[6] Tchelistcheff had not always been so positive about Washington's potential, but even he was coming around.

Project 0050: administration

In January of 1971, less than a year after Project 0050 was funded, a meeting was held to review research results so far. Besides representatives from WSU, OSU, and the Western Regional Research Laboratory, others had been invited and time set aside for them to report in order to encourage their attendance.[7] Another (good) incentive was a wine tasting.[8] This was the first of several yearly meetings of Project 0050 participants.

There were some questions from the USDA on the marketing aspect of the project, and in October 1971, Dennis L. Oldenstadt, Assistant Director of Research in the College of Agriculture, wrote J.L. Allison to say they wanted Hatch Marketing approval for 0050, but were having difficulties as per an enclosed letter from Paul J. Jehlik, Director for Social Sciences, USDA Cooperative States Research Service, Washington DC to Acting Director L. W. Rasmussen seeking additional documentation of project activities. Jehlik wanted in particular documentation of the commitment to marketing research, as opposed to just quality testing. He said it was not "research" to use standard techniques to make wine from different varieties and to apply standard chemical or taste tests to determine quality. Real research

[6] William Penn Mott, III, Agribusiness Manager, Antaeus Resources Corp, Sacramento, California to Clore, 7 August 1970, Walter J. Clore Papers 1961-1999, Folder 65, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[7] Ackley wrote Clore in December saying January 20 appeared to be workable for a Project 0050 meeting to review research results and coordinate ongoing work; he suggested Clore put out a call to WSU, the Western Regional Research Laboratory, and OSU, and reminded him he was to report results for 1970 in the annual progress report. William B. Ackley to Walter J. Clore, 7 December 1970, Walter J. Clore Papers 1961-1999, Folder 223, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

Extension horticulturist Ronald B. Tukey also wrote Clore with a copy to Ackley, wondering if other individuals should not be alerted to this review of wine grape production, processing, and marketing. He suggested Sam Doran for Farm Management, Tom Brewer for Marketing, Paul Larsen of the Tree Fruit Research Center in Wenatchee, Cyril Woodbridge, in Horticulture, and John Vielvoye or someone else from British Columbia. Tukey went on to say, "I hope that throughout your discussion a differential can be made between research developments and needs and those of Extension. There are reasons for this as you realize. It could help us more adequately outline our potential needs in Extension." Walter J. Clore Papers 1961-1999, Folder 78, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[8] Richard T. Dailey to Clore, 3 January 1971, Walter J. Clore Papers 1961-1999, Folder 182, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

would begin only when the researcher attempted to make adjustments in the winemaking process to overcome or ameliorate the difficulties presented by Washington grapes. He said he believed WSU did intend to do genuine marketing research, but the project outline was inadequate documentation of commitment and an addendum was needed.[9] Other areas also needed clarification, and in October of 1971 Clore and Allison proposed an addendum to the objectives for IAREC's part of the project. These were: to determine the cause of high pH in wines of high acidity, typical of wines produced from grapes grown in Washington; to develop techniques for controlling malolactic fermentation of high acid wines; to develop "spätlese" wines from late harvested grapes for special wine markets; and to develop a "noble rot wine" from grapes naturally infected with the fungus *Botrytis cineria* for special wine markets.[10] (Research on these objectives had been part of the study since it was initiated, but had not been explicitly stated.) Rasmussen then wrote Allison asking if high pH in wines of high acidity actually existed (it did), and suggesting the term "to study" not be used at all, and a succinct statement of procedure for accomplishment of each of the objectives be included.[11] All this correspondence points up the amount of work that went into complying with grant requirements so that research could continue.

Projects such as 0050 were intended to have a wide-reaching effect, and attendance at the Annual Washington State University Wine Project meeting held in February of 1972 included five people from IAREC, 13 from WSU in Pullman, three Canadians, two from OSU plus three more from Oregon, three from California, two from the University of Idaho, one Idaho Extension representative, one from the WSU Puyallup station, three WSU Extension agents, one visitor from France, and one Economic Development Administration representative.[12] (The meeting was held the day after the annual Grape

[9] Jehlik to Rasmussen, n.d., Walter J. Clore Papers 1961-1999, Folder 212, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[10] Dennis L. Oldenstadt to J. Lewis Allison, 12 October 1971, Walter J. Clore Papers 1961-1999, Folder 212, Box 4, Cage 668, MASC, WSU Libraries, Pullman. *Malolactic fermentation* is a bacterial process by which malic acid is changed to lactic acid and carbon dioxide. It is used with many red wines to give them greater complexity and to correct problems with acidity. *"Spätlese"* wines are typically sweet dessert wines made from grapes that have been allowed to wither on the vines. *Botrytis cinera* is a mold that desiccates grapes, thus concentrating their sugars and resulting in a very sweet wine.

[11] L. W. Rasmussen to J. Lewis Allison with copy to Clore, 28 October 1971, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 20, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

[12] Walter J. Clore Papers 1961-1999, Folder 213, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

School to make it easier for more people to attend. Some other 0050 meetings were held to coincide with yearly conventions such as those of the American Society of Enologists for the same reason.)

The 0050 project work also served to leverage other investment in research. An example of such synergism was the project on soil fertility and plant nutrition relationships in irrigated vineyards that A. Irving Dow discussed in a letter to J.L. Allison, J. C. Engibous, and Ackley in May of 1972.[13] Dow noted that grapes were second only to apples in Washington fruit crops (he does not say whether he means in relation to acreage, yield, or value), and that acreage was rapidly expanding, but grapes had received only minimal attention regarding soil fertility and nutrition. There was a pressing problem of nitrogen fertility with *vinifera,* especially if grown on soils of light or coarse textures. Dow proposed a project on nitrogen relationships on wine grapes to begin 1 July 1972, saying his present project on alfalfa would taper off by 1973 and end in June 1975, freeing his time up for other work. The grape project would be mostly in sandy soils off-station and he anticipated needing $4,000-$5,000. Ackley promptly wrote back to say the Horticulture Department would welcome input on grape nutrition, and to suggest the work Dow proposed could be done under project 0050, in which he was already a participant.[14] Thus, work funded by the USDA was directly tied to other initiatives related to helping Washington develop its wine grape industry.

Project 0050 results: the wines

In August 1970 Glenn G. Watters, a chemist at the USDA WURDD Fruit Laboratory in Albany, California, wrote to Clore saying the Cooperative Agreement had been approved and they were ready to start work on the wines. Watters had discussed with Drs. Boyle and Popper in his laboratory the kinds of wine and number of samples of each to be sent for evaluation.[15] From the 1969 harvest they wanted a minimum of six bottles of each variety. For the 1968 “get acquainted” wines, they requested samples from

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[13] Dow to Allison, Engibous, and Ackley with a copy to Clore, 22 May 1972, Walter J. Clore Papers 1961-1999, Folder 182, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[14] Ackley to Dow, 24 May 1972, Walter J. Clore Papers 1961-1999, Folder 182, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[15] Wines were normally shipped by common carrier, and required special permits.

grapes that did well in Washington. Since the Agreement had not specified who would pay for the cost of shipping, it seemed fair to divide the charges between WSU and the WURDD laboratory. Under the terms of the Agreement the USDA would supply help to crush and process the 1970 crop from experimental plantings, but only if meaningful data could be obtained. Watters wrote "As I understand it, this depends upon whether George Carter will have time to change the method of heating and cooling of the juice prior to bottling . . . We are all looking forward to hearing about your two-month stay in Germany this fall."[16]

Already by that autumn, while Clore was in Europe investigating cold-climate viticulture there, a progress report showed what was happening in the wine evaluation work. The wines from 1968 and 1969 had been shipped to WURDD for analysis in August.[17] Early in November, 23 cases of Concord juice samples processed by Dr. G.G. Watters and J. Nelson at Prosser were shipped. Most of the juice samples were from a double curtain spacing and pruning level study that was evaluating the effect of vineyard management on grape quality.

The wines sent to WURDD for analysis had already been evaluated by taste panels in Pullman and generally received good scores. The Chenin Blanc, Helena, and Chardonnay had top ratings; the Seibel 10868 (a French hybrid), French Columbard, Grey Riesling, and Sylvaner were all good. Of the red wines, Lemberger and Barbera were best, even though the Barbera had a high acid content. The Lemberger was the most consistent of the red wines. A common problem for reds was a high pH even when the acidity was acceptable; this was prevalent in 1969. Some wines also had high acidity even when the grapes had an acceptable soluble solids level. The report said that therefore "we are convinced that the malo-lactic fermentation is a necessary step in the wine making of varieties that are high in total acidity. This is common practice in Europe." In the future the researchers intended to look at the acid

[16] Glenn G. Watters, Chemist, USDA Fruit Laboratory to Clore, 7 August 1970, Charles W. Nagel Papers 1964-1991, Folder 126, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[17] Clore said he was shipping 29 cases of 12 fifths each for evaluation, including only those scoring 15 or higher by the WSU taste panel for 1968. All 1969 varieties were included. To give two years of data toward a four-year study of double curtain spacing and pruning levels of Concords, Clore proposed repeating the 1968 procedures. He also said he had discussed the heating and cooling of processed juice, and come up with procedures. A list of the 1968 and 1969 wines was included. Clore to Glenn G. Watters, 12 August 1970, Walter J. Clore Papers 1961-1999, Folder 80, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

composition of different varieties, possibly by gas chromatography, to determine tartaric and malic acid content and to predict how much reduction in acidity could be expected from malolactic fermentation. Preliminary testing showed pH and possibly also acidity were both much affected by the length of exposure of the juice to the skins after crushing.[18]

From the 1970 harvest 48 varieties (29 white and 19 red) had been made into 55 lots of wine. Of these varieties, 31 were *vinifera* and the rest American or hybrid. The growing season had been cool and acidity was good, even excessive; some amelioration of the wines would likely be needed. In preparing samples of fresh grapes for testing soluble solids, titratable acidity, and pH, four methods were used. The equipment was not highly technical: they used the standard kitchen Waring blender, a "Squeezo Strainer," a Pexton lab press, and a potato ricer. While the tools used may seem unscientific, it was important to determine what processing techniques might affect the final product, and the researchers had to make do. They found the results interesting: there were no differences in soluble solids between methods, but the Waring blender gave the best acidity and pH values for reds and the Squeezo was best for whites. Areas identified for future study included completing wine making for all varieties pressed in the 1970 season; determining the effect of sugar and acid on quality; studying the malic acid content of wines; running taste panels for the 1970 wines; correlating Concord analyses to yield and growth measurements from the spacing and pruning level studies; determining what varieties to consider for wine making in 1971; developing techniques for malolactic fermentation of high acidity wines; studying techniques to minimize high pH in wines; and studying the effect of cropping levels on wine quality. This ambitious program was realized over the next several years.

In the summer of 1971 George Carter wrote Dr. Daniel G. Guadagni, a chemist at the Western Utilization Research and Development Division, regarding the wine samples sent for analysis. Clore had asked Carter to explain why WSU had shipped multiple samples of the same varieties. As an example of the level of specificity WSU scientists were investigating in developing a fine wine industry, there had been two 1968 Cabernet Sauvignons, one aged seven months in French oak and one aged 6.5 months in American oak; the grapes had come from different areas in the valley but the main differences in the

[18] "Cooperative Agreement between Washington State University and USDA, Agricultural Research Service, Western Utilization Research and Development Division; Progress of Work," n.d., Charles W. Nagel Papers 1964-1991, Folder 130, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

wines were expected to come from the oak. In 1969 Carter had made multiple samples of white wines from Gewürztraminer, White Riesling, Semillon, Chardonnay, and Chenin Blanc grapes to evaluate the effects of different fermentation temperatures, fermentation with or without the skins, differing harvest dates, the effects of freezing, and the fining of White Riesling with bentonite. Some 1970 wines had been ameliorated to reduce acidity. All these trials were aimed at finding clues to the improvement of winemaking procedures.[19]

The December 1971 "Progress Report" listed 44 varieties made into wine for evaluation. Taste panels had evaluated 26 whites and 22 reds from 1970, and all but three of the whites and seven of the reds were rated acceptable or better. Clore had carried out studies on eight *viniferas* to determine the effect of crop load on production, growth, and wine quality, while others had studied the effect of sugar on perception of acidity. Investigation of high pH levels in some wines led to the determination of their potassium ion content, which ranged from 360mg per liter for French Colombard to 1165 for Sauvignon vert, and 1010 for Lemberger to 2470 for Foch. Both 1970 and 1971 wines were assayed for tartaric and malic acid in order to select those most suitable for malolactic fermentation studies.[20]

Graduate student Mokhtar Atallah wrote Dr. T.L. Forster in Pullman about the wine project in March of 1972, describing its goal as determination of the suitability of different grapes grown in Washington for "commercially acceptable" wines.[21] His letter explained how the research was being carried out. The grapes were grown mainly in the Prosser area, and the wines, all processed by standard procedures and fermented to dryness, "i.e. no sugars left," were evaluated in Pullman. All musts were analyzed at Prosser for soluble solids, titratable acidity, and pH. Wines were analyzed for alcohol, volatile acids, titratable acidity, pH, reducing sugar,[22] tannin, and total and free sulfur dioxide. Data collected over seven years indicated that several grape varieties were highly suitable for Washington in terms of yield

[19] George H. Carter to Daniel G. Guadagni, 13 April 1971, Charles W. Nagel Papers 1964-1991, Folder 126, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[20] Progress Report, "Production, Wine Making and Marketing of Wine Grapes in Washington," January 1971- December 1971, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 20, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

[21] Mokhtar Atallah to T.L. Forester, 17 March 1972, Charles W. Nagel Papers 1964-1991, Folder 130, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[22] A reducing sugar is any sugar that forms some aldehyde or ketone in a basic solution. Reducing sugars include glucose, fructose, lactose, and maltose. Sucrose is not a reducing sugar.

and production of quality wines. A major problem affecting quality was high acidity, common in wines produced in cold regions. Atallah noted that "When recently more funds became available for this project, other phases of research were initiated." These included work on understanding and solving the acid problem by looking at the interaction of sugar and acid in wines, on malic and tartaric acid analysis and malolactic fermentation on 1969 wines and 1970 musts, and on phenols and polyphenoloxidases in grapes.[23]

There was much work yet to be done: since climate conditions and wines produced in Washington differed so much from those in California, it was clear Washington's problems could not be solved with California's methods. It would be necessary to understand all the characteristics of wines produced in Washington and to study methods to solve their unique problems. Work needed included studying the effect of horticultural practices, location, and processing on wine; following the changes in composition and quality of wine during storage and aging under different conditions; investigating all phases of malolactic fermentation and how it could be controlled, including use of bulk preparations of responsible enzymes instead of micro-organisms; evaluating changes in the composition of grapes during maturation under different conditions; analyzing the flavor components of Washington wines; and experimenting with blending wines from different varieties of grapes. Atallah's summary of project 0050 and other work needed offers a concise snapshot of the state of the industry in Washington in the early 1970s.

The 1972 Project 0050 "Progress Report," dated 4 January 1973, included evaluating the evaluators: a computer analysis was run on all the tasters who had participated over the previous four years, 40 tasters per year, to determine their ability to detect such characteristics as sugar, acid, and tannin in wines. Then the top 24 tasters (as determined by the consistency of their ratings and ability to detect different tastes in the wines) were asked to evaluate 47 samples of the 1970 wines. Melon, Delight, and Seibel 9110 grapes made the favorite whites, while Buffalo, Lemberger, and Grenache

[23] These and other projects resulted in theses and dissertations by graduate students involved with the research, for example those of Nagel's students Shirley A. Noordeloos, **"**Effect of Sucrose on Acid Perception in Wine" (M.S. thesis, Washington State University, 1972); James Robert Munyon, "Comparison of Methods of Deacidification of Musts and Wines" (M.S. thesis, Washington State University, 1976); Joseph Powers, "Polyphenoloxidase and Glycosidase Activities and Phenolic Content With Relationship to Browning in Several White Grape Varieties" (M.S. thesis, Washington State University, 1973). See Appendix A, "WSU Theses Related to Wine, 1948-1992."

produced the best reds. Interestingly, all the WSU wines rated higher than a commercial sample tested with them. An additional tasting evaluation of 1971 wines was being investigated for a correlation study of varietal preference by age group. The 1969 wines and 1970 musts and wines were analyzed using a dehydrogenase enzyme method for malates and a metavanadate method for tartrates. One study showed a logarithmic function for the effect of sugar concentration on acid perception in Semillon and Pinot Noir; other research looked at reducing acidity in a wine made from Foch grapes by inoculation with *Leuconostoc citrovorum* ML 34 to induce malolactic fermentation right after crushing, which dropped the titratable acidity from 0.88 to 0.5 percent, and more research was being planned. Another problem being investigated was the browning of white wines, with several varieties being analyzed for phenolic contents and polyphenoloxidase and glycosidase activity. Researchers had also begun experimenting with blending wines from different varieties, such as Lemberger and Early Burgundy.

While Project 0050 focused on *viniferas,* it included some work on Concords. (This was still the era of “cold duck” type wines, which were largely made from Concord grapes.) Thirteen cases of juice samples that had been processed at IAREC were shipped to the Western Utilization Research and Development Division laboratory for analysis in November of 1970. The grapes came from study of pruning levels and double-curtain trellising. Growth measurements, yields, and berry and petiole analyses had been taken. Samples from potassium-deficient vines, and one that had shown excellent yield and cold hardiness, were also sent.

Over the course of Project 0050, research activities grew and changed as some facets were completed and others initiated. The section on “Work Planned for 1972-73, Project 0050” included taste panel evaluations on 82 wines from 43 grape varieties from the 1971 harvest, using the usual procedures. Analysis for acids would continue with the determination of malate and tartrate in the 1971 wines, and researchers would follow the changes in the concentration of different major acids in Foch, Chardonnay, Concord, and Müller-Thurgau grapes during maturation and ripening, looking at the same acids found in the wines. Malolactic fermentation studies were planned to establish the optimum procedures for inoculation of the must with the bacterium *Leuconostoc citrovorum* (at the time of adding yeast, after preliminary fermentation, or after fermentation was completed), and to establish the best procedures for correcting wines by malolactic fermentation if needed.

Research on all these topics involved many people who were not regular faculty or staff employees. Tamis Johnson held a research assistantship under project funds and worked on the high acidity of experimental wines made at IAREC. She did her thesis under Nagel on the changes in organic acid content during maturation and ripening in Foch, Lemberger, Concord, Chardonnay, and Müller-Thurgau.[24] Food Science and Technology students Larry Wulf, working on browning in wines, and John Amistoso, working on pH and acidity in white wines, were just two of the graduate students working with Nagel and other faculty on research projects related to grape growing and wine making. These young scientists and many others contributed to the complete package of research, education, and extension responsibilities of a land-grant University.

Clore wrote to his department chair William B. Ackley in April of 1973 with information on the projects he was responsible for, including 0050.[25] The research had resulted in numerous papers, Bulletins, Circulars, and articles over its first three years. (As an indication of how popular wine grape research was, the following year J.L. Allison wrote George Bowman, Research Editor for the College of Agriculture, to request an initial 500 copies for distribution of Clore's *American Journal of Enology and Viticulture* article "Summary of Experimental Testing of Grape Varieties for Wine in Washington," which had been produced under Project 0050.)[26] Recent studies had sought to reduce acidity by malolactic fermentation and to improve color and tannin of Pinot Noir musts fermented after fractioned amounts of free run juice were removed.

The effects of crop load levels on grape quality for wine making and vine maturity for cold survival were also under investigation. The July 1973 Project 0050 Progress Report discussed taste panel evaluations of wines that considered the effect of high and low crop loading on wine quality.[27] Crop loads

[24] She found that Lemberger and Müller-Thurgau accumulated potassium at a much slower rate than the others and had lower grape pH at maturity, meaning they were of better quality for wine making. Tamis Lee Johnson, "The Organic Acid Composition of Washington Wine Grapes" (MS thesis, Washington State University, 1975), 52.

[25] Clore to William B. Ackley, 26 April 1973, Walter J. Clore Papers 1961-1999, Folder 158, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[26] J. Lewis Allison to George Bowman, 6 June 1974, Walter J. Clore Papers 1961-1999, Folder 137, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[27] Charles W. Nagel Papers 1964-1991, Folder 130, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

affected both profits, with the grower wanting to maximize returns per acre while maintaining a desirable sugar-acid ratio, and cold hardiness, where the grower had to worry that vines carrying heavy crops matured later and therefore might not harden off before freezing temperatures occurred. Balancing quality, quantity, and cold hardiness was difficult. Moreover, taste panelists had noted some dilution of bouquet in Semillon and White Riesling wines made from high crop load/high yield berry lots. The intensity of varietal character certainly varied with changes in the balance of tannins, acids, and sugars, which were tied to crop load and yield. The 1971 wines and musts had been analyzed for malic acid (by the malic dehydrogenase enzyme method) and tartaric acid (by the colorimetric metavanadate method), with results similar to those of 1970. As expected, because of precipitation of acid salts during processing, acid contents of musts were higher than those for the corresponding wines. Research on phenolics and browning continued.

Early results from Project 0050 work were promising, and Clore noted in a letter to Dr. Glenn Fuller, Chief of the Fruit Laboratory at the Western Regional Research Laboratory, that the findings had already been shared at the "Seminar for the Pacific Northwest Grape and Wine Industry" held in Yakima in 1973.[28] There were 236 registered attendants who heard Clore, Nagel, and a host of Washington and national wine industry leaders, all sponsored by WSU, the Washington Departments of Agriculture and of Commerce and Economic Development, the Greater Yakima Chamber of Commerce, Burlington Northern Inc., and the U.S. Small Business Administration and Economic Development Administration. One outcome of the seminar was the formation of the Washington Wine Society to advocate for the industry. Obviously, many people were interested in "Washington's Wine Future," as the proceedings were titled.[29]

Similar work went on in 1974 and 1975. The 1976 0050 Report compared the cold hardiness of primary buds of White Riesling and Cabernet Sauvignon to that of Bing cherries; Concords were about 5 degrees hardier than the *viniferas.* This was Clore's last year on the project, as he retired in 1976. Satisfactory soluble solids to acidity ratios were obtained from Lemberger, Merlot, Clevner Mariafeld,

[28] Clore to Glenn Fuller, 3 July 1974, Walter J. Clore Papers 1961-1999, Folder 141, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[29] *Washington's Wine Future; Proceedings of a Seminar for the Pacific Northwest Grape and Wine Industry*, (Olympia, WA? : Washington State Department of Commerce and Economic Development, [1973]).

Cabernet Sauvignon, and Grenache vines. All whites had reached acceptable maturity. The reds rated highest for taste were Lemberger, Merlot, Cabernet Sauvignon, and Clevner Mariafeld. Several Muscat varieties gave promise as dry or slightly sweet wines. In contrast to some earlier studies, which had found the hot interior of Washington unsuitable, Pinot Noir grapes had done best around the Grandview-Sunnyside area, with some differences in quality attributable to culture and vineyard management rather than the site. Wine evaluation had also focused on the Pinot Noirs from several sites, including analysis of berries during maturation, studies of methods for adjusting titratable acidity, and the use of high pressure liquid chromatography for analysis of phenolic acids and flavonoids. With regard to marketing research, wine purchasing households had been found to tend to be older, with higher income and education levels.

The termination report for Project 0050, "Production, Wine Making and Marketing of Wine Grapes in Washington," covered January 1971 through June 1979.[30] Several cultivars had been evaluated over the eight years for productivity, fruit and wine quality, susceptibility to winter injury, and other characteristics. Greater differences were found between cultivars than between sites, and yields ranged from 3.5 to 7.9 tons per acre. Two irrigations per year were shown to result in excellent maturity and winter survival. High pH levels were noted at several sites; work on wines had shown adjustment of high pH and acidity gave a fresher, fruitier taste. During the Project researchers had developed specialized high pressure liquid chromatography methods for analysis of grape and wine phenolics.

Data collected from seven years of taste panel results showed several varieties grown in Washington were suitable for high quality wines: Cabernet Sauvignon, Gamay Beaujolais, Meunier, Lemberger, Pinot Noir, Merlot, Chenin Blanc, Semillon, White Riesling, Chardonnay, Melon, Helena, and Gewürztraminer all met with favorable responses. Preliminary work on malolactic fermentation indicated the feasibility of reducing acidity in wine from 0.9 percent (as tartaric acid to) 0.5 percent. Phenols and polyphenoloxidases in the grapes, which influenced the browning of white wines, were under investigation.

[30] Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 21, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

The investment in research under Project 0050 paid off well: WSU faculty, staff, and graduate students had solved some of the problems facing the Washington wine and grape industry, responded to changing needs, compiled large amounts of useful data that would be put to use in other work, and shared their results widely through presentations and publications. Still, the work done under 0050 was just one part of the overall wine research program of the University, and there were other ongoing projects that taken together had a synergistic effect on the state's wine industry.

Projects 9468 and 1503 - Economic development and the wine-grape industry in Washington: two more federal projects

Interwoven with project 0050 were two projects funded by grants from the Economic Development Administration of the U.S. Department of Commerce. They were project 9468, the results of which were published as "Economic Development Impact of an Expanded Wine-Grape Industry in Washington," and project 1503, published as "Technical and Economic Assistance in Fostering the Economic Development of the Wine-Grape Industry in Washington."[31] Despite the emphasis on economics in the titles and the source of funds, both of these projects dealt largely with the science behind the wines.

Discussions about applying for a Technical Assistance Grant at WSU began in 1971. One advocate for a research program at WSU was Washington citizen Ellery W. Newton, who founded a group called the American Small Farm Institute and was very interested in grape growing in the state. He wrote to Clore about another group he had founded, called the "Pacific Northwest Grape Expansion Committee (Ad Hoc)," and said he would be going to Wenatchee and the Tri-Cities soon, and hoped to meet with George Wolcott, Vice President of Seneca Foods Corporation.[32] It is hard to judge Newton's

[31] *Economic Development Impact of an Expanded Wine-Grape Industry in Washington* (Pullman: Economic Development Administration, prepared by Washington State University, 1974); *Technical and Economic Assistance in Fostering the Economic Development of the Wine-Grape Industry in Washington* (Pullman: Economic Development Administration, prepared by Washington State University, 1975); *Technical and Economic Assistance in Fostering the Economic Development of the Wine-Grape Industry in Washington, Supplemental Report* (Pullman: Economic Development Administration, prepared by Washington State University, 1976).

[32] Ellery W. Newton to Clore, 22 June 1971, Walter J. Clore Papers 1961-1999, Folder 212, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

role; he certainly was a fervent advocate for the grape industry, even if he sometimes seemed to be the only active member of his "groups." Clore wrote back saying he appreciated Newton's interest, but the scope of the project he proposed went beyond Clore's research responsibilities. Clore went on to say that the present situation on developing large areas in Washington for wine depended on cold hardiness, and that the industry was encouraged by WSU's studies, but wanted further assurance. Financial support needed for such a study would run $15,000 annually for five to seven years.[33] (Clore was referring to just the cold hardiness studies; the entire research program would be much more expensive.) Newton wrote Clore again in October and November, bringing up the idea of the wine industry as a source of employment opportunities for minorities.[34] On 15 November 1971, Clore answered saying he had been busy with harvest, but had read over the booklet from the Economic Development Administration and was concerned that its programs for "technical assistance" were not really research. Moreover, funding was for a year at a time, and the research study he had in mind that would pertain to minorities (as per the federal grant guidelines) would require five to seven years funding. In response to Newton's request for a meeting, Clore suggested Dr. Allison and he could meet in early December.[35] Newton was persistent in advocating for an EDA grant, and met with Ed Fernie of the EDA in Seattle in mid-December about applying for a Technical Assistance Grant for developing a wine industry in Washington. He reported to Clore that the EDA was very interested and felt WSU would be capable of doing the work, and proposed a meeting in Seattle in January.[36]

A November 1971 memo from C. Mark Smith, Western Regional Director of the Economic Development Administration, to Thomas P. Dunne, Special Assistant to the Assistant Secretary of

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[33] Clore to Newton, 9 August 1971, Walter J. Clore Papers 1961-1999, Folder 212, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[34] On a related note, Clore's *Papers* include a letter from Roger W. Roll, an EDA Seattle Program Planning Consultant, to Daniel Ward, Director of the Washington State Department of Commerce and Economic Development, on a "Feasibility Study – Expanded Grape Growing, Washington State." The program was to provide economic development opportunities for Washington's underprivileged labor force, especially Latin Americans. Walter J. Clore Papers 1961-1999, Folder 202, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[35] Newton to Walter J. Clore, 15 October and 2 November, 1971, and Clore to Newton, 15 November 1971, Walter J. Clore Papers 1961-1999, Folder 212, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[36] Newton to Clore, 20 December 1971, Walter J. Clore Papers 1961-1999, Folder 212, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

Economic Development, U.S. Department of Commerce, Economic Development Administration, on "creative and innovative" new technical assistance project ideas put "Development of the Table Wine Industry in Washington" at the top of the list.[37] (Smith was proud enough of his role in bringing this grant to WSU that he listed it in his professional biography.)[38] David M. Desmarteau, Market Research Analyst for the Trade Promotion Division, Washington State Department of Commerce and Economic Development (DCED), wrote Clore saying that he had enjoyed the meeting at IAREC, and that he felt they had taken the first steps toward organizing the grape and wine industry in Washington. The growers present had seemed excited about working together toward common goals and the DCED was willing to cooperate.[39] Desmarteau wrote again in early December enclosing a letter from EDA Program Consultant Roger Roll, whose approach to expanding the industry seemed to him more logical than Newton's. The EDA had informed his office that it had funds for a feasibility study, and Desmarteau thought the Washington DCED might apply for them and contract the study out, possibly partly to IAREC.

WSU did receive an EDA grant as of 15 June 1972.[40] The quarterly "Progress Report for Technical Assistance Grant No. 07-6-09468" for the period ending 15 June 1973 gives a good overview of the types of work being carried out and the number of WSU researchers involved. At IAREC, Clore, Michael Wallace, Robert Fay, and L.P. Christiansen were working on grape production studies. George Carter was concerned with wine making and analyses. At WSU in Pullman, Richard T. Dailey, Raymond Folwell, and Paul S. T. Lee were involved with economic studies, and Tamis Johnson with wine analyses and taste panel evaluations.[41] The information in the report came from papers developed for the American Society of Enologists 1973 annual meeting and the authors proudly noted that "This year, 1973, marked the 3rd consecutive year that faculty members associated

[37] Mark Smith to Thomas P. Dunne, 12 November 1971, Walter J. Clore Papers 1961-1999, Folder 190, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[38] http://www.cms-assoc.com/markbio.html (accessed 15 April 2008).

[39] David M. Desmarteau to Clore, 22 November and 1 December 1971, Walter J. Clore Papers 1961-1999, Folder 202, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[40] Clore to Dr. Howard Brooks, National Program Staff, ARS-USDA, Beltsville, Maryland, 10 October 1972, Walter J. Clore Papers 1961-1999, Folder 180, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[41] During this period (1971-1972), Nagel was working for United Vintners, Inc. in California.

with this project have presented papers at these professional society meetings. Without the financial support of the Economic Development Administration it is highly unlikely that the information could have been generated that is included in the papers attached to this report." The report was divided into four sections: 1) vineyard development on Indian reservations (dealing with the Colvilles and Spokanes); 2) grapevine nutritional studies (dealing with black leaf, seasonal changes in vine nutrition levels, and boron; 3) cultural practices studies (dealing with soils, vine training, and machine harvesting); and 4) economies of size in wineries.[42]

Also in 1973, Dean C. J. Nyman of the WSU Graduate School wrote to Gaines Sutherlin of the U.S. Economic Development Administration regarding a proposal for the continuation of the work done under Grant No. 9468. The proposal was prepared by Clore, Folwell, and Nagel, and requested $94,680, including $23,670 for the first year. Folwell also wrote to Sutherlin, saying he and Clore had discussed the final report for Grant 9468, and that "In addition to the final report, there will be various publications through the Agricultural Research Center at Washington State University as various phases are completed. We feel that it is important that this information be put in published form so that various aspects of it are made available to the public." This concept is at the crux of the role WSU played in the economic life of the state: scientists carrying out research, and then sharing their results. Folwell also wrote Nagel, who was still with United Vintners but was soon to return to WSU, saying the EDA was willing to extend the grant until 15 June 1974, and wondering if Nagel would like to be the principle investigator for objective 5, wine analysis and tasting. (Nagel would end up being responsible for preparing that phase of the final report.)[43]

For the 1974-75 grant cycle, Folwell, Clore, and Nagel again submitted a proposed continuation of their previous grant to provide technical and economic assistance and basic research to foster the development of the Washington wine grape industry.[44] This year the primary goals were

[42] "Progress Report for Technical Assistance Grant No. 07-6-09468," Charles W. Nagel Papers 1964-1991, Folder 126, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[43] Letter from Nyman to Sutherlin, 14 September 1973; letter from Folwell to Nagel, 19 September 1973, Charles W. Nagel Papers 1964-1991, Folder 126, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[44] "Request for Approval of Application for Extramural Support," Charles W. Nagel Papers 1964-1991, Folder 93, Box 2, Cage 639, MASC, WSU Libraries, Pullman. While Folwell, Clore, and Nagel are listed on the cover sheet as the principal investigators, the "Applicants" are given as WSU President Dr. Glenn

1) to provide technical and economic assistance on the development of vineyards, especially to traditionally low income groups such as Latinos and Native Americans, 2) to develop a vocational program dealing with viticultural and enological problems of Washington for members of low income groups,[45] 3) to develop a climatic map of the state and incorporate existing knowledge about wine-grape variety adaptability, 4) to determine winter hardiness under field and laboratory conditions, 5) to evaluate the suitability of different varieties from different sites for wine making, and 6) to refine market profile data so marketing programs could be developed. They asked for $51,200 from the EDA, to go along with $17,518 of state money. In an accompanying letter to Sutherlin, Folwell wrote that they had achieved the objectives of the earlier grant but needed to follow up with more research and "subsequent technical advice to the various minority groups who [sic] have established vineyards." [46]

W. Terrell, Dean of Agriculture Dr. John S. Robins, Director of the Agriculture Research Center Dr. James M. Nielson, Chair of Agricultural Economics Dr. J. Edwin Faris, Chair of Food Science and Technology Dr. John Spencer, Chair of Horticulture Dr. William B. Ackley, and Superintendent of IAREC Dr. J. Lewis Allison. Much attention is given throughout the proposal to low-income and minority groups. The proposal starts off with sheer hubris: "This project will solve the problems of unemployment . . ."

[45] Currently WSU offers certificate programs in enology and viticulture for place-bound students who do not want to get a traditional college degree but do want advanced training in these fields.

[46] Clore devoted a good deal of attention in the early 1970s to trying to help tribes, especially the Confederated Tribes of the Colville Reservation, develop vineyards. On 10 July 1972 Jack McDermott, of McDermott and Associates, wrote Clore to say he was working with the Spokanes and the Bureau of Indian Affairs on planning for reservation lands, and some of the leaders were interested in grapes. The Extension Viticulturist for the California Agricultural Extension Service, Armand M. Kasimatis, had referred McDermott to Clore. (Folder 190, Box 4) Clore wrote back to say he and Dailey had had discussions with the Yakima tribe on the development of land for grapes, and he would be pleased to talk with the Spokane tribe. He would need information on temperatures, frost-free days, site location, and amount of land. (Folder 182, Box 4). Apparently not everybody who needed to be involved in the discussions was; County Extension Agent Joe S. Maxwell wrote to Dailey with copies to Clore and Folwell on 3 August 1972 to say there had been an article in the *Spokesman Review* about the study on the feasibility of growing grapes in eastern and central WA. The Spokane Tribal Council had asked him why Stevens County and the Spokane reservation were not included. Maxwell said he had already talked with Clore and Tukey, and the tribe would probably be contacting him with a request for areas along the Spokane river to be included. (Folder 190, Box 4). Clore went to the Spokane Reservation on 7 September 1972 to investigate the potential for grape production there. (Folder 217, Box 4).

Apparently Agricultural Extension agents did a good job on keeping up with potential developments for their areas. The agent for Yakima Country, John Arthur Ries, wrote Dailey and Clore on 27 March 1973. He, too, had seen a news release about the EDA grape feasibility study. He wanted to know what was happening in case a member of the tribal council asked. (Folder 173, Box 4). Dailey wrote back 9 April 1973 thanking Ries for his interest and inquiry about work on the Yakima Reservation, and saying he was working closely with the Colvilles on development of a vineyard.(Folder 161, Box, 4).

Clore wrote Dan Cadagan of the WSU Department of Agricultural Economics on 28 March 1973, enclosing copies of certification and quarantine orders for grapes and listing cooperators who were growing grapes to test for adaptability. The list included Mike Sauer on the Yakima Reservation, Wendell George, Dr. Archie Van Doren, and Robert Dellwo on the Colville Reservation, and Alfred McCoy, Morris

They were planning to expand research to include not only Indians, but also other low income minorities such as Chicanos [sic], in learning how to keep proper records for effective management and how to create cash flow analyses for obtaining financing. In 1973, eight new variety test sites had been established, seven of which were on or adjacent to Indian land, but funds were needed to compile temperature records, conduct cold hardiness trials, and evaluate the composition of grapes grown at these sites. A proposal, "Technical and Economic Assistance in Fostering the Economic Development of the Wine-Grape Industry in Washington," was forwarded to the U.S. Department of Commerce by Dean Nyman on 10 June 1974. It was funded as Project 1503.[47] As with other federal grants, there was much paperwork involved: an "Assurances of Compliance with the Department of Commerce Regulations under Title VI of the Civil Rights Act of 1964," a "Work Schedule Plan for Technical Assistance Grant NO. 07-6-01503," and the "Special Terms and Conditions" including

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Lynds, and Iva Rajewski on the Spokane Reservation. (Folder 160, Box 4). Clore traveled to Nespelem several times in 1973 to confer on establishing vineyards and to deliver grape plants. (Folder 175, Box 4). On 20 November 1973 he wrote Wendell George asking about growth, maturity, and plant survival of the plantings established his property. He advised George that the plants should be covered with three to four inches of soil at his earliest convenience to protect them through the winter. By this time Clore had established that well-established vines did not require extra protection for the winter, but young vineyards were quite susceptible to frost injury. (Folder 164, Box 4).

Clore received a letter dated 19 February 1974 from William Cleveland, who was employed by the Colville Indian Tribal Enterprises and had been sent Cleveland to study at the viticulture program at the University of California-Fresno. He had met Clore the previous summer when the tribe planted its three-acre test vineyard, and now asked Clore for the latest information on grape production in Washington, which Clore sent. On 1 October 1974 Clore wrote Cleveland to say he had limited funds for viticulture training, but he had talked with Wendell George about Cleveland working for a time at IAREC, and George though it would be worthwhile. Cleveland would have the opportunity to learn about Washington problems not encountered in California, including trellising, training, pruning, cultural practices, winter injury, diseases, and insects. Cleveland replied that he was interested and would be finished at Fresno in mid-January. He said, "As far as I know there will not be any interference with my responsibilities with the Colville Tribe. At this time, the Council has not decided to plant any grape vineyards." George confirmed Cleveland would not be needed on the Reservation until the weather was favorable for fieldwork, and Clore hired him as an Experimental Aide II. (Folder 138, Box 4). Cleveland subsequently produced an unpublished four page report titled "Grape Growing Season of 1975" including a map of the varieties planted in the Colville reservation test plots. (Folder 129, Box 3).

By this time there were three test plots on the Colville reservation and at least one on the Spokane reservation. (Folder 143, Box 4). Clore and Nagel visited many of these and other cooperative plantings on or near reservations in 1975 and 1976. (Folder 48, Box 2). IAREC Superintendent J.L. Allison was also involved, writing to Simon Sampson of the Yakima nation on 1 November 1974 asking for help recruiting Yakimas to participate in a trainee program on developing and operating vineyards funded under the EDA grant. (Folder 152, Box 4). Little came of any of the efforts to encourage wine grape growing by Washington tribes. All citations above refer to the Walter J. Clore Papers 1961-1999, Cage 668, MASC, WSU Libraries, Pullman.

[47] Charles W. Nagel Papers 1964-1991, Folder 126, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

sections on Questionnaires and Surveys, Environmental Considerations, and Energy Considerations. To all these and more were added requirements for quarterly reports on work accomplished, financial expenditure reports, and the substantial Final Reports.

Even though there was a great deal of paperwork behind every scientific report or paper a WSU scientist prepared, the research that was carried out under Projects 9468 and 1503 turned out to be of great value the state.[48] The section on "Horticultural Studies" in *Economic Development Impact of an Expanded Wine-Grape Industry in Washington* (1974) included chapters on "Grape Vine Hardiness Studies and Variety Testing" by Clore, Fay, Wallace, and Brummund; on "Growth Controlling Substances" by Clore and Brummund; and on "Nutritional Studies and Shoot Productivity" by Clore, Wallace, Christensen,[49] Woodbridge, Carter, and Fay. Part of the hardiness studies had already been published in a scientific journal before the final grant report came out.[50] Central Washington had experienced almost a week of below zero temperatures in December 8, 1972, which had provided an opportunity to evaluate the effects of vine condition on cold hardiness. About half of both the 88 *vinifera* and 34 *labrusca* varieties checked showed little or no injury, which of course was encouraging. Followup studies throughout the 1973 growing season looked at weather and moisture level data, and showed that young vines had suffered considerable trunk and root damage, partly because the low temperatures had come when there was no snow cover. Weakened vines were also more susceptible to 2,4-D damage. Older vines did better. Drought-induced boron deficiency was present in some vineyards, along with symptoms of nitrogen, manganese, potassium, and magnesium deficiencies. Despite these conditions, the 1973 harvest yields and quality were generally good. Even after over 50 percent of their primary buds were killed, 14 of the *vinifera* varieties included in the trial produced over three tons per acre. Clore and his colleagues also ran artificial sub-zero tests for

[48] Nearly half of the 1974 report on Project 9468 and two thirds of the 1975 report on Project 1503 were devoted to the economic aspects of the industry. The much shorter 1976 *Supplement* to 1503 was entirely scientific. As noted in the introduction to this study, the economic research and support provided by WSU faculty, especially Raymond Folwell and Richard Dailey, is out of scope here, but certainly deserving of close attention from someone trained in agricultural economics.

[49] L. Peter Christensen was a visiting faculty member from the University of California.

[50] Walter J. Clore, Michael Wallace, and R.D. Fay, "Bud Survival of Grape Varieties at Sub-Zero Temperatures in Washington," *American Journal of Enology and Viticulture* 25, no. 1 (1974): 24-29.

hardiness and bud kill, and looked at how cropping levels affected bud hardiness. Interestingly, not all varieties had the highest yield at harvest when pruned for highest production at the beginning of the growing season; the implication was there was a difference in productivity between optimum cropping and overcropping of vines. Further experiments on pre-conditioning showed how gradual lowering of temperatures, as compared to sudden drops, allowed vines to survive greater cold. Observations of temperatures at ground level and at different trellis heights showed the lowest readings came at 3.5 inches from the ground, explaining why vines high on the trellis could seem to be unharmed but still suffer damage from freezing near ground level.

Another aspect of research under this grant was work with growth regulators, which promoted or inhibited development, for increasing yields, facilitating fruit maturity and harvesting, and inducing bud hardiness. This work was done on Concords, which were still by far the largest grape crop in the state, and was promising. Vines treated with Alar and gibberellic acid showed exceptionally high yields, very good soluble solids, and low titratable acidity and pH. Clore planned to repeat the study during the 1974 season to see if the results could be replicated. Ethephon (the trade name of a plant growth regulator) seemed to have a favorable effect on bud hardiness, but none was measured with Racuza (another commercial product).[51]

Results from the plant nutrition studies had already been published in the Washington State Grape Society *Proceedings* for 1973, in keeping with WSU's belief in getting research results to the public as quickly as possible.[52] The testing involved taking samples of plant parts and analyzing them in the laboratory to determine what fertilizers would benefit the crop. Tissue analysis had advantages over soil analysis in that it showed what the plant was actually absorbing, which can vary in response to cultural management including moisture, and also by variety. The researchers found nutrients varied depending on what time of year the sampling was done (the need for different nutrients varies over the

[51] *Economic Development Impact of an Expanded Wine-Grape Industry in Washington*, 142. Materials used were Racuza 4 E.C. (Methyl 3,6-dichloro-o-anisate), Alar (Succinamic acid, 2,2-dimethylhydrazide), Ethephon (2-Chloroethyl-phosponic acid), and gibberellic acid or GA (Potassium gibberellate).

[52] Peter Christensen, Cyril G. Woodbridge, Walter J. Clore, and A. Irving Dow, "Boron Deficiency Occurrence and Symptoms in Washington Vineyards," and "Tissue Analysis Studies in Grapevine Nutrition," in *Proceedings, 1973 Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1974), 5-11and 79-85.

course of the growing season) and what part of the plant was sampled (recently matured leaf stems, called petioles, seemed to be the best for overall analysis.) Certain varieties showed a need for higher levels of certain nutrients, for example nitrogen for Meunier. The information gathered in this study was used to show that vineyard location, vine condition, and fertilization practices were more important than variety differences. Boron seemed to be low in Washington vineyards overall, and boron deficiency was closely tied to drought. It could affect vines the following year. Other research showed that for some varieties such as Semillon and Zinfandel, secondary and even tertiary buds could produce decent crops even after high percentages of the primary buds were killed by frost. However, a frost occurring in late spring, when the vine's nutritional reserves had already gone into the primary buds, would cause significant losses if the vineyard was overcropped, or not in good vigor and well nourished.

The section on "Enology Studies," by Nagel, Tamis Johnson, and George Carter, dealt with "Quality Testing of Fresh Grapes and Wine."[53] Already the varieties that have since proven best for Washington were scoring highly. Pinot Noir, Gamay Beaujolais, and Meunier all exhibited variable color content when grown in central Washington and were recommended only for the cooler climates along the lower Columbia River and on the western side of the state. Wines made from Lemberger scored 16 (out of 20) or higher in seven out of eight years, better than any other variety.[54] The Lemberger also had an excellent balance between pH and titratable acidity. (Unfortunately, the popular demand for Cabernet Sauvignon and Chardonnay led many grape growers to rip out their lessen-known Lemberger vines in the 1980s and 1990s; the variety has yet to reach its potential for producing fine wines in the state.) Nagel *et al.* went on to say that Merlot had not been tested as frequently, but was more consistent in character than Cabernet Sauvignon. Zinfandel, a high-acid variety, had excellent varietal character. For white wines, White Riesling, Chardonnay, and Chenin

[53] *Economic Development Impact of an Expanded Wine-Grape Industry in Washington*, 167-225.

[54] A letter from wine expert Leon Adams to Clore said the 1975 Lemberger tasted by the Bay Area wine writers had been recognized as "a Vinifera red of considerable promise." Adams went on to say, "though realizing it is a young and unfinished wine, I give it my vote for aroma and flavor, as distinctive." He also thought the Limberger version of the name (as opposed to Lemberger or one of the several synonyms) might actually be an asset. Adams to Clore, 8 September 1976, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 237, Box 4, Archives 214, MASC, WSU Libraries, Pullman.

Blanc all made good wines, although sometimes the acidity and pH needed adjustment. Gewürztraminer scores varied year by year, probably because of sometimes too low acidity and high pH, but that problem could be solved by the addition of tartaric acid. Since it was an early maturing variety, growers were advised to plant it in the cooler areas of the state where its typical spicy aroma would have time to develop. The research included several American and hybrid grapes, but results were less promising than with the *viniferas*. The chapter concluded with the observation that since the climate of the Colville Reservation was warmer than that of Prosser, the more acidic varieties should be considered for planting there.

Included in the 1974 report was an Environmental Impact Statement prepared by an agricultural economist.[55] The laws and regulations reviewed applied to semi-solid winery wastes, liquid winery wastes, air pollution from vineyards and wineries, water use, erosion control, industry effects on the native flora and fauna, chemicals used on the vines, and chemicals used in winemaking. Overall, negative impacts from the wine industry were judged no worse than those of other uses to which the land might be put. The only "irreversible and irretrievable resource commitments with the proposed action" would be leveling of land and the possible spread of nematode worms. The wine industry appeared to be relatively clean with regard to potential pollution.

The report summary discussed meetings and seminars held concerning the possibilities for growth in the Washington wine industry and the formation of a new industry society to conduct research and make an impact on state legislation.[56] There had been several meetings with the Colville Confederated Tribes, the Spokane tribe, and the Yakima tribe, and preliminary site suitability studies carried out. A trial planting in 1973 on the Colville Reservation had led to plans for developing a 250 acre site, but there was a problem getting funding because the site was on tribal land, which could not be used as collateral for outside financing. The Colvilles had also sent a tribal member to the California State University at Fresno to study viticulture and enology, as noted above. WSU committed itself to

[55] Dan Cadagan, "Environmental Impact Statement," in *Economic Development Impact of an Expanded Wine-Grape Industry in Washington*, 226-259.

[56] Raymond J. Folwell, Walter J. Clore, and Charles W. Nagel, "Summary and Significant Developments in the Washington Wine Industry," *Economic Development Impact of an Expanded Wine-Grape Industry in Washington*, 269-274.

help in any financial analyses the tribe might need for promoting vineyards. Unfortunately, the enterprise never developed.

Statewide grape acreages had expanded in the previous two years, with the Concord industry, "backbone of the existing grape industry" in Washington, adding 4000 acres and planning for more. *Vinifera* plantings were also expanding "in an orderly fashion with the purpose in mind of making a profit rather than being a tax dodge as often exists in the wine industry in other states . . . " Grape processing plants were expanding their capacity, and wineries such as Ste. Michelle were offering more varieties.[57] A new winery, headed by an enologist who had been a research associate on the EDA grant, was to be established at Bingen on the lower Columbia River, fostering the economic development of the community. Furthermore, the report concluded that the support of the EDA through the technical assistance grant had resulted in the probability of the food technology laboratory at Prosser being reopened by the Agricultural Research Service. This was seen as a significant benefit to the entire state fruit and vegetable industry, not just grapes, and one that would not have happened without the impetus of the EDA grant. The report concluded that "The future development of [the] Washington wine-grape industry will hinge heavily upon the continued research efforts and assistance provided to the infant industry by Washington State University." Those efforts were already underway.

As noted above, Project 9468 segued into Project 1503. Most of the final report for project 1503 was devoted to economic studies by Raymond Folwell and John L. Baritelle. Clore, Wallace, and Brummund contributed a short chapter on cold hardiness, and Martin W. Ledwitz, Research Aide for the Air Pollution Research Section of the WSU College of Engineering, wrote an extensive report on the suitability of state's climate for grapes. Several people contributed to the enological evaluation of varieties from different sites, and J. R. Munyon and Nagel discussed their work on acid adjustment

[57]Regarding Ste. Michelle: "Chateau Ste. Michelle is the oldest winery in Washington state with some of the most mature vineyards in the Columbia Valley. The winery's roots date back to after the Repeal of Prohibition, when the Pommerelle Wine Company and the National Wine Company were formed in 1934. They merged in 1954 to form American Wine Growers and produced mostly fortified sweet wines. In 1967, American Wine Growers began a new line of premium *vinifera* wines called "Ste. Michelle Vintners" under the direction of legendary California winemaker and consultant André Tchelistcheff. Ste. Michelle Vintners planted its first vines at its Cold Creek Vineyard in Eastern Washington in 1972. Cold Creek Vineyard remains one of the oldest and most renowned vineyards in the state. In 1976 Ste. Michelle Vintners built a French style Chateau in Woodinville, outside of Seattle, and changed its name to Chateau Ste. Michelle to reflect its new facility." http://www.ste-michelle.com/Sub_OurWinery.cfm (accessed 17 April 2008).

of wines, an extremely important factor given Washington's often high-acid grapes. [58] There was still followup work to be done and IAREC Superintendent Allison wrote Sutherlin at the USDA on 24 July 1975 about getting an additional $5,000. Clore had 20 wine grape sites in central Washington from which he wanted to get 1975 production information and make experimental wines, which would not be possible without additional funding. The extension of the grant was forthcoming, and the Supplemental Report included further information scientific information on cold hardiness, 1975-1976 weather and phenologic data for Concords, White Riesling, and Cabernet Sauvignon, 1975 wine grape variety evaluations, evaluation of Pinot Noir grapes from different sites, and finally a summary and discussion of further significant developments in the industry.[59]

Project 1628 – Cultural Studies of Concord Grapes

There were yet other studies going on during the 1970s, and like the Economic Development Administration and Western Utilization Research and Development Division projects, they overlapped and supplemented each other. Some, such as the work with Concord grapes, had deep roots in the juice and jelly industry.[60] In the early 1970s Concords were also briefly popular as, the basis for "cold duck" type wines.[61] Studies on Concords in Washington had been ongoing for decades and provided much information that was also useful for *viniferas*. As noted above, Dr. Nelson J. Shaulis spent a six-month sabbatical at IAREC in 1950 studying Concord culture, and Clore had long been concerned about the effects of 2,4-D on Concord grapes. He and Drs. Huber and Blodgett had surveyed 2,4-D damage in the

[58] *Technical and Economic Assistance in Fostering the Economic Development of the Wine-Grape Industry of Washington*. James Robert Munyon was a graduate student working with Nagel. His work indicated that the calcium double salt method gave the best results in reducing the total acidity of high acid musts while having the least effect on wine quality. James Robert Munyon, "Comparison of Methods of Deacidification of Musts and Wines" (M.S. thesis, Washington State University, 1976), 82.

[59] *Technical and Economic Assistance in Fostering the Economic Development of the Wine-Grape Industry of Washington*, *Supplemental Report*.

[60] Concords of course had been used for wines since the original wild vine was discovered and improved by Dr. Ephraim W. Bull in Concord, Mass. The grape was first exhibited at the Massachusetts Horticultural Society in 1853. *New York Times*, Oct. 13, 1895, p. 25.

lower Yakima and Kennewick-Pasco areas in 1953. Research by Clore and Bruns found that Concords were extremely sensitive to even minute quantities of the herbicide.[62]

Concord grape research had been funded by the state in 1961 as Project 1628, "Cultural Studies of Concord Grapes." This work would continue for over twenty years. The Research Project Outline for the project gave a succinct overview of the problems facing Concord growers and the work needed to solve them.[63] The Outline talked about previous studies having contributed to the increase in grape production in the state, with total tonnage up from the 1950 level of 22,500 to a 1959 level of 58,000 with only a minimal increase in acreage. Concords accounted for 85 percent of the total, and yields per acre and sugar content were higher in Washington than in other Concord growing areas. The future of the juice grape industry looked promising, but there were problems.

One problem was excessive fertility, which affected yield, quality, and vine maturity (which in turn affected winter hardiness.) Excess fertility meant excess vine growth, with not enough of the plant's resources going into the berries, and also led to late maturity and greater susceptibility to cold temperatures. Additionally, a study of moisture and nutrient requirements was needed to evaluate deficiencies of nitrogen, zinc, iron, manganese, and potassium, as current practices for soil amendments and foliar applications did not always help correct problems. Research was also needed on pruning levels and training systems, always with the object of increasing production while improving quality and decreasing costs. Yet another area for investigation was the residual effects of the most promising weed control chemicals being used in vineyards – the best weedkiller in the world was no use if it also damaged the vines. Because of the nature of the underlying Sagemoor soils of Washington, excessive use or poor drainage of water caused chlorosis.[64] If improved drainage and more judicious irrigation did not solve the problem, then vineyards might have to be replanted with vines grown on chlorosis-tolerant understocks,

[62] Walter J. Clore Papers 1961-1999, Folder 1, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

[63] Washington State University, Agricultural Experiment Station, Research Project Outline, "Cultural Studies of Concord Grapes," 1961, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 47, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

[64] *Chlorosis* in grapes is usually caused by an iron deficiency brought on by over-watering.

which had been identified in earlier studies. Other work was needed on increasing soluble solids, 2,4-D contamination, and various diseases.

Interestingly, research from other Concord areas was less applicable in Washington precisely because conditions were *more* favorable in the state, and the problems were different.[65] (Work done in California, which was closer to Washington in climate than were New York or Michigan, was centered on *viniferas*.) Thus there was a need for research applicable to the specific conditions Concord growers faced in Washington. The same situation would develop in the 1970s when *viniferas* were being heavily planted and promoted in the state—research done in Albany, New York or the Napa Valley in California was not necessarily what was needed by viticulturists and enologists in Yakima or Walla Walla. (Despite some of the earliest vineyards in the state having been located near Puget Sound, the region west of the Cascade Mountains was too cool and wet for most *viniferas.* WSU's Mount Vernon Experiment Station did work on identifying what varieties did best under these maritime conditions, but the primary wine grape area remained in the central basin and along the Columbia.)

The Outline for the Concord research project included specific procedures to address the questions that had been posed. Clore was to be the project leader, with Associate Horticulturist Woodbridge responsible for physiological and analytical studies, Assistant Plant Pathologist Skotland to handle problems related to fungus and virus diseases, and Assistant Soil Scientist A. H. Hunter in charge of soil sampling and analysis. The duration was to be five years; in actuality, the project stretched over four times that long. Included with the proposal was a list of all known Washington publications on any sort of grapes from 1941 to 1961; there were 27. By 1992, the year this study ends, there were nearly 100 more publications just on Concords from WSU researchers.

One annual report for Project 1628 will serve to illustrate the way work was carried out and shared with the industry over the course of years. In 1965, research was centered on fertilizer requirements, pruning levels, herbicides, diseases, and handling grapes grown on an arbor trellis.[66]

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[65] Central Washington's total heat units, frost free growing season length, limited rainfall but readily available irrigation water, suitable soils, and summers with warm days but cool nights were all highly favorable. Below zero winter temperatures, of course, were not.

[66] The arbor trellis would soon be replaced, as it was unsuited to the mechanical harvesting that became the standard during the later 1960s.

Arbor trellises were shown to increase yields by nearly a ton an acre over the conventional two-wire Kniffin system. Fruit quality overall also improved, but soluble solids went down by 18 percent. Geneva double curtain trellising also increased quantity and quality. The researchers working on this project compared trellis systems by vines per acre, yield, acidity, color, soluble solids, and picking ease. Growers could then use this data to make decisions on their own vineyard management practices.

Also in 1965 Alar was applied at three different levels and different times. The concentration did not affect fruit color, but the timing of applications did, with reductions of up to 40 percent when sprayed in mid-July. (Color was one of the characteristics processors evaluated when buying grapes.) Gibberellin sprays applied after full bloom loosened clusters and increased yields, but succinic acid seemed to have no effect on yield or fruit quality. This was a case where negative results were positive: knowing that in a scientific study succinic acid was found ineffective, growers could ignore it and concentrate on other substances that could add value to their crops. On the other hand, Dalapon, a herbicide commonly used to control grasses and weeds between rows of vines, was shown to reduce yields by 11 to 21 percent.

The results of this work were disseminated as usual through WSU publications, scientific journals, popular magazines, society meetings, and talks to industry and civic groups. If growers were to be expected to contribute to research, they needed to realize value on their investment. For example, in 1963 WSU researchers spoke to 50 people at a Washington Wine and Grape Growers Council meeting and another 175 at the Annual Grape School. They also gave talks at the Euclid Grange in Grandview (75 attendees) and the Grape Field Day at IAREC (150 attendees). Two WSU publications were in press: "Composition of Washington Produced Concord Grapes and Juices," and "Weed Control in Grapes with Herbicides." [67] Clore, Brummund, and Woodbridge had given presentations at the Washington State Horticultural Association annual meeting, and these would be published in the Association's *Proceedings*,

[67] Walter J. Clore and others, *Composition of Washington-produced Concord Grapes and Juices,* Technical Bulletin 48 (Pullman: Washington Agricultural Experiment Stations, College of Agriculture, Washington State University, 1965); the second item was published as *Weed Control in Grapes: Central and Eastern Washington,* Extension Mimeo 3763 *(*Pullman: Agricultural Extension Service, Washington State University, [1965]).

further expanding the audience.[68] Two articles had appeared in scientific publications, one by Cone on black vine weevil, and one by Ingalsby, Neubert, and Carter on Concord pigments. [69]

In order to keep such work going it was necessary for the researchers to seek additional outside funding. Clore wrote to Russ Hays, Manager of the Pacific Northwest Plant Food Association in Portland, Oregon, early in 1969, enclosing copies of a research Memorandum of Understanding and the estimated 1969 budget.[70] The association was to contribute $700 for a vineyard survey of Concord grape nutrition. In February Clore wrote to Herbert Barber of the National Grape Cooperative in Grandview, saying that since grape growers, grape processors, and fertilizer dealers had all been asked to contribute, WSU had designated the Pacific Northwest Plant Food Association to be the collection agency. (The University had long struggled with how to handle small contributions from many sources without being overwhelmed by the paperwork, and having an outside agency handle the process was one solution.) Of course, time that Clore and other University scientists spent making such arrangements and following up on payment records was time that was not available for research, but it was essential to bringing in the funding necessary to continue their work.

An IAREC proposal titled "Washington State University Proposed Research to Meet the Needs of the Grape Industries of the State of Washington," dated December, 1969, was distributed to grape growers in January 1970. At this time by far the greatest portion of the grapes grown in the state was still Concords, with little acreage in *viniferas.* The proposal pointed out that state and federal funding only paid for the maintenance of facilities and the salaries of appointed employees. It was necessary for industries to support research that benefited them specifically. Some areas of research that could help solve

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[68] Walter J. Clore and Cyril G. Woodbridge, "Some Leaf Abnormalities of Concord Grapes," in *Proceedings, 59th Annual Meeting - Washington State Horticultural Association* (Wenatchee, WA: Washington State Horticultural Association, 1963), 181-182; Walter J. Clore and Vere P. Brummund, "Some Aspects of Washington State's Remarkable 1963 Grape Crop," in *Proceedings, Annual Meeting - Washington State Horticultural Association,* (Wenatchee, WA: Washington State Horticultural Association, 1963), 165-169.

[69] Wyatt W. Cone, "Black Vine Weevil, *Brachyrhinus sulcatus,* as a Pest of Grapes in South Central Washington," *Journal of Economic Entomology* 56, no. 5, (1963): 677-680; D. W. Ingalsbe, A. M. Neubert, and George H. Carter, "Concord Grape Pigments," *Journal of Agricultural and Food Chemistry* 11 (1963): 263-268.

[70] Walter J. Clore to Russ Hays, 23 January 1969, Walter J. Clore Papers 1961-1999, Folder 88, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

growing, processing, and marketing problems of grapes were 1) cultural practices that resulted in maximum cold hardiness ($2,000), 2) training, trellising, and pruning practices for quality (just $300!), and 4) cutworm control ($750). An 11 December 1969 handwritten estimate of WSU expenditures on grape research, excluding industry contributions, gave the total for the year as $92,659.[71] Most of the research being done of course dealt with grapes that were turned into juice and jelly, not wine, although the Yakima Valley Grape Producers had just signed a ten year contract with Gallo Wineries for one and a half to two million gallons of Concord juice a year for making into Cold Duck wines.[72]

The last year WSU grape and wine research was supported by the Washington Wine and Grape Growers Council was 1970, but work continued on Project 1628 throughout the decade with help from other groups such as the Concord growers. The 1970 and 1971 Project 1628 Progress Reports included definitive information on the differences in yield and quality among trellising systems. The six year average for vines on the Geneva double curtain system was 13.4 tons per vine, 22.2 percent more than vines trained on either the Kniffin or bilateral cordon systems. (Note that arbor trellises were no longer even being considered.) In 1970 grapes from Geneva double curtain trellised vines were one and a half percent higher in soluble solids and 32 percent more intense in color than those from bilateral cordons. This was exactly the sort of information growers needed as they considered switching their trellising systems to accommodate mechanical harvesting. They also needed to know how far apart to place their vines for best productivity and use of space, which Clore had studied. He found in there was little difference in the yield from vines from rows spaced nine, eleven, or thirteen feet apart. Soluble solids did vary with spacing, increasing as distance between rows increased. There were no marked differences between pruning levels studied in either yield or soluble solids. The average 1970 yield of all treatments in the nitrogen nutrient study was 12.2 tons per acre.[73] The following year, 1971, was the first time yields appeared to correspond to nitrogen levels. Yields from Geneva double curtain trellising continued to run

[71]Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 13, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

[72] Walter J. Clore Papers 1961-1999, Folder 1, Box 1, Cage 668, MASC, WSU Libraries, Pullman. According to Irvine and Clore, Gallo's first purchase of Concord juice from Washington was in 1949. *The Wine Project,* 411.

[73] Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 13, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

over 20 percent higher than with the Kniffin system. (As is the norm in science, results needed to be compared over several repetitions before there could be any certainty as to their validity).

In the summer of 1972 Clore sent Ackley his annual report on the various research projects for which he was responsible. He saw no point in continuing Project 1617, as he had not worked with small fruits other than grapes for several years. (By this time Clore's only non-grape project dealt with asparagus.)[74] While grape variety studies on *viniferas* could continue under Project 0050, he thought "Cultural Studies of Concord Grapes" (1628), should be revised to study the development of nutrient deficiency symptoms, the use of chemicals for advancing maturity and improving quality, and the effect of total mechanical pruning. Later he sent a revision of Project 1628 to Woodbridge with notations as to where they might elaborate on work that should be done to enhance the Concord industry. The revised proposal went to Ackley for approval in December.

Work on nutrient deficiencies was already underway and was included in the 1972 report. After heavy soil leveling and extensive soil sampling to establish base nutrient levels, various fertilizer treatments had been tried on two acres of a commercial Concord vineyard. Different levels and combinations of phosphorus, potassium, manganese, and zinc had then been supplied, but results were not yet evident. A seven year fertilizer study on nitrogen in a Geneva double curtain trellised vineyard failed to show any differences in yield from varying application strengths. In other work, when the chemical compound Alar had been applied at 500 parts per million (PPM) at bloom, it did not affect yield or clusters numbers appreciably, but it did decrease berry weight. Further 2,4-D damage work showed that shoots with two or more severely malformed leaves had both berry numbers per shoot and weight per cluster reduced, as compared with lightly damaged controls. Severely damaged vines also produced juice in which color was slightly reduced. [75]

The sheer variety of the grape research Clore and others were carrying out at this time was impressive. Writing to Ackley in 1973 about the projects he was responsible for, Clore reported on

[74] Letter from Clore to Ackley, 1 August 1972, Walter J. Clore Papers 1961-1999, Folder 179 , Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[75] To run these studies, vines that showed severe damage in May were tagged, so their production could be evaluated at harvest in October. Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 13, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

progress that had been made on the evaluation of the 250 different grape varieties on trial that were old enough to bear fruit. Data had been collected on time of harvest, cluster weight, berry numbers, soluble solids, total acidity, and pH of the grapes, along with their suitability as table (fresh), juice, or wine grapes. The more promising varieties had been tested weekly for several weeks before harvest. There were trial plantings all around the state for determining the best grapes for different microclimates, and there was also post-harvest research underway. Tests had shown that fresh Campbell Early table grapes could keep 12 weeks or longer at 35° Fahrenheit in plastic bags with 1.1 to 4.4 grams of sodium bisulfite crystals, which greatly expanded the time frame for storage, shipping, and sale. [76] Other work dealt with disease (the effect of black leaf on growth, production, and quality of Concords, and how to control it); cultural practices (the development of completely mechanical pruning and harvesting practices and evaluation of the resulting growth, yield, and juice quality); nutrition (the determination of nutritional requirements for maintaining high yields of good quality grapes on double curtain trellises); and growth regulators (the use of chemical compounds for facilitating pruning, harvesting, and maturing vines).[77]

While it was essential to have a plan of work that addressed the perceived needs of the industry, WSU's researchers also needed the flexibility to respond to special circumstances. The winter of 1972-1973 brought extreme low temperatures, and the damage done to vines emphasized the importance of hardiness studies carried out in artificial cold chambers to help growers make decisions on managing their vineyards. Clore's work showed that buds were most sensitive to subzero temperatures early in the winter (November and December), and that a 50 percent kill of primary, secondary and tertiary buds occurred at -16°, -22.5°, and -31° Fahrenheit respectively. Further work on mechanical harvesting showed both single trellis and Geneva double curtain trellis vineyards had crop losses of over 10 percent compared to hand harvesting. Growers would have to consider whether the lower costs of mechanical harvesting would offset the crop loss.

Cyril Woodbridge was involved at this time with research on boron in Concords. He wrote the President of the Washington State Concord Grape Research Council early in the year with copies of the

[76] Sodium bisulfite, NaHSO3, is a food additive that releases sulfur dioxide gas, which kills bacteria, yeasts, and fungi.

[77] Clore to William B. Ackley, 26 April 1973, Walter J. Clore Papers 1961-1999, Folder 158, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

pertinent Memorandum of Understanding that would cover funding for part of his work, and later with a report of his activities. In 1974, no boron deficiencies or toxicities had been found, even in areas where such conditions were present earlier. As requested by the Council, the study was extended to include some Niagara vineyards, and for comparison French hybrids growing alongside Concords in three areas were also tested. It was known that boron was more rapidly leached from sandy soils under sprinkler irrigation than from heavier soils with rill irrigation. Woodbridge's recommendation was that a boron compound such as Solubor should be applied annually as a spray at three pounds per acre. In some instances he had also checked magnesium and zinc, which were occasionally much below recommended levels. He noted he hoped for more funds to explore and develop techniques for eradication of such deficiencies, and said a research proposal would be forthcoming.[78]

How essential such external funding was to continuing research was illustrated by a memo from Clore to Brummund notifying him that his appointment as an Experimental Aide would terminate on 31 December 1974 unless money was made available by the Washington State Concord Grape Research Council. Clore was hopeful the Council would vote to continue support at its December meeting, which it did.[79] Without his intervention with the Council, important research would have had to be abandoned because of lack of funds, but the trade off was the time and energy Clore and other senior researchers had to spend in securing support.

Work on Project 1628 continued under Clore's direction in 1975 and 1976. Much of it, such as evaluation of mechanical harvesting and the effects of growth regulators, would later prove to be useful for the development of the *vinifera* industry. There was still more to do, as Edward L. Proebsting pointed out in the March 1976 draft of an article on how to meet the needs of the industry he wrote for *Goodfruit Grower*.[80] He noted Clore's upcoming retirement, and pointed out that, "Because of financial support from the industry research on grapes will not stop with Dr. Clore's retirement." A study on the cause of dying

[78] Cyril G. Woodbridge to Charles W. Fox, 10 April 1974 and 27 November 1974, Walter J. Clore Papers 1961-1999, Folder 156, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[79] Clore to Vere Brummund, 17 November 1974, Walter J. Clore Papers 1961-1999, Folder 137, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[80] Proebsting, draft for *Goodfruit Grower* dated 31 March 1976, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 13, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

arm disease was set to begin under Skotland, and they hoped to maintain the work on virus-free varieties started by Mink. Work on soil fertility and irrigation of vineyards on lighter soils would be continued under Dow and Middleton, and control of nematodes, insects, and weeds under Santo, Cone, and Ogg. Nagel would continue with enology. Proebsting wrote "It is apparent that if we are to maintain a strong grape research program we will need a strong industry commitment for financial support. Because grapes are perennial plants good research must develop over several years. This requires confidence that there will be money to maintain programs and people to direct the research."

As acting Superintendent of IAREC at this time, Edward L. Proebsting had to spend much of his time soliciting research funding. A talk he drafted titled "Grape Research – Needs and Opportunities" emphasized the importance of Concords in the Yakima Valley. Success for the industry was related to its ability to adapt to new methods and "to solve cultural problems with the help of research workers at WSU's Irrigated Agriculture Research and Experiment Center," which was going to be facing a crisis with the retirement of Clore and the budget shortfalls that prevented re-filling his position. He pointed out that research at IAREC was funded primarily by the state through WSU. State funds paid the salaries of research professionals, research technologists, secretaries, administrators, maintenance workers, and farm labor. Additionally state money covered buildings, laboratories, the library, shops, storage, farmland, and machinery. Money was also needed for equipment, supplies, extra labor, and travel in order to conduct research, but less and less was available after paying for energy, water, parts, etc. It was this portion of the costs of research that was supplemented by industry funds directed toward problems of specific interest. For horticultural research on perennial crops such as grapes, it was important to have programs complete with test plots and laboratory-office facilities. In this and other presentations, Proebsting and his WSU colleagues were making the point that the scientific work of the University was of direct relevance and value to the grape growers and processors of the state—and well worth supporting.

The industry agreed. A memo from Robert Fox of the Washington State Concord Grape Research Council gave a list of the specific research problems they wanted to see addressed:

1. long-range effect of mechanical harvesting on grapevine productivity
2. pruning level recommendations for different training methods due to the increased cane and bud damage from mechanical harvesting
3. evaluation of different mechanical harvester picking heads and their impact on injury
4. continued work on ethephon in relation to mechanical harvesting
5. mechanical pruning

6. evaluation of tissue testing versus soil testing for determining fertilizer needs
7. cold hardiness and spring frost control measures
8. differential in yield and return per acre in single curtain versus double curtain trellising in relation to labor and trellising costs
9. evaluation of growth regulators and their impact on production, maturity, and pH
10. evaluation of the usefulness of nutrient sprays and trace mineral fertilizers
11. effectiveness of herbicides in relation to soils and irrigation systems
12. overhead sprinkler systems
13. promising pesticides
14. nematode research
15. dying arm disease
16. potash and zinc deficiencies in established vineyards
17. integrated chemical-biological control of grape pests[81]

These and other topics became the targets of WSU research efforts over the next several years. Fox wrote to the new IAREC Superintendent Lin Faulkner enclosing a check for $7,400, the first half of the Council's agreed payment for 1976 research projects on grape culture, insects, and dying arm disease. The second half would come in December after the Board of Directors met with researchers to review their findings and consider their new proposals. [82]

Results for 1975 and 1976 showed that the use of ethephon did not affect cold hardiness of primary buds, but did loosen berries to make them easier to harvest (as it was supposed to). Measurements of the temperatures vines needed to develop from one stage to the next showed it took 24 heat units to advance grape buds from first swell to bud burst. Data such as this allowed growers to make plans based on actual weather conditions, rather than guesswork. Other research continued on a system to evaluate the effects of 2,4-D contamination on vine maturity. Funding from the Council for 1976 had been $8,000; for 1977 it would be $8,800, later increased to $10,900 to cover one quarter of Brummund's salary.[83] Clore retired in 1976, but still kept in contact. He wrote Chair of Horticulture Orrin E. Smith in 1977 to say he thought it might be useful to compare the record of funding from the Washington Concord

[81] Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 13, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

[82] Robert Fox to Lindsey R. Faulkner, 14 July 1976, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 13, Box 1, Archives 214, MASC, WSU Libraries, Pullman. A subsequent letter from Faulkner to James M. Nielson, Director of the WSU Agricultural Research Center in Pullman, directed that the funds be credited as $4,000 to Proebsting (cultural studies on Concords), $1,500 to Cone (control of black vine weevils, cutworms, and grape mealybugs, ($1,250 to Santo (nematodes), and $650 to Skotland (dying arm disease).

[83] Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 47, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

Grape Research Council for the past nine years to that of Washington Asparagus Growers: WSU had received three times more money from the asparagus industry.[84]

One of the projects proposed for 1977 was to work with a commercial concern, Snake River Vineyards, to determine the moisture and nitrogen requirements of Concords for highest production, while still maintaining satisfactory quality and ensuring the plants would reach full vine maturity.[85] Nature again intervened, this time in the form of a drought. Proebsting wrote the Washington Concord Grape Research Council in February of 1977 to say that Snake River Vineyards had pulled out of the agreement, and the drought had changed overall research priorities. As matters stood, Brummund would have to be terminated the 30th of June, leaving Bob Fay to do the work with Concords in addition to the wine studies WSU was by now committed to pursue. While Brummund had made good progress on low temperature work, the 2,4-D studies could not be done and the Concord vineyard IAREC had intended to plant at the station would be delayed at least a year. Proebsting pointed out it would be difficult to be sure 2,4-D had injured vines already water stressed anyway, so postponing that work was reasonable. Most importantly, he said 1977 should be devoted to documenting the effects of the drought. He proposed the Council fund IAREC with an additional $4,400 to cover another three months of Brummund's time; WSU would also fund an additional three months. This was done.[86]

The internal WSU relationships among IAREC, the Agricultural Research Center in Pullman, and Cooperative Extension could be complex, as could the determination of what unit should be responsible for particular activities. Yakima County Extension Agent Daniel F. Mayer wrote to Extension Horticulturist Tukey in early 1977 to say Washington had approximately 20,000 acres of grapes with a farmgate value of about $12,650,000, much of it in Yakima and Benton counties. He noted that, to date, there had not been an Extension project on grapes, and this might be an excellent time to begin. Such an enterprise

[84] Clore to O. E. Smith, 12 December 1977, Walter J. Clore Papers 1961-1999, Folder 122, Box 3, Cage 668, MASC, WSU Libraries, Pullman. Federal funding was not included in the total, as those funds were for developing the wine industry, and the grape industry had no input.

[85] Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 27, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

[86] Edward L. Proebsting to the Council, 22 February 1977, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 13, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

could begin by getting together with grape specialists and Extension agents who had responsibility for grapes. Tukey responded saying he was aware of the value of the crop and the problems caused by the loss of Clore. Cooperative Extension would consider creating a new position with a with split appointment in research at IAREC, but industry support for such a move would be critical. Tukey agreed it would be a good idea to get together with Frank Anderson, Ray Hunter, and others at Prosser, but he could not commit to more as Extension was already overcommitted when the water crisis hit. [87]

Project 1628 continued throughout 1977 with work on the effects of the drought and other topics, including several insects that were causing increasing problems. There was ongoing research on determining the hardiness of buds throughout fall, winter, and early spring as influenced by climate, cultural practices, and vine characteristics. Buds had been found to be fifteen degrees hardier in January than in early December (that is to say, they could stand that much colder temperatures without damage). Sprinkler-induced frost damage caused by sprinkler failure in several vineyards had allowed for field-next-to-field comparison of frosted and non-frosted vines.[88] (Sprinklers can stave off frost damage, but only if they keep running.)

Although research done on Concords (and hybrids) was not always exactly applicable to the *vinifera* plantings that were becoming more prominent in Washington, some findings were transferable. Among these were the background work done on the effect of Alar as a foliar spray to improve fruit set and increase yield. Another was the result of investigations into the causes of winter damage, which turned out to be primarily from root damage due to the freezing of the soil. Irrigation studies had looked at the effectiveness of various irrigation regimes. Studies had been done on the metabolism and translocation of radioactive 2,4-D on grapevines, trying to determine what length of time externally applied 2,4-D remains unmetabolized in the vine. Arginine in the grape juice had been used to help determine the nitrogen needs of vines, and winter injury studies were conducted on the effect of the vine's nutritional status. (Interestingly, there was less winter damage when growers used foliar feeds than when they did

[87] Daniel F. Mayer to Ronald B. Tukey, 17 March, 1977, Tukey to Mayer, 24 March 1977, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 13, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

[88] 1977 Reports and 1978 Proposals to the Washington State Concord Grape Research Council, November 1977, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 12, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

not, but more damage when they used soil fertilizers, especially nitrogen, than no fertilizer. Other factors such as depth of rooting, post harvest irrigation, etc. did not make significant differences. Proposed 1980 research included 1) root hardiness and cold acclimation of grape buds, 2) the use of Alar to improve fruit set and increase yield, 3) shoot positioning (other Concord growing states had reported that reorienting vine shoots increased crop maturity, bud fruitfulness, and cane maturity in the year following), 4) arginine analysis of grape juice as an indicator of the nitrogen needs of the grape vines, 5) investigations into the value of foliar fertilization of grapes, and 6) irrigation studies to determine the total amount of water applied by trickle, sprinkler, and rill irrigation. The grant budget for 1979 had been $25,090, and the proposed budget of $34,056 for 1980 included the fulltime salary of $19,000 for Brummund.[89]

By this time wine grape research was taking up more of the time of WSU researchers. Acting President of the Washington Wine Grape Society Mike Wallace wrote Ahmedullah late in 1979 to point out that very little work had been done in Washington on the irrigation of wine grapes. He felt Middleton's work on irrigation in Concords had only limited application to *viniferas,* and supported Ahmedullah's research proposal on water economy for wine grapes. [90] Nonetheless, Concords were still, and would remain, a large part of the Washington grape industry, and the *Goodfruit Grower* reported in 1985 that the Concord Research Council had allocated $44,500 to IAREC for studying the role of insecticides in reducing bud injury, the effect of sprinkler irrigation and vineyard age on Eutypa dieback, the economic impact of nematodes, and optimum fertilizer levels.[91] As the basis of the viticultural industry in the state, work done on Concord grapes was also important for improving wine grapes and thus Washington wines.

[89] "1979 Reports and 1979 [sic] Proposals to the Washington State Concord Grape Research Council, December 1979," Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 41, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

[90] Wallace to Ahmedullah, 13 December 1979, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 41, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

[91] *Goodfruit Grower*, 15 April 1985, 41, Walter J. Clore Papers 1961-1999, Folder 10, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

Project X05: Tri State Wine Grape Research

Finally, there was the Tri-State Wine Grape Demonstration Project proposal that was submitted to the Pacific Northwest Regional Commission (PNRC) in February 1976 and revised in March.[92] The sponsors were listed as Clore and Nagel from WSU, Drs. Hoya Yang and Ralph Garren from Oregon State University, Extension horticulturist Tony Horn from the University of Idaho, the Winegrowers Council of Oregon, the Washington Wine Society, and industry representatives Richard Ponzi, William Blosser, and Michael Wallace. Even though Walter Clore was to retire that summer, he was well known in the region and his name would have served to add credibility to the proposal.[93] The request was for funding for one year beginning May 14, 1976, a date chosen because the enology phase of the project had been initiated in May of 1975 with PNRC funds. The budget for viticultural work at WSU, OSU, and UI, plus enological work at WSU and OSU, plus steering committee meetings, was $101,860. University contributions of personnel and facilities were valued at $95,531, and in-kind services from industry (acreage for test plots, labor, grapes for wines) at $8,064, for an overall combined effort of $205,455.

By this time, the mid 1970s, the problems that the industry faced were more often complex and specific than those of the previous decades. Now that variety trials had winnowed out many potential grapes as less suitable, viticulturists needed to determine the most suitable micro-climates for particular cultivars, and also the cultural practices necessary to obtain the best maturity of fruit and vine. Each of the three states was to plant identical clones of four cultivars in test plots for close comparison of climate and environmental effects on the fruit and the vines. Since there was now a solid body of evidence

[92] "Tri-State Wine Grape Demonstration Project," Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 33, Box 1, Archives 214, MASC, WSU Libraries, Pullman. Various facets of this work were known by different project numbers: 4485, AG 3009, 752, and X05. The Pacific Northwest Regional Commission was a federal-state partnership established in 1972 to oversee economic planning and development in Oregon, Washington, and Idaho.

[93] "Horticultural Programs at the IAREC to be Retained in Asparagus and Grapes after July 1, 1976," Walter J. Clore Papers 1961-1999, Folder 120, Box 3, Cage 668, MASC, WSU Libraries, Pullman. This unattributed document detailed what was going to happen to Clore's work after he was gone. Two acres of foundation cultivars were to be maintained for cuttings and evaluation. Murit Aichele of the State Department of Agriculture was to be responsible for taking cuttings and distributing them to certified growers. Additionally, two more acres of vines were being evaluated for production, fruit quality, and wine and juice manufacture, and another 1.5 acre eleven year old block of ten cultivars being used for studies on trellising, pruning, and wine making would be continued. R.D. Fay would be responsible for the field work and maintenance of the vineyards. Brummund's hardiness study was to terminate at the end of June, and he would take on the viticulture part of the study (petiole and berry sampling and production records) under the supervision of Irving Dow and Pat Middleton.

identifying the most promising grape varieties for the region, the focus was also shifting to looking at different clones of a given variety, since clones can vary from others of their type. The project was also to include phenological[94] testing to provide information on bloom periods, growth and fruiting cycles, fruit characteristics, fruit and wine maturation, quality, yield, and wine quality as related to vineyard site.

Enologists were also addressing problems on a different level than in earlier studies. Since the region was subject to occasional chilly autumns and/or early rains that prevented grapes from fully maturing, there were problems with high acidity leading to "sour" wines. One objective of the project was to investigate the best way to reduce acidity.[95] Working with growers, food scientists at WSU and OSU wanted to determine what represented "optimum maturity" for different varieties and what sites were most likely to produce this condition. The project proposal noted that "During this developmental stage of the industry, it is imperative that the Universities supply the facilities for translating theoretical research into acceptable commercial practices, as well as required problem-solving analysis." [96]

The economic and private sector part of the proposal was written by William Blosser, who estimated there were 3,100 acres of vinifera in the tri-state region. He said "the long term (5-10 years) economic impact could be substantial . . . The large investment requirements together with the relatively low present production make it difficult or impossible for the industry at present to fund the research that is needed. A grant from the Northwest Regional Commission will complete or initiate some of the significant research that the industry believes will be beneficial to it and to the economy of the Pacific Northwest. Once the industry is solidly on its economic feet, it expects to participate fully in funding necessary research." [97]

The Quarterly Reports WSU filed according to the Tri-State Wine Grape Demonstration Project requirements are quite detailed as grant reports go. Looking at samples of these will suffice to show the types of work being carried out. The 15 August through 30 November 1976 report included temperature

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[94] *Phenology* is the science of the relations between climate and seasonal biological phenomena, such as the flowering and fruiting of plants.

[95] Dr. Hoya Yang, OSU Department of Food Science and Technology to Nagel, 19 January 1976, Walter J. Clore Papers 1961-1999, Folder 118, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[96] "Tri-State Wine Grape Demonstration Project," 6.

[97] "Tri-State Wine Grape Demonstration Project," 10.

(in August, Prosser was 245 heat units behind the 33 year average; the entire state had had unusually wet weather for the month) and varietal data (must samples from 23 cultivars from an IAREC vineyard had been analyzed for harvest date, yield, soluble solids, titratable acidity, and pH, with comments (e.g., "excess crop to achieve maximum varietal character, low vigor, slight mildew, boron deficiency, slugs present in sample").[98] The same report said WSU's enology personnel had compared different methods of reducing acidity, and had done computer modeling of data from the last 13 years, which raised some questions as to whether high acidity in white wines was really undesirable. White wines with pH levels below 3.1 got high scores from tasting panels regardless of acidity content. Nagel conjectured that it was possible that below this pH, wine quality is markedly improved because undesirable organisms are unable to grow, and was testing this hypothesis.

As with the any other long-term project, it was necessary to make adjustments over the course of the grant as problems arose. At a January 1977 meeting the participants decided that some wines would be exchanged between WSU and OSU to check whether the tasting panels were giving similar readings. The consensus on the first year results was that cultural practices had as much to do with differences in grape quality as anything else, and the investigators needed to pay more attention next year. The report noted "Washington State found that many of the cooperative growers were not very good growers and therefore the cultural practices were very difficult to supervise." Unless standardized cultural techniques were followed in the field, the evaluation of the wines had little meaning. Moreover, the 1976 experience showed crop load and the ability of the grower to control mildew influenced grape quality greatly, and there was no point in doing multiple site evaluations until those factors were under control. This was something Clore had been trying to get across for years: vineyard management, especially hardening off the vines for winter, was absolutely critical.

Bureaucracy was an ever-present feature of the scientific research work carried on by academic researchers. After the 1977 meeting Proebsting contacted Blosser to say WSU would be able to do better work with fewer off-station plots, since there was currently no faculty member with responsibility for viticulture. He wanted to use to use the ongoing drought emergency to study soil moisture and leaf water

[98] "Quarterly Report, TRIS," for 15 August 1976 through 30 November 1976, prepared by Proebsting and Nagel, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 35, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

potential and their effects on vines and fruit quality. Blosser replied that cutting back the number of sites in Washington to three and focusing on the drought was not a problem, and the completion date for the project could be extended—as long as no extra money was being requested.[99] Such administrative maneuvering was important for flexible responses to emerging problems.

Other bureaucratic hoops were more onerous. A PNRC Project Monitor sent Proebsting an insultingly simple-minded "quiz" to fill out before their meeting to arrange the work plan for 1978, and any changes, such as WSU taking on more of the cultural work to standardize the trials, had to be spelled out ahead of time. It is possible this heavy-handed oversight may have been triggered by deficiencies in the WSU reports to date, as the contract did specify that payment was tied to receipt of both financial and narrative quarterly reports, and the reports needed to reflect both University and industry contributions each quarter. Additionally, while the contract did allow purchase of equipment, such purchases required the prior approval of the project coordinator and a formal budget revision, since no equipment was currently budgeted. Proebsting wrote PNRC's Sharon McPherson early in 1978 explaining that the 1977 contribution of vines and fruit by the industry in 1977 totaled just one acre and 3300-4000 pounds of fruit, less than implied in the contract, because a different approach had been taken. The PNRC wrote again in early 1978 to say that WSU needed to revise the budget documents even though the project was over, so that all the files would agree.[100]

Project X05: results

The Tri-State Wine Grape Demonstration Project was in some senses a capstone grant, building on both early independent research trials carried out by Clore, Nagel, and others, and on several preceding grants, and it is therefore worthwhile to spend some time looking at its results. Irrigation was always important for Washington (Oregon did not grow wine grapes under irrigation), but equal

[99] Blosser to file, 26 January 1977, Proebsting to Blosser, 27 January 1977, Blosser to project participants, 15 February 1977, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 35, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

[100] Linda S. Craig to Proebsting, 8 December 1977, Proebsting to McPherson, 5 January 1978, Craig to Proebsting, 11 January 1978, Craig to File 752 regarding meeting of 29 December 1979, all Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 35, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

applications of water did not necessarily mean equal results. Research had shown that the time of year, time of day, previous condition of vines (insect or disease damage, frost, pruning practices), nutritional state of vines, slope of vineyard, soil types and textures, and wind all had varying effects, as of course did whether the water was applied by trickle, sprinkler, rill (surface), or central pivot irrigation, or even—rarely—rainfall. Too little water meant plant stress, possibly leading to susceptibility to pests and diseases, and meager berries; too much meant "flabby," flavorless fruit, not to mention unnecessary costs to the grower.

Vine maturity and hardiness had been shown to be directly related, and this was perhaps Clore's greatest contribution to the industry. He had shown that it was possible to grow most white and many of the best red *viniferas* in the state if proper attention was paid to maturity of the vine. Cultivars had to be able to ripen fully during Washington's growing season, which was shorter than California's, and to reach harvest soon enough for the vines to harden off before winter set in.[101] Hence, the work under the Tri-State project on clonal differences in productivity and ripening dates was fully apposite. Hardiness under the occasional severe winter temperatures was as closely tied to the state the vine had been in before the cold hit as it was to whether the low temperatures came early or late in the winter or whether there was snow cover on the ground. Interestingly, irrigation practices had been shown not to influence hardiness. The luscious red wine grapes that thrived in Burgundy and Bordeaux could also survive in Washington providing proper cultural practices, worked out by WSU's research efforts, were followed.

Since vigor in grapevines was not an undisguised good, part of maturing the vines was making sure growth was controlled during the season. Too much nitrogen, for instance, meant a leggy and leafy vine that put more of its energy into expanding its reach than concentrating flavors in the berries. Other elements, such as boron, affected how well the plant performed, and different cultivars needed different amounts of different nutrients. Pruning the canes and training them onto different trellis systems also affected vigor (and berry quality) by changing the amount of sunlight reaching leaves and berry clusters or the temperatures under the canopy.

[101] A letter from Nagel to Oldenstadt dated 27 April 1978 said, "We feel that this problem is the most important production research problem now facing the Northwest wine industry." Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 33, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

The grant provided for investigations of several types of chemical inputs into grape growing. Growth regulators were under investigation for their effects on ease of picking, berry color, and acidity. Ethephon (known by several trade names, including Ethrel) was used on Pinot Noir at veraison to improve the color and seemed to help (the wine from treated vines had 82 percent more color than the control after ten months in the bottle).[102] It also promoted berry abscission, making harvesting easier.[103] Pesticides and fertilizers were studied for their positive (resistance to insects) and negative (2,4-D damage) aspects, since as concentrated plantings expanded so did the need for chemical assistance. A circa 1979 proposal to extend the Tri-State Wine Grape project said there were at that time 12 wineries in Washington, 30 in Oregon, and one in Idaho, but problems were growing: "The wine grape industry has benefited from information generated by the Tri-State Wine Grape Demonstration Project. With expansion of the grape industry, many problems not envisioned at the time of inception of this project have emerged. Included are root pests such as nematodes and Phylloxera, and viruses that have caused devastating damage to the grape industry in California . . . Extension of the Tri-State Wine Grape Project for three years will serve to provide needed research until the developing wine grape industry can provide resources to help solve its problems." [104] One objective of continuing the project would be an extensive nematode and Phylloxera survey.

The greatest question facing wine makers in Washington (Idaho was not involved in the enological part of the Tri-State project, and Oregon's mild, semi-maritime Willamette Valley climate produced much different grapes) was that of acidity. Generally, Washington's conditions were favorable for developing a good sugar-acid balance, as the state was far enough north to enjoy longer hours of sunlight during the growing season than California, for instance, while cool evening temperatures throughout most of the central *vinifera* growing region helped preserve enough acidity to give the wines

[102] Joseph R. Powers, E. A. Shively, and Charles W. Nagel, "Effect of Ethephon on Color of Pinot Noir Fruit and Wine," *American Journal of Enology and Viticulture* 31, No. 3 (1980): 203-205.

[103] Walter J. Clore and R. D. Fay, "Effect of Pre-harvest Applications of Ethrel on Concord Grapes," *HortScience* 5, No. 1 (1970): 21-23.

[104] "Tri-State Wine Grape Demonstration Project (Viticulture Phase)" n.d. but circa 1979, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 34, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

character.[105] Too much acid, however, was a problem, and a great deal of effort was put into research on amelioration techniques under the Tri-State and other projects. Post-fermentation processing included final racking, protein stabilization by addition of bentonite for whites, cold stabilization, filtration, and bottling. Single and double salt precipitation and malolactic fermentation were tested and found successful on both musts and on wines. Researchers ran analyses on pH, percent alcohol, titratable acidity, volatile acidity, balling, Brix (sugar) levels, residual reducing sugar, free and total sulfur dioxide, total phenolics, and color in new and aged wines. In red wines, they were exploring using a double salt (Acidex) treatment immediately after crushing combined with a malolactic secondary fermentation. Nagel's lab had developed high performance liquid chromatography techniques for measuring bitter and astringent compounds and anthocyanin pigments in grapes and wines during maturation and vinification, and shown that hydroxycinnamic tartrate esters were major contributors to bitterness. The level of expertise required to carry out these tests and experiments was far beyond that of most wineries, and as one Tri-State Wine Grape Demonstration Project report pointed out, "During the 3 years the grant has been in operation, there has been a dramatic expansion in the PNW wine industry . . . The majority of the PNW wineries do not have the technical personnel or facilities to service many of the problems being encountered." [106] Thus, work done at WSU was essential to the industry.

Not all research collaborations ran smoothly. When the Tri-State grant came up for renewal in 1979, WSU representatives from Prosser and Pullman met in Portland at a session sponsored by the Table Wine Research Advisory Board, which was the sponsoring group that had successfully sought the expiring grant. By this time Idaho had dropped out, but Oregon State University had proposals for enology ($93,000) and viticulture ($30,000). WSU proposed a new plant protection phase with studies on viruses, insect pests, diseases, and nematodes, and encouraged OSU faculty who might want to participate or to develop complimentary proposals. Preliminary budget projections were $317,394 for 1980 and $301,116

[105] Gerald Asher, *Vineyard Tales* (San Francisco: Chronicle Books, 1996), 191-192. Asher was Wine Editor for *Gourmet* Magazine.

[106] "Discussion Draft, Tri-State Wine Grape Research Project, Enology Phase" 6 March 1979, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 33, Box 1, Archives 214, MASC, WSU Libraries, Pullman.

for 1981.[107] The WSU viticulturist, Mohammed Ahmedullah, was not pleased with OSU's proposal and told WSU Horticulture Chair Orrin E. Smith so.[108] He thought their budget figures were highly inflated to pay for the vacant position of viticulturist at OSU; even the expenses for interviewing candidates were to be charged to Tri-State funds. He had requested Dr. Garren to revise OSU's budget figures; he had also called a meeting at Prosser for 28 February 1979 to acquaint Washington wine grape growers and wineries with the proposed research, indicating that he was fairly confident of ultimate funding.

The Tri-State Wine Grape Demonstration Project was renewed through 1980. The Termination Report, which covered 14 December 1979 to 13 December 1980, summarizes viticulture work since 1977, when uniform clones were established at eight locations. They grew well until "unprecedented and prolonged sub-zero temperatures without any snow cover on the ground" in the winter of 1978-79 severely damaged the plantings; the loss had the effect of reviving interest in winter-hardy rootstocks for wine grapes..[109] Sites from LaCenter in western Washington to Lewiston, Idaho matured berries in roughly the order expected by their individual heat unit averages, but it was clear microclimate, soil fertility, and vineyard management were important contributors. The report stated that Pinot Noir was "definitely unsuited" for planting in central Washington, a refreshingly straightforward statement. Experiments comparing spur to cane pruning showed no appreciable advantage to either method. Cold hardiness tests – it seems there were always cold hardiness tests—showed White Riesling the most hardy and Cabernet Sauvignon the least hardy, but pointed out that primary bud damage did not always mean reduced yields, as secondary buds could do equally well. This was important: it meant that even if there was potential for hard freezes, as is the case for most of Washington, it was still feasible to grow less hardy but more desirable varieties for premium wines. Work done in 1980 looked at application of 1-naphthaleneacetic acid to vine trunks to help control suckers, and at whether berry color would develop normally when light was excluded (11 varieties did not develop normal color, but 13 did.) The latter work was significant for vineyard management of leaf canopies.

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[107] Bud Weiser, OSU Department of Horticulture, to Tom Moore and Bruce Eldridge, 22 January 1979, ibid.

[108] Ahmedullah to O. E. Smith, 29 February 1979, ibid.

[109] Nagel to Oldenstadt, 10 February 1982, "Termination Report of Project 4485," Charles W. Nagel Papers 1964-1991, Folder 128, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

Enological work showed that Merlot seemed to make good wine no matter where it was grown in central Washington. White Riesling did almost as well, but Chardonnay was more dependent on location. Other work over the course of the grant concentrated on reducing acidity, determining the effects of acidity and pH on the acceptability of white wines, developing techniques for analyzing the phenolic compounds that are responsible for bitterness, and studying anthocyanin pigments and aging. 1980 work seemed to show the high pH problem was associated with grapes grown north of Pasco, and was exacerbated by the choice of cultivar, as some varieties were more susceptible. All the lowest scoring Merlot, Gewürztraminer, and Riesling wines came from the same high pH site. Specific values preferred by tasters were 0.7 to 0.8 percent for titratable acidities and 3.3 or less for pH. Low pH/high acidity wines had been found to be fruitier with less body than high pH/low acidity, a result never before reported in the literature.

Summary: scientist or financier

This chapter has reviewed the work done under four of the most significant research grants that enabled WSU faculty and staff to conduct investigations beneficial to the grape and wine industry of the state. Two were funded by federal agencies (the Departments of Agriculture and Commerce), one received industry support from the Concord grape industry, and one came under a federal-state partnership. Without these grants WSU's scientists would have been unable to carry out grape and wine research at anything like the level they did, but the grants did not come free. The process of applying for a grant was time consuming and fraught with bureaucratic hurdles. Preparation to submit each of the above grants involved many, many hours expended by WSU researchers and administrators on delineating the current state of knowledge, work needed, work plans, and finances. Additionally, grants quite naturally came with strings at the ends of which were reports that had to be submitted – sometimes quarterly, sometimes annually, but always justifying the funding by explaining how the money was spent, what work had been done, and how much progress had been made on whatever particular topic the grant addressed. Such reports usually included lists of publications deriving from the work done under the grant, which will be more fully addressed in the next chapter.

Chapter 5

From Project to Publication

Tell Ste. Michelle to drop the Cabernet and come with this one!
Don Stangle[1]

The situation in the state by the 1970s

The 1960s had set the stage for Washington State University's involvement in the development of the state's fine wine industry. With the infrastructure in place to deal with problems such as choosing the very best variety for local conditions, emerging diseases and pest problems, vineyard management to mitigate climate variables and to control sugar and acidity, and enological treatments to improve the quality of the wines, the University was in the position of having created the knowledge base necessary to turn a minor venture crop into a major element of the state's economy. Question by question, innovation by innovation, WSU scientists tackled the major concerns in the industry and provided solutions that helped Washington's grape growers and winemakers expand and improve their production. How they went about their work and then shared their results is the focus of this chapter.

Projects and publications in the 1970s: varieties and cold hardiness

At the heart of the science that underlay the development of the wine industry in Washington was methodical, repeated experimentation to determine what premium wine grapes would thrive and produce high quality vintages. After the Columbia River had been dammed and irrigation canals dug, there was a great interest in crops for the more arid—but very fertile—central part of the state. Concord grapes had done well there, and some *vinifera* had been planted, but no one knew what premium wine grapes were best suited to the combination of soils, sunlight, and temperatures in the region. Before Clore and other WSU scientists embarked on their work, there was a widespread belief that only American *labruscas* or

[1] Don Stangle, California restaurateur, on Limberger [sic] wine, quoted in a letter from Gene A. Ford to Clore, 28 March 1977, Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 237, Box 4, Archives 214, MASC, WSU Libraries, Pullman.

the very sturdiest European white *viniferas* could survive Washington's cold winters.[2] In some senses, work on cold hardiness and frost resistance can be equated with the basic variety trials Clore began in 1937. Thirty-three years of carefully planned and executed comparisons proved that several early-to-medium-early maturing *viniferas* could survive "all but the coldest winter temperatures."[3] Over 150 varieties were tested for their ability to withstand below freezing—and even below zero Fahrenheit — temperatures. Clore noticed that the maturity of the vines *before* cold weather set in was vitally important, and increased survivability at all temperatures. This meant that growers had to limit fertility, cane and fruit growth, and crop load to ensure that the vines had time to harden off post-harvest and become fully dormant before low temperatures arrived. Interestingly, varietal recommendations changed just in the three years between the 1967 and the 1970 versions of *Grape Variety Responses and Wine Making Trials in Central Washington,* partly due to how the vines responded to the winter of 1968-1969.

1967 reds	1967 whites	1970 reds	1970 whites
Meunier	Müller-Thurgau	Cabernet Sauvignon	Chardonnay
Blauer Portuguiser	Seibel 10868**	Lemberger	Chenin Blanc
Chauche Noir	Muscat Ottonel	Pinot Noir	Müller-Thurgau
Cabernet Sauvignon	Muscat Ferdinand		Helena
Eumelan*	Delaware*		French Colombard
	Naples*		White Riesling

* = labruscas, ** = hybrids

Figure 3. Recommended Wine Grape Varieties, 1967 and 1970*

The great significance of Clore's work was that it showed the overriding importance of vine maturity in Washington's climate, and the best techniques to advance that maturity long before freezing weather ever came. Through careful experimentation and data analysis, factors such as withholding

[2] Despite one of the earliest grape growing operations in Washington having been established on Stretch Island in Puget Sound in the 1870s, there were problems with grape growing in western Washington. Low winter temperatures were less of a problem, but there the lack of summer heat units and an oversupply of moisture made growing wine grapes difficult. Work on wine grapes for the western part of the state has been done at the WSU Mount Vernon Northwestern Washington Research and Extension Center (http://mtvernon.wsu.edu/FruitHorticulture/Grapes.html) and the WSU Puyallup Research and Extension Center, and in publications such as *Growing Wine Grapes in Maritime Western Washington* by Gary Moulton and J. King, Extension Bulletin 2001 (Pullman: Washington State University Extension, [2005]), http://cru.cahe.wsu.edu/CEPublications/eb2001/eb2001.pdf.

[3] *Grape Variety Responses and Wine Making Trials in Central Washington*, 1970, 1. This same title had been used for the 1967 Circular 477, which had been much expanded and reissued in 1970 as Circular 524.

water or fertilizer, judicious pruning early in the season, crop load control, and competing or nourishing cover crops were all proven to be important determinants of whether the vines would live through the occasionally severe winters Washington experiences. Cold hardiness tests typically analyzed the percent of primary, secondary, and tertiary bud survival at a given temperature for a given period of time. This was often expressed as T-10 and T-90 ratings, the temperatures at which 10 percent and 90 percent of primary buds died. The more time the vine had to mature or harden off after harvest, the lower the number of buds killed at a given temperature. Clore's trials also included studies of whether the labor-intensive process of covering the lowest portion of the vine with dirt before winter and then uncovering it in spring was useful (sometimes yes) and cost effective (almost always no).

The number and frequency of communications discussing cold hardiness testify to the importance of the subject and the work done on it. In 1970 the three-year-old publication *Grape Variety Responses and Wine Making Trials in Central Washington* was revised. In 1971, Clore addressed the results of IAREC hardiness trials in the Washington State Horticultural Association *Proceedings.*[4] At the 1973 Washington State Grape Society Grape School and Annual Meeting, his topic was "Cold Hardiness of Grapes," and Don Chaplin talked about "Vineyard Frost Problems in the Yakima Valley." [5] Two scholarly articles were published on the subject in 1974, one with Clore and one with IAREC Horticultural Aide George C. Carter as lead author.[6] At the 1974 Grape School and Annual Meeting, there was one talk by a WSU-IAREC employee on cold hardiness; in 1975, three; in 1976, two. [7] This pattern continued

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[4] Walter J. Clore, "Wine Grapes in Washington," in *Proceedings, Annual Meeting - Washington State Horticultural Association* (Yakima, WA: Washington State Horticultural Association, 1971), 157-160.
[5] Walter J. Clore, "Cold Hardiness of Grapes," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1974), 119-130; Donald A. Chaplin, "Vineyard Frost Problems in the Yakima Valley," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1974), 41-48.

[6] Walter J. Clore, Mike A. Wallace, and R. D. Fay, "Bud Survival of Grape Varieties at Sub-zero Temperatures in Washington," *American Journal of Enology and Viticulture* 25, No. 1 (1974): 24-29; George H. Carter, Charles W. Nagel, J. Nelson, Mohammed Atallah, Tamis Johnson, Robert Early, and Walter J. Clore, "Summary of Experimental Testing of Grape Varieties for Wine in Washington," *American Journal of Enology and Viticulture* 25, No. 2 (1974): 92-98.

[7] Walter J. Clore, Mike A. Wallace, Vere P. Brummund, and R. D. Fay, "Cold Hardiness Studies," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1975), 20-28; Walter J. Clore, "Reducing Frost Damage and Inducing Hardiness in Grapes," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1976), 111-115; Donald A. Chaplin, "Frost Protection Update," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1976), 77-82; Walter J. Clore, "Reducing

throughout the rest of the 1970s, with two articles in *HortScience* and two more Grape School presentations on cold hardiness and frost.[8]

Projects and publications in the 1970s: pests and diseases

With more grapevines, in more vineyards, on more acres, came more pests. Mercifully, Phylloxera was not yet a problem in the state (it would be the 1990s before the little louse caused much concern in Washington), and leaf hoppers seemed to be under control. A yearly WSU "Spray Guide for Grapes In Washington" series dealt with recommended practices and treatments for controlling the insects, mites, and worms that were becoming more problematical.[9] Mealybugs were a problem on Concords and rated two publications in the 1970s (and would be the topic of six more in the 1980s, four in the 1990s).[10] Most healthy vines could tolerate the mealybug itself, but the honeydew it exuded supported the growth of sooty mold fungus, and the insect was also capable of transmitting grapevine leafroll virus. Cutworms were of special concern because, according to the draft of a presentation by Cone and Brummund for the 1974 Grape School,

> The two best chemicals for control of cutworms on grapes have been scuttled by EPA . . . At this point in time we have nothing that matches the effectiveness of the two banned chemicals [DDT and Dieldrin], but we still have the problem. Faced with using chemicals that are partially

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Frost Damage and Inducing Hardiness in Grapes," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1976), 111-115; Edward L. Proebsting and Vere P. Brummund, "Cold Temperature Research," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1977), 13-15; Vere P. Brummund, "1975-1976 Hardiness of Grape Buds," in *Proceedings, Grape School and Annual* (Grandview, WA: Washington State Grape Society, 1977), 41-44. Typically the *Proceedings* were published early in the year following the meeting, so the date of the meeting and the date of the publication are nearly always different.

[8] E. W. Hewett, K. Young, Edward L. Proebsting, and H. H. Mills, "Modification of Critical Freezing Temperatures in Fruit Buds by Elevated Tissue Water Content," *HortScience* 13, No. 3 (1978): 247-249; Edward L. Proebsting and Vere P. Brummund, "Yield and Maturity of "Concord" Grapes Following Spring Frost," *HortScience* 13, No. 5 (1978): 541-543; Edward L. Proebsting and Vere P. Brummund, "Low Temperature Research," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1978), 13-15; Daniel F. Mayer, "Overhead Sprinklers for Frost Protection," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1978), 17-18.

[9] *Spray Guide for Grapes in Washington,* Extension Mimeo 3669 (Pullman: Cooperative Extension Service, College of Agriculture, Washington State University, 1974, 1976, 1977, 1978, 1979).

[10] Wyatt W. Cone, "Grape Mealybug Control in Concord Grape Field Trials in Central Washington," *Journal of Economic Entomology* 64 (1971): 1552-1553; Wyatt W. Cone, "Biology and Control of Grape Mealybug on Concord Grapes in Central Washington," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1973), 126-133.

> effective and more costly, we must critically evaluate the destruction done by cutworms. We must determine the balance point between the loss of some buds or young clusters and the cost of control practices.[11]

Such a cost-benefit analysis seems a remarkably sensible approach when compared to some of the advice from chemical companies.

Nematodes were another increasing problem. These small, parasitic roundworms attacked the roots of vines (and many other horticultural crops), decreasing plant vigor and yield. Some of them could also serve as vectors for viruses. The growing need to control these pests is indicated by the amount WSU researchers published over several decades: from nothing in the 1960s, to eight items in the 1970s, eight again in the 1980s, two in the 1990s. Gerald S. Santo was the entomologist most involved, and his work during the 1970s included three articles in scholarly journals and five Grape School presentations.[12] Most of these dealt with Concords, but nematodes also affected *viniferas* and, as virus vectors, were a problem for the wine industry as well as the juice industry.

In grapes as with humans, crowding facilitates the spread of disease, and transporting individual plants sometimes meant importing diseases too. Dying arm disease was one of the newer problems cropping up with increasing vine acreage, and was listed by the Washington State Concord Grape Research Council in the mid-1970s as one of its top research priorities for WSU.[13] The disease was

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[11] "An Evaluation of Cutworm Injury on Concord Grapes," Irrigated Agriculture Research and Experiment Center (Prosser) Grapes/Wine Research Records, 1940-1984, Folder 149, Box 3, Archives 214, MASC, WSU Libraries, Pullman.

[12] Gerald S. Santo, "Nematodes: a Potential Problem on Grapes in Washington," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1975), 44; Gerald S. Santo, "Influence of Nematodes on Growth of Concord Grapes under Greenhouse Conditions," in *Proceedings, Grape School and Annual* (Grandview, WA: Washington State Grape Society, 1976), 31-33; Gerald S. Santo, "Nematode Investigations on Concord Grapes," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1977), 5-6; Gerald S. Santo, "Nematode Control Studies on Concord Grapes, 1978," in *Proceedings, Grape Seminar and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1978), 5-8; Gerald S. Santo and W. J. Bolander, "Effects of *Macroposthonia xenoplax* on the Growth of Concord Grape," *Journal of Nematology* 9 (1977): 215-217; Gerald S. Santo, "Effect of 1,2-dibromo-3-chloropropane on Yields of Concord Grapes in Central Washington," *Journal of Nematology* 10, No. 4 (1978): 298; Gerald S. Santo and W. J. Bolander, "Separate and Concomitant Effects of *Macroposthonia xenoplax* and *Meloidogyne hapla* on Concord Grapes," *Journal of Nematology* 9, No. 4 (1977): 282-283.

[13] Gaylord I. Mink, "Grape Diseases," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1972), 134-138; Gaylord I. Mink, "Dying Arm-like Disease of Grape Vines," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1976), 25-26; Calvin B. Skotland and Dean Alvin Glawe, "Investigations of Dying Arm of Grapes (June 1- December 31, 1976)," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA:

produced by infection with the ascomycete (fungus) *Eutypa lata* and was responsible for major production losses in vineyards, causing dieback of the shoots and cordons. A WSU graduate student, Dean Glawe, did his master's thesis on dying arm, an example of the synergistic relationship among the University's teaching responsibility, its research role, and the needs of the industry.[14] Iron chlorosis, a nutritional deficiency disease, and crown gall, caused by the bacterium *Agrobacterium tumefaciens,* were other problems.[15] Crown gall caused vine decline and could lead to vine death, and was capable of surviving in dead vine root pieces in the soil for at least two years, meaning that once a vineyard was infected, eradication was very difficult. The bacterium caused disease at vine wounds, and was a particular problem in areas where vines can freeze and split in winter; it could also form galls around injuries from regular pruning, grafting, and training practices. As the gall formed, transfer of water from roots to leaves and of photosynthesized products from leaves to roots was interrupted. WSU's researchers had not yet been much concerned with the disease in the 1960s, but its growing prevalence shows in the increase from just two articles in the 1970s to five in the 1980s and six in the 1990s, as grower need for effective control measures increased.

Projects and publications in the 1970s: wines and acidity

The overwhelming problem for Washington wines in the 1970s was acidity, and Charles Nagel's work on its causes and cures was exceptionally valuable for the growth of the premium wine industry in the state. At a time when over 90% of the grapes grown in Washington were still *labruscas,* Clore, Nagel and others had embarked in 1965 on a trial of ten premium wine grapes that had previously shown

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Washington State Grape Society, 1977), 65-66; Dean Alvin Glawe, "The Dying Arm Disease of Grapevines," (MS thesis, Washington State University, 1978).

[14] Noreen Mahoney et al., "Dying-Arm Disease in Grapevines: Diagnosis of Infection with *Eutypa lata* by Metabolite Analysis," *Journal of Agricultural and Food Chemistry,* 53 (2005): 8148 -8155.

[15] A. Irving Dow, "Iron Chlorosis in Washington Orchards and Vineyards," Extension Mimeo 4396 (Pullman: Cooperative Extension, College of Agriculture & Home Economics, Washington State University, 1979); Calvin B. Skotland and Dean Alvin Glawe, "Grape Disease Investigations," in *Proceedings, Grape Seminar and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1979), 78-79; Earle C. Blodgett, "Crown Gall of Grapes," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1974), 67-69; Otis C. Maloy, "Crown Gall of Grape," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: (Grandview, WA: Washington State Grape Society, 1975), 123-126.

promise.[16] The varieties chosen for investigation of their wine-making potential were Chardonnay, White Riesling, Chenin Blanc, Semillon, Seibel 10868, Cabernet Sauvignon, Pinot Noir, Gamay Beaujolais, Meunier, and Foch. The Seibel and Foch were hybrids, the others *viniferas*. The climate in the area as computed from heat units varied between Regions I and II as classified by Amerine and Winkler.[17] From 1967, when the vines came into bearing, through 1970, the area averaged 2437 degree-days and 170 frost-free days. Because of Washington's more northerly latitude, the hours of sunlight during the growing season were long, and because of the semi-aridity of the region, moisture was easily controlled, both of which were advantageous for wine-grape growing. There was one hard winter during the trial, 1968-69, with temperatures dropping to 11° below zero Fahrenheit, but 1969 yields were normal. It was on the wines made during these years that Nagel focused his work.

The significance of this multi-year trial for the long-term development of the Washington wine industry lay with the analysis of the grapes and subsequently of the wines. Many factors were evaluated for their contribution to berry quality, not just climate, soil, fertility, and irrigation. Not all the cultivars were virus free, for instance, which had to be considered in evaluating vine vigor, but all were own-rooted, which meant if above-ground parts did die off in cold weather, regrowth would be true to variety. (Own-rooting, rather than grafting *viniferas* onto pest-resistant *labrusca* roots, was somewhat uncommon in wine grape growing regions after the devastation wrought by Phylloxera on *viniferas* worldwide in the later nineteenth century, but Clore always preferred it.)[18] Rows in a given plot were trained on various trellis systems, with wires at different heights, to provide more data usable to growers. Pruning was consistent across varieties, as were the timing of picking and procedures for analyzing fruit quality and making wine. All varieties had good to very good yields, with favorable sugar and acid readings, but four of them had high total acidity averages, which signaled a potential problem for the wine. The relatively high acidity

[16] Walter J. Clore, Charles W. Nagel, George H. Carter, Vere P. Brummund and R. D. Fay, "Wine Grape Production Studies in Washington," *American Journal of Enology and Viticulture* 30, No. 3 (1979):198-201.

[17] M.A. Amerine and A. J. Winkler, *California Wine Grapes,* California Agricultural Experiment State Bulletin 794 (1963).

[18] His stand was vindicated in the 1980s when California suffered a Phylloxera attack after having grafted many varieties onto AXR1 rootstock. This hybrid rootstock, a cross between European *vinifera* and American *rupestris* stock, failed after the louse adapted to it; most of the Napa and Sonoma Valleys had to be replanted. Clore's insistence on own-rooted stock paid off.

produced in the 1970 season was attributed to low total heat units during the growing season, which had unusually cool nights and clear days, especially in late August, September, and early October. All of these factors came into play in planting and managing Washington vineyards, and ultimately in the wines they produced, and thus had to be taken into consideration in the scientific work done by WSU.

An early report on the results of these trials noted that any single factor in the analysis of grapes for wine has a poor correlation with sensory scores, and that because of the complexity of wine, there was no substitute for sensory evaluation by humans who could provide subjective analysis to augment objective data.[19] This of course was why Clore had been eager to recruit Nagel to work on the wines themselves, and why Nagel chose to use panels of trained non-professional tasters who could provide useful guidance on likely consumer preferences. Standardized procedures were followed to make the wines and analyze their constituent pH, acidity, and sugar in relation to the climatic and cultural factors which had influenced the grapes.[20] The year 1967 had been warm, and grapes that year were low in acidity. (Clore and others had shown that while crop load did not affect acid levels, solar radiation did.[21]) The next year, 1968, was cool, and the grapes were high in acidity (0.98 percent); similar correlations between low heat and high acidity were noted in 1969 and 1970. Another factor the researchers found worth noting was the high pH of the red wines, which was not expected when acidity was also high. While reds did spend more time on the skins, which had been shown to raise pH, it was also true that many of the varieties grown in Washington had naturally high malic acid content levels. If lower acidity was desired, the grapes could be grown in warmer areas, or the wine adjusted by blending, ion exchange,

[19] Charles W. Nagel, Mohammed Atallah, George H. Carter, and Walter J. Clore, "Evaluation of Wine Grapes Grown in Washington," *American Journal of Enology and Viticulture* 23, No. 1 (1972): 14-17.

[20] As an example of procedures followed in a typical trial: white grapes were harvested when their acidity was 0.7-0.9 percent and soluble solids were 19-23 percent. Grapes were crushed in a crusher-stemmer and SO_2 was added to a level of 100-125 ppm. The must was immediately pressed with a hydraulic press and the juice collected in glass carboys. After four hours a dried yeast preparation was added and the container allowed to stand at 70° F for 16-24 hours, then transferred to a 55° room until fermentation was complete. Then the wine was racked and the SO_2 adjusted, and the containers were placed in a room at 22-25° F for 10-14 days. Finally it was decanted, fined with bentonite and filtered if necessary, and bottled.

[21] Walter J. Clore, A. M. Neubert, George H. Carter, D. W. Ingalsbe, and Vere P. Brummund, *Composition of Washington Produced Concord Grapes and Juices,* Technical Bulletin 48 (Pullman: Cooperative Extension, College of Agriculture & Home Economics, Washington State University, 1965).

neutralization, or malolactic fermentation. It was to these later techniques that Nagel turned his attention in the 1970s.

WSU graduate students under Nagel's guidance were actively involved in research that benefited the wine industry. Well-known wine researchers Maynard Amerine and Cornelius Ough had shown consumer taste panelists preferred a sweet wine to a dry wine,[22] and adding sucrose seemed a possibility for making high-acid Washington wines more acceptable. Shirley Noordeloos studied the ameliorating effect of sugar on acid perception, and noted that the tannins in red wines also affected the perception of sweetness.[23] Inexperienced tasters were

> . . . purposely chosen for this study because it was thought that such panelists would be more representative of the consuming public than highly trained tasters, especially in tasting wine … There are disadvantages in using an inexperienced panel, as can be seen by the wide variability of individual responses within the mean values as demonstrated by the confidence limits about each mean … Therefore, the mean values of sucrose are not proposed as an absolute standard to use in ameliorating a given acid concentration; the values represent an approximation within limits to be used as a guide in modifying wines.[24]

Another student, Tamis L. Johnson, also worked on acids in Washington wine grapes and methods for adjusting them to optimal levels.[25] The approaches suggested in the literature included sugar solutions such as Noordeloos had investigated, biological degradation of malic acid, use of carbonate salts to neutralize the acids, precipitation of the double salt of tartrate and malate with calcium carbonate, and the use of anion-exchange resins. (Europeans had reservations about malolactic fermentation for reduction of acidity because they thought it adversely affected the wine.) Washington's problem was unusual if not unique, in as much as grapes grown in the state often had both high acidity and high pH, which were supposed to be mutually exclusive conditions. Starting with Chenin Blanc, Rubired (a hybrid, used mostly

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[22] M. A. Amerine and Cornelius S. Ough, "Sweetness Preference in Rose Wine," *American Journal of Enology and Viticulture,* 18 (1967): 121-125.

[23] Shirley Ann Nordeloos and Charles W. Nagel, "Effect of Sugar on Acid Perception in Wine," *American Journal of Enology and Viticulture* 23, No. 4 (1972): 139-143. Noordeloos wrote "Although adding sucrose to wines provides an inexpensive, convenient means of ameliorating the taste of acid, [it] cannot be regarded as the only way to modify high acid wines . . . California regulations forbid the adding of any sugar but grape sugar concentrates to a table wine . . . " Shirley Ann Noordeloos, "Effect of Sucrose on Acid Perception in Wine" (MS thesis, Washington State University, 1972), 27.

[24] Noordeloos and Nagel, 143.

[25] Charles W. Nagel, Tamis L. Johnson, and George H. Carter, "Investigation of Methods for Adjusting the Acidity of Wines," *American Journal of Enology and Viticulture* 26, No. 1 (1975): 12-17; Tamis L. Johnson, "The Organic Acid Composition of Washington Wine Grapes" (MS thesis, Washington State University, 1975).

for adding color), and Zinfandel grapes, WSU researchers learned what techniques worked best reducing acid in Washington wines.

Throughout the 1970s other Nagel graduate students worked on problems related to wine and acidity, and often had the opportunity to present their results at regional and national meetings. James R. Munyon focused on comparing deacidification techniques,[26] while Bruce Y. Ong looked at variations in hydroxycinnamic acid-tartaric acid esters during the maturation of White Riesling grapes.[27] Larry Warren Wulf dealt with the development of high pressure liquid chromatography techniques to analyze acids and flavonoids,[28] and John Lee Amistoso with the ways pH and acidity affected scoring of dry white wine.[29] (It was during the 1970s that consumer tastes started to shift from sweeter to dryer wines, and WSU's research changed to meet the new situation.) Malolactic fermentation was just one of the techniques being explored for acid reduction, and would not become a primary topic until the 1980s.

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[26] James Robert Munyon and Charles W. Nagel, "Comparison of Methods of Deacidification of Musts and Wines," *American Journal of Enology and Viticulture* 28, No. 2 (1977): 79-87; James Robert Munyon, "Comparison of Methods of Deacidification of Musts and Wines" (MS thesis, Washington State University, 1976).

[27] Bruce Y. Ong and Charles W. Nagel, "High-pressure Liquid Chromatographic Analysis of Hydroxycinnamic Acid Tartaric Acid Esters and Their Glucose Esters in *V. vinifera*," *Journal of Chromatography* 157 (1978): 345-355; Bruce Y. Ong and Charles W. Nagel, "Hydroxycinnamic Acid-Tartaric Acid Ester Content in Mature Grapes and During the Maturation of White Riesling Grapes," *American Journal of Enology and Viticulture* 29, No. 4 (1978): 277-281; Bruce Y. Ong, "Variation in Hydroxycinnamic Acid-Tartaric Acid Esters During the Maturation of White Riesling Grapes" (MS thesis, Washington State University, 1977).

[28] Larry Warren Wulf and Charles W. Nagel, "Analysis of Phenolic Acids and Flavonoids by High Pressure Chromatography," *Journal of Chromatography* 116 (1976): 271-279; Larry Warren Wulf and Charles W. Nagel, "High-Pressure Liquid Chromatographic Separation of Anthocyanins of *Vitis Vinifera*," *American Journal of Enology and Viticulture* 29, No. 1 (1978): 42-49; Charles W. Nagel, John Douglas Baranowski, Larry Warren Wulf, and Joseph R. Powers, "Hydroxycinnamic Acid-Tartaric Acid Ester Content of Musts and Grape Varieties Grown in the Pacific Northwest," *American Journal of Enology and Viticulture* 30, No. 3 (1979): 198-201; Charles W. Nagel and Larry Warren Wulf, "Changes in the Anthocyanins, Flavonoids and Hydroxycinnamic Acid Esters During Fermentation and Aging of Merlot and Cabernet Sauvignon," *American Journal of Enology and Viticulture* 30, No. 2 (1979): 111-116; Larry Warren Wulf, "The Separation of Phenolic Acids, Flavonoids, and Wine Phenolics by High Pressure Liquid Chromatography, (MS thesis, Washington State University, 1975).

[29] John Lee Amistoso, "The Influence of pH and Titratable Acidity on Scoring of Dry White Wine," (MS thesis, Washington State University, 1980).

Naturally, cold hardiness, diseases and pests, and wine adjustments were not the only topics under investigation in the 1970s. Ongoing work also dealt with irrigation,[30] the continuing problem of 2,4-D damage to grapevines,[31] and mechanization.[32] Moreover, there were some thirty WSU-authored publications reporting on work done on the economic aspects of grape growing and wine making during the decade, which are outside the range of this study. All of this research would prove beneficial to the grape and wine industry and would help it advance in productivity and reputation, but first the information derived from the research had to be passed on to the viticulturists and enologists who needed it.

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[30] Mel A. Hagood, "Drip Irrigation for Grapes?" in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1974), 131-137; Mel A. Hagood, "Evaluation of Irrigation Systems," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: The Society, 1975), 59-64; James E. Middleton, "Snake River Vineyard Irrigation Study," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: The Society, 1977), 73-83; E. W. Hewett, K. Young, Edward L. Proebsting, and H. H. Mills, "Modification of Critical Freezing Temperatures in Fruit Buds by Elevated Tissue Water Content," *HortScience* 13, No. 3 (1978): 247-249; Daniel F. Mayer, "Irrigation of Grapes," in *Proceedings, Grape Seminar and Annual Meeting* (Grandview, WA: The Society, 1979), 15-19.

[31] Elmer Robinson, "Atmospheric Drift and Field Concentrations of 2,4-D," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1974), 53-63, (this item discussed the initiation of a research program, jointly funded by the grape and wheat industries with WSU support, to be conducted by WSU to gather information on the concentration of 2,4-D in grape growing areas of the lower Yakima area); Frank A. Anderson, "2,4-D Surveys," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: The Society, 1974), 65-66; Elmer Robinson, "Long-distance Transport of 2,4-D During 1973-74 Grape Growing Seasons," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: The Society, 1975), 88-103; Lawrence L. Fox, "1976 2,4-D report," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: The Society, 1977), 50-63; Elmer Robinson and Lawrence L. Fox, "2,4-D Herbicides in Central Washington," *Journal of the Air Pollution Control Association* 28, No. 10 (1978): 1015-1020; Alex G. Ogg, "Preliminary Observations on the Response of Concord Grapes to Applications of 2,4-D," in *Proceedings, Grape Seminar and Annual Meeting* (Grandview, WA: The Society, 1979), 20-24.

[32] Mechanical harvesting was becoming prevalent in the 1970s, although mechanical pruning would not become an important research topic until circa 1988-2004. According to Proebsting, "Prosser scientists aided the adoption of this technology by identifying problems associated with shaking and catching the fruit and helping to develop solutions." Edward L. Proebsting, *A History of Accomplishment* (N.p. [2003]), 18. Early publications included: Walter J. Clore, "Visit to the Most Northern Grape Regions of Europe, " in *Proceedings - Washington State Horticultural Association* (Yakima, WA: Washington State Horticultural Association, 1970), 218-223, which discussed mechanization in Europe; Walter J. Clore, George H. Carter, and R. D. Fay, "Washington's 1970 Grape Season," in *Proceedings - Washington State Horticultural Association* (Yakima, WA: Washington State Horticultural Association, 1970), 223-226; Walter J. Clore and R. D. Fay, "Effect of Pre-Harvest Applications of Ethrel on Concord Grapes," *HortScience* 5 (1970): 21-23; Richard T. Dailey and Roland C. Bevan, "Mechanical Harvesting Has Arrived—Some Suggestions for Vineyard Owners," *Goodfruit Grower* 1970; Richard T. Dailey, Raymond J. Folwell, and Roland C. Bevan, *Economics of Owning and Operating Mechanical Grape Harvesters in Washington*, Circular 540 (Pullman: WSU Agricultural Experiment Station, College of Agriculture, 1971); Edward L. Proebsting, "Value of Growth Regulators as Aids to Mechanical Harvesting of Apples, Cherries and Grapes," *Acta Horticulturae* 34 (1973): 363-371; Vere P. Brummund and Walter J. Clore, "Mechanical Harvesting of Concord Grapes," in *Proceedings, Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1975), 105-108.

Summary: Getting the word out

Before the Washington State Grape Society was formed, the Washington State Horticultural Association was the primary professional group for grape growers. The secretary, Fred Westberg, wrote to Clore late in 1970 asking for more studies on grapes for his group's *Proceedings*, and Clore provided two papers.[33] Thereafter, it was the *Proceedings* of the Washington State Grape Society (established in 1971) from its Grape Schools and Annual Meetings that were important for spreading research results over the next decades.[34] Faculty were, of course, also publishing technical accounts of their work in academic journals, most notably the *American Journal of Enology and Viticulture.* Perhaps most important for reaching the industry, WSU's own publications were freely given out by the thousands to potential and actual growers and winemakers across the state. As noted in Chapter Two above, "Disseminating information in the 1960s," these *Circulars*, *Bulletins* and other works were widely distributed by mail and through Extension agents. They were written in language accessible to the non-specialist and gave practical answers to questions on what, when, and where to plant and how to manage vineyards, as well as on winemaking and amelioration. The surviving correspondence of both Clore and Nagel is full of requests for them.

In the mid 1970s two summaries of several years of experience with all the many factors that had to be considered when growing grapes for premium wines were published. Together, they illustrate the breadth of what had been accomplished by WSU's scientists. The first, a scholarly article, gave harvest dates, yields, analyses of musts and wines, and taste panel ratings for 41 varieties.[35] Amazingly, 39 of these scored ratings of 15 or higher, as opposed to a mean score of only 13 for the commercial wines used as standards. The second, a WSU publication, was the extremely popular *Ten Years of Grape*

[33] Correspondence between Clore and Westberg, December 1970, Walter J. Clore Papers 1961-1999, Folder 80, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

[34] The title for these changed over the years, from "Grape School and Annual Meeting" to "Grape Seminar and Annual Meeting" to "Annual Meeting."

[35] George H. Carter, Charles W. Nagel, J. Nelson, Mokhtar Atallah, Tamis Johnson, R. Early, and Walter J. Clore, "A Summary of Experimental Testing of Grape Varieties For Wine In Washington," *American Journal of Viticulture and Enology* 25, No. 2 (1974): 92-98.

Variety Responses and Wine-making Trials in Central Washington.[36] This title, published the year Clore retired, was the capstone of the first era of WSU wine grape research. It summarized in 32 pages thousands upon thousands of hours of work on the adaptability of some 82 varieties to Washington's climatic conditions and on their suitability for premium wine. Many of these were varieties that are still those most popular for wine in Washington today: Chardonnay, Cabernet Sauvignon, Merlot, Riesling, Syrah and Petite Sirah), Sauvignon Blanc, and Gewürztraminer. Others have more recently become popular: Barbera, Lemberger (sometimes called Lemberger), Zinfandel, Pinot Gris, and Semillon. Still others were shown to be less suited for the terroir and have never been important wine grapes in Washington: Black Monukka (a seedless *vinifera*), Calzin, DeChaunac, Eumelan, Lucie Kuhlman, Tannat, Trousseau, Chauche Gris, Dutchess [sic], Feher Szagos, Helena, Peverella, and Romulus. For all of these, information was included on harvest dates, yield in tons per acre, percent soluble solids, percent titratable acidity, pH, and apparent winter hardiness. For the wines, the report gave percent alcohol by volume, titratable acidity in grams per 100 milliliters, percent volatile acid, pH, Balling degrees, percent reducing sugar, percent tannins, color, and evaluation panel scores and preferences. With this information, growers and vintners could make informed choices.

Not all the "most promising" varieties listed have stood the test of time: the reds favored in 1976 were, in alphabetical order, Cabernet Sauvignon, Chauche Noir, Early Burgundy, Foch, Gamay Beaujolais, Pinot Meunier and Pinot Noir (which was ultimately discarded as a choice for central Washington, as it does better in the cooler regions around the lower Columbia River basin), followed by Grenache and Lemberger (here spelled Lemberger; Clore and Nagel were still having trouble deciding how to spell it).[37] The favored whites were Chardonnay, Chenin Blanc, Gewürztraminer, Grey Riesling, Helena, Melon, Muller-Thurgau, Muscat Ottonel, Pinot Blanc, Semillon, Seibel 10868, Sylvaner, and White Riesling. Some of these were recommended only for blending because they lacked strong varietal

[36] Walter J. Clore, Charles W. Nagel, and George C. Carter, *Ten Years of Grape Variety Responses and Wine-making Trials in Central Washington*, Bulletin 823 (Pullman: Washington State University, College of Agriculture Research Center, 1976.) Credit for funding was given to the former Washington Wine and Grape Growers Council, the U.S. Department of Agriculture Western Marketing and Nutrition Research Division, and the Economic Development Administration.

[37] Clore to Nagel, 13 March 1970, Walter J. Clore Papers 1961-1999, Folder 73, Box 3, Cage 668, MASC, WSU Libraries, Pullman.

character. Problems of high acidity/high pH were noted, as were other characteristics such as early bloom (a danger when there are spring frosts) and lack of body. Also included in the report were weather reports for 1964-1973 and 50-year averages for precipitation, frost-free days, heat units, and dates for maximum and minimum temperatures, all of which were important for grower decision making.

Statistics on the printing history of some of the most significant WSU grape and wine publications show how widely they were distributed. One of the most popular was the 1967 Circular 477, *Grape Variety Responses and Wine Making Trials in Central Washington,* which was expanded and reissued in 1970 as Circular 524. The initial printing of the 1970 version was 1,500, quickly supplemented by runs of an additional 600 in 1971, 600 in 1972 and 500 in 1976.[38] It was so popular because it answered the question most critical for growers: what grape varieties did best in Washington? The first version was only 11 pages long and began by noting that grape acreage had been stable until about 1963, but 3500 more acres had been planted in 1964-66—which meant there were more growers wanting more information. Initial printing data for the 1972 Bulletin 635, *Grapes—Their Characteristics and Suitability for Production in Washington* is missing, but an additional 5,000 copies were printed almost a decade later, in 1981. [39] By 1975, the publications people were learning: *Grape Varieties for Eastern Washington*, Circular 394, had an *initial* print run of 5,000 copies.[40]

[38] Walter J. Clore, Charles W. Nagel, Vere P. Brummund, and George H. Carter, *Grape Variety Responses and Wine Making Trials in Central Washington,* Circular 524 (Pullman: Washington Agricultural Experiment Station, College of Agriculture, Washington State University, 1970). Clore had warned George Bowman in May that when the publicity went out on this publication he would be getting a "flood of requests." Clore to Bowman, 22 May 1970, Walter J. Clore Papers 1961-1999, Folder 224, Box 4, Cage 668, MASC, WSU Libraries, Pullman.

[39] Ronald B. Tukey and Walter J. Clore, *Grapes—Their Characteristics and Suitability for Production in Washington*, Extension Bulletin 635 (Pullman: Cooperative Extension Service, College of Agriculture, Washington State University, 1972).

[40]Walter J. Clore and Ronald B. Tukey, *Grape Varieties for Eastern Washington*, Circular 394 (Pullman: Washington Agricultural Experiment Station, College of Agriculture, Washington State University, 1975).

Chapter 6

Maturing Vines and Wines: the 1980s

> WSU is basically the one who has done all of our research.
> They have paved the way for Washington viticulture.
>
> Cheryl Barber[1]

By 1980 the Washington wine industry was on its way to national prominence. The industry was well aware of how valuable WSU's contribution had been, and it supported the bill passed by the Washington Legislature in 1981 to tax wines at 25 cents per liter, with the money going to grape research. The tax was expected to bring in $125,000 the first year. At last there was a reliable (even though temporary) source of state funding to carry on the increasingly complex and specific research needed on grape culture and wine making. Four WSU faculty were particularly involved in wine and grape research in the 1980s: Mohammed Ahmedullah, viticulturist, and Sara Spayd, food scientist, at Prosser; Ray Folwell, agricultural economist, at Pullman; and Nagel himself. WSU did not yet have a Department of Enology and Viticulture, but there was a research program at the graduate level, offering Master's and PhD degrees in Food Science with an emphasis on wine.[2]

Some of the problems that had arisen in the early years were more or less under control, while others still needed work. One of these was the anomalous problem of wines showing both high pH and high acidity. Normally, a low total acidity means few free protons are available in the solution, which equates to high pH. A high pH in the grapes, over about 3.6, reduces color and provides favorable growth conditions for organisms that create spoilage. High total acidity should mean low pH, which is good for controlling undesirable organisms but may make the wine too astringent. High pH and high titratable acidity (high pH/high TA) should be mutually exclusive, but sometimes do occur together. If

[1] Michael Shepard, "Winemaker starts sales of Cougar Rieseling" [sic], November 1986, Charles W. Nagel Papers 1964-1991, Folder 87, Box 2, Cage 639, MASC, WSU Libraries, Pullman. Cheryl Barber was Senior Winemaker for Chateau Ste. Michelle through much of the 1980s. She worked extensively with André Tchelistcheff and supervised over 1.4 million gallons of wine annually. She is, not incidentally, a WSU alumna.

[2] Nagel to Don Neel, Editor, *Practical Winery*, 6 January 1982, Charles W. Nagel Papers 1964-1991, Folder 15, Box 1, Cage 639, MASC, WSU Libraries, Pullman.

there is excess potassium in the soil, for instance, the substitution of potassium+ cations for hydrogen+ in the grapes can lead to high pH levels even when acidity is also high. High pH wines are more subject to microbial contamination and haze formation. The crucial question of the 1980s was what to do about high pH levels in Washington wines.

Project 158: high pH and high titratable acidity

Other states were noticing similar problems, and several of them came together to conduct research under Project W-158, "Determination of the causes of and corrections for pH imbalance in grapes for processing." Cornelius Ough had contacted Nagel in 1978 about the possibility of a project centering on a coordinated approach to solving the problem of high pH, and Nagel responded that while WSU was still in the process of filling the viticulturist position at IAREC that was vacated when Clore retired, he would commit whoever was hired to participation. He also noted that having WSU investigate the effects of climate on pH would fit in well with the site studies underway, which were indicating that late harvest varieties often chosen in Washington were much higher in pH.[3]

Besides Washington, the other states involved were Arkansas, California, Ohio, Oregon, and Texas. The project, funded by the USDA Science and Education Administration Cooperative Research program under the Hatch Act, was approved and became operational on 1 October 1979.[4] The objectives were: to determine the role of potassium in controlling the pH of grapes and wines, including factors that influenced uptake, translocation, distribution, and redistribution of potassium in grapevines; to determine the effects of different vineyard cultural practices on vine microclimate and pH values of grapes and wines; to determine the effects of the physical and chemical properties of soils on pH values of grapes and wines; and to determine the physical, chemical, and biological methods of improving grape juice and wine pH during their processing, fermentation, and aging. This multi-pronged approach to dealing with high pH was intended to provide a thorough analysis of all the factors that might affect the end product.

[3] Ough to Nagel, 8 May 1978, Nagel to Ough, 13 June 1978, Charles W. Nagel Papers 1964-1991, Folder 129, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[4] The *Hatch Act* of 1887 created the nationwide system of agricultural experiment stations; not to be confused with the Hatch Act of 1939, which was aimed at preventing federal civil servants from engaging in partisan political activities.

The first meeting to discuss preliminary data and analyses was held 6-8 May 1980 in Prosser.[5] Ough chaired the session, which included committee reports, a methodology workshop, and visits to the research facilities and area vineyards. The group discussed development of a computer program to handle data analysis, standardization of methods for juice and soil analysis, and validation of varieties (making sure a grape listed as Merlot really was a Merlot, and not something else).[6] This was the first of many meetings, interspersed with much correspondence; it was not easy to run an effective project with the participants separated by thousands of miles and by widely differing experiences and conditions.

The 1980 Project 158 Annual Report noted that the Washington participants (Ahmedullah, Nagel, Powers, and Spayd) had sampled five cultivars from 24 locations. Work done in California seemed to show that high pH was caused by plant loss of hydrogen, which was replaced by potassium; if hydrogen loss could be controlled, it could be of considerable value in limiting potassium and therefore high pH, and this became a focus of the project.[7] The 1981 meeting was held in Fayetteville, Arkansas, and covered methods of determining total anions, while the annual report for that year stated " . . . not all cases of high pH can be explained based on soil analysis as shown by data obtained by Washington State University . . . That climate has an effect which also may be related to water intake is evidenced by the fact that Arkansas had a greater pH problem in 1980 which was a warm year. Data supporting this are apparent in the reports presented by [others] and Washington State University." [8] Thus, it was already becoming clear that no single factor accounted for the high pH levels in Washington *vinifera* grapes and

[5] James Lyons, Administrative Advisor, University of California-Davis to C. I. Harris, Acting Associate Deputy Directory, USDA-SEA-CR, 26 February 1980, Charles W. Nagel Papers 1964-1991, Folder 129, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[6] Participants from all states were to collect 300 seeds from each variety tested to send to Ahmedullah for isozyme banding patterns by starch gel electrophoresis tests to determine if they were true to variety. O. E. Smith to J. M. Lyons with copies to Nagel, Ough, and Powers, 27 May 1980, Charles W. Nagel Papers 1964-1991, Folder 129, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[7] "Annual Report of Cooperative Regional Project Supported by Allotments of the Regional Research Fund, Hatch Act, as Amended August 11, 1955. January 1, 1980 to December 31, 1980. Project W-158, Determination of the causes of and corrections for pH imbalance in grapes for processing," Charles W. Nagel Papers 1964-1991, Folder 129, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[8] "Annual Report of Cooperative Regional Project Supported by Allotments of the Regional Research Fund, January 1, 1981 to December 31, 1981. Project W-158, Determination of the causes of and corrections for pH imbalance in grapes for processing," Charles W. Nagel Papers 1964-1991, Folder 129, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

the wines made from them. Soil pH, hydrogen loss, potassium levels, and water intake could all be involved.

The 1982 meeting was held in Corvallis, Oregon, with Ahmedullah and Spayd attending for WSU. The objectives of the project were deliberately restated, leading one to wonder if there had been some problem getting members to focus. Certainly at this point, two years into the project, WSU still had not received the seeds for testing for varieties included in the study from all states.[9] WSU's yearly report showed wines with high pH and titratable acidity also had high potassium (up to twice as much as wines that did not have high pH/high TA), and more malic acid. Therefore, it seemed necessary to remove both potassium and malic anions. It might be possible to blend high pH/high TA wines with similar wines that were low pH/low TA, but not many varieties produced both conditions. Another possible remedy was the use of malolactic fermentation, resulting in the production of lactic acid from malic acid. The pH could then be adjusted with the addition of tartaric acid, or by ion exchange chromatography to remove potassium and malic acid. Cation exchange did not have an adverse effect on quality, but there were fears anion exchange might. By 1982 WSU scientists had already published one scientific article on the results of their work.[10] The section on "Usefulness of findings" in the complete 1982 report talks about pH titratable acidity imbalance in grapes as a major problem in many varieties throughout the industry; Washington was not alone.

In 1983 the Project 158 Technical Commission met at Davis to report findings and determine if a five-year extension of the project was needed (the project was extended, from 1 October 1984 to 30 September 1989). WSU reported it had identified three vineyard sites with high pH problems and had imposed pruning, crop load, and irrigation treatments on Chardonnay and Cabernet Sauvignon vines. Only in Chardonnay was the pH affected by pruning and irrigation: for a given irrigation treatment, the pH of Chardonnay vines pruned to 25 buds was higher than that of those with 50 buds. A Chardonnay hedging study at IAREC was monitoring percentage of leaves removed, trellising practices, and

[9] "Minutes of Meeting of Regional Project W-158, Causes and corrections for pH imbalance in grapes for processing, 17 June 1982," Charles W. Nagel Papers 1964-1991, Folder 129, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[10] Charles W. Nagel, John Lee Amistoso, and Robert B. Bendel, "Effect of pH and Titratable Acidity on the Quality of Dry White Wines," *American Journal of Enology and Viticulture* 33, No. 2 (1982): 75-79.

differences between mechanical and hand hedging. Harvest maturity and wine quality were computed for five treatments; grapes from the hedged vines were less mature at a given date as indicated by Brix, but must and wine acidity were not affected by hedging despite the differences in Brix at harvest. Grape maturity studies followed changes in berry weight, Brix, acidity, total anions, potassium, pH, and malate and tartrate concentrations weekly for eight cultivars. (As expected for the Prosser area, none of these vines showed high pH/high TA; vineyards affected with that problem were in other parts of the state.) The effect of heat on malate degradation had already been demonstrated, along with the effects of freezing on must and wine quality. Freezing resulted in lower acidity and higher pH. Nagel discussed the anion exchange technique for adjusting pH and plans for taste panel evaluations of wines adjusted by various techniques.[11] As noted in the minutes of the 1984 meeting, the project was primarily set up to correct high pH/high TA in the field rather than in the winery, and these experiments were meant to evaluate what changes could be made to cultural practices that would have a positive effect on the ultimate end product.[12] It was becoming apparent there was a need to add soil and enzymology experts to the group.

As the decade progressed an inkling of frustration crept into project meetings and reports, despite solid work from some of the participants. At the 1985 annual meeting the project administrative advisor mentioned the growing competition for funding for regional projects, but USDA representative Dr. Tomkins thought the Hatch Act programs such as 158 would probably not be cut, since 1987 would be the centennial of the Act. There was general agreement the project needed to be more focused on studying specific cultivars, generally Cabernet Sauvignon and Chardonnay, and that more soil moisture and plant-water measurements were needed in the future. The extraction method developed by Nagel's group was to be used as the standard for berry analysis.[13] There were real advantages to having the group get together to talk, rather than each participant pursuing different projects independently and reporting only in writing, and one of those advantages was being able to discuss

[11] Nagel to Dr. Justin Morris, University of Arkansas Department of Food Science, 22 July 1983, Charles W. Nagel Papers 1964-1991, Folder 129, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[12] Minutes of the W-158 meeting, 20 June 1984, Charles W. Nagel Papers 1964-1991, Folder 129, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[13] This method is not described in the extant project documentation.

best practices and decide on next steps. Other discussions involved the need to develop a method of characterizing vine canopies, the timing of plant analysis to coincide with bloom, veraison, and defined intervals thereafter, and the need to evaluate various regional studies by a common grapevine growth model, perhaps the one from California based on degree days (the model used by WSU).[14]

WSU's work reported in the 1985 annual report included a segment on research that had begun in 1980 on the effect of potassium fertilization on the sugar, acidity, and pH of Concord grapes. The crop load and irrigation trials with Chardonnay and Cabernet had been discontinued because of severe winter damage in 1984 and 1985, which had meant there was no uniformity in the vine and bud number data. Ahmedullah and Ogg had been studying the effect of single and repeated applications of 2,4-D to grapes under field conditions at different stages of growth; foliar symptoms, yield, and quality data were collected, along with the effect on pH and acidity. The result of the Chardonnay hedging study was that taste panels did not perceive differences in the quality of wines from various hedging programs. Nagel had been working on the high pH problem, using ion exchange to adjust wines by substituting tartrate anions for malate. Because of the low solubility of the potassium bitartrate, a reduction in both pH and titratable acidity should have occurred, but anion exchange alone did not result in low enough pH levels. Nagel had tried treating both the original wine and the anion-exchanged wine with cation exchange and back-blending with untreated wine, and comparing the results to wine adjusted by malolactic fermentation. The taste panel results were mixed; anion treatment resulted in the loss of some of the varietal character, which negated the benefits from the acid adjustment.

As a multi-state project such as this developed, there were ongoing needs for consistency in practices and correlation of objectives with accomplishments that were not always met. Nagel and Ahmedullah attended the 1986 meeting where, yet again, there was much discussion of the need for standards in extraction procedures, soil and petiole analysis, reporting on soil and plant water status, and characterization of vine canopy development. In order to emphasize the progress that was being made toward the stated goals of the project, it was decided that future reports would be organized

[14] Minutes of 1985 Project 158 meeting, 26 June 1985, Charles W. Nagel Papers 1964-1991, Folder 129, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

under objectives rather than state-by-state. (As it happened, no report for the year was submitted at all.) Under Objective 3, determining the effects of the physical and chemical properties of soil on pH, Ahmedullah reported on potassium fertilization applied before planting in relation to vine growth, yield, and fruit and petiole composition. The first year of production had shown little effect of soil potassium on juice pH, which would mean fertilization treatments were not the answer to high pH. Under Objective 4, determining physical, chemical, and biological methods of improving grape juice and wine pH during processing, fermentation, and aging, Nagel reported on his work with pH/high TA wines. He had adapted the "double-salt" procedure, adjusting tartaric acid levels and then back-blending with the original wine.[15]

Somewhat unusually, the grant did not fund members to attend the annual meetings. WSU funded one researcher's attendance, but most states did not even do that. In 1987 Ahmedullah was present to talk about his data on the effects of nitrogen and potassium fertilization on color, hue, anthocyanins, and potassium content of Concord juice. He had found nitrogen caused a significant increase in yield, but potassium did not, and neither nutrient seemed to affect quality. Ahmedullah was project chair for the year, and had trouble getting the other states to submit their annual reports.[16] Nagel was chairing the group dealing with improving juice and wine pH, and he too was having difficulty getting people to send in their data; it is unclear from the extant letters and memos whether this was because they had not done the work or because they did not get around to sending it in.[17] He had been looking at adjustment of high pH/high TA in commercial wines by the use of tartaric acid and Acidex[18], focusing on the amount of must that had to be treated in order to get to the desired end pH and acid levels.

The importance of the work being done under Project 158 was that it showed the problem of pH imbalance was not isolated, and the environmental and/or soil conditions that lead to it, while still not fully

[15] Minutes of the 1986 Project 158 meeting, 25 June 1986, Charles W. Nagel Papers 1964-1991, Folder 129, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[16] Ahmedullah to members of Project 158, 19 August 1987, 19 October 1987, Charles W. Nagel Papers 1964-1991, Folder 129, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[17] Nagel to Drs. Morris, Watson, Gallander, Ough, Mitchell, and Boulton, 11 December 1987, Charles W. Nagel Papers 1964-1991, Folder 129, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[18] Acidex is a brand name for a calcium carbonate product designed to reduce both tartaric and malic acids in juice or wine.

understood, might be altered to help correct it. Climate, soil, and length of day all could affect potassium and pH levels, as might the microclimate created by canopy management, grape varieties, and even rootstocks. It was becoming clear that the use of tartaric acid and the Acidex treatment were important remedies, but the malic acid concentration necessary for the desired pH and titratable acid relationship was not yet understood. This malic acid problem was the center of Nagel's report at the 1988 meeting. He and his group had prepared an algorithm showing the relationships among pH, titratable acidity, and acid anion content, so that malic acid content could be predicted from the pH and acidity.[19]

In the final project report, compiled in 1989, the explanation given for terminating the grant was the completion of most objectives, combined with the recognition that the problem went beyond just the matter of high pH and high acidity. The high pH/high TA problem was now believed to be caused by high concentrations of potassium and malic acid. Excess potassium in the must and wine could be removed by cation exchange or by tartaric acid addition and cold stabilization, and malic acid concentration could be reduced by either biological (yeast fermentation or malolactic fermentation) or physical-chemical (anion exchange or the double salt procedure) reactions. Over the course of this ten-year project, WSU scientists had produced seven major publications plus several presentations at conferences and meetings.[20] The results of their research were of direct benefit to Washington grape growers and wine makers in correcting what had been a major problem.

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[19] Minutes of the Project 158 meeting, 23 June 1988, Charles W. Nagel Papers 1964-1991, Folder 129, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[20] Mohammed Ahmedullah, S. Roberts, and Alan K. Kawakami, "Effect of Soil-applied Macro- and Micro-nutrients on the Yield and Quality of 'Concord' Grapes," *HortScience* 22 (1987): 223-225; William Reynolds Bonorden, Charles W., Nagel, and Joseph R. Powers, "Adjustment of High pH/High Titratable Acidity Wines by Ion Exchange," *American Journal of Enology and Viticulture* 37, No. 2 (1986): 143-148; Charles W. Nagel, Karen M. Weller, and Diana Lynn Filiatreau, "Adjustment of High pH-High TA Musts and Wines," in *Proceedings of the Second International Symposium for Cool Climate Viticulture and Oenology, 1988, Auckland, New Zealand (*Auckland: New Zealand Society for Viticulture and Oenology, 1988), 222-224; Charles W. Nagel and I. W. Herrick, "Effect of Malate or Lactate Content on the pH-TA Relationship of Potassium Bitartrate Saturated Alcohol-water Solutions," *American Journal of Enology and Viticulture* 40, No. 2 (1989): 81-84; Charles W. Nagel, I. W. Herrick, Karen M. Weller, and Sara E. Spayd, "Use of an Algorithm to Predict Malic and Lactic Acid Content of Wines," in *Actualites Oenologiques 1989. Comptes rendus du 4e Symposium International d'Oenologie, Bordeaux, France, 1989* (Paris: Dunod, 1990), 506-510; Charles W. Nagel, John Lee Amistoso, and Robert B. Bendel, "Effect of pH and Titratable Acidity on the Quality of Dry White Wines," *American Journal of Enology and Viticulture* 33, No. 2 (1982): 75-79; Mohammed Ahmedullah and S. Roberts, "Effect of Soil-Applied Macro- and Micro-nutrients on Results of Diagnostic Tissue Tests for Concord Grapevines," *Communications in Soil Science and Plant Analysis* 18 (1987): 221-234.

Consulting work

After he retired in 1976, Clore was a sought-after consultant to the Washington wine industry, especially Ste. Michelle. Nagel also worked as a consultant in the 1980s. He was asked to be a partner in Arbor Crest Winery, and he wrote to Dean Pettibone asking if such an arrangement would be appropriate.[21] The Dean objected on the basis that it would be a conflict of interest. Instead, Nagel used his weekends and vacation time when he was asked to advise on enological problems. He was also sometimes called on to provide expert testimony in legal cases.[22] When growers such as Carl and Dorothy Pinard of Seattle enquired about the services he could provide as a consultant for the Pinard Farms Development, Nagel replied he could give advice on the best suited grape varieties, fruit maturity requirements for processing, and production of juices or wines. He sent his resume and his fee: $300/day plus expenses.[23] René Gamache wrote to ask the order and time of harvest for Riesling, Semillon, Sauvignon Blanc, Chenin Blanc, Gewürztraminer, Chardonney [sic], Cabernet Sauvignon, Merlot, Limburger [sic] in 1981, and again in 1984 to ask Nagel to be a consultant for the coming harvest. Nagel was asked to evaluate options, instruct the enologist as to wine specifications, and aim for unique flavor characteristics—elements that would produce "a wine WE [the winery owners] would enjoy." Gamache wanted to be able to produce a $5.00 per gallon bulk wine, which he planned to offer to Associated Vintners, although he did not expect they would buy any for the first three seasons.[24] Winemaker Scott Harris once called Nagel in on a matter of a "stuck fermentation" (not fermenting to dryness) in a

[21] Nagel to Dean Pettibone, 20 January 1982, Charles W. Nagel Papers 1964-1991, Folder 75, Box 2, Cage 639, MASC, WSU Libraries, Pullman. Nagel wrote Dean Pettibone again on 31 March 1982 regarding consulting for Mielke Orchards in Spokane. Nagel was to provide guidance in establishing and equipping winery, consult on the selection of an enologist, and serve as consultant to the enologist. The contract was to be in effect until the retirement of Nagel or 1 January 1992, whichever came first. Nagel was to be a silent partner with one-third ownership until his retirement from WSU, when he would become an equal voting member.

[22] Jay Inslee of Peters, Schmalz, Leadon and Fowler, attorneys, to Nagel, 24 January 1980, Charles W. Nagel Papers 1964-1991, Folder 75, Box 2, Cage 639, MASC, WSU Libraries. Inslee enclosed a Memorandum of Opinion in which the judge had sided "almost entirely for our position," and thanked Nagel for his crucial testimony.

[23] Nagel to Pinard, 1 February 1980, Charles W. Nagel Papers 1964-1991, Folder 75, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[24] Gamache to Nagel, 11 January 1984, Charles W. Nagel Papers 1964-1991, Folder 75, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

Sauvignon Blanc. Nagel tasted it and said, “Don’t change a thing. Just clear it, filter it, bottle it,” realizing that a little bit of sugar made it much more complex.[25]

Nagel thought that the University’s policy restricting consultation with industry was a mistake, because involvement with the industry helped scientists get a better idea of what research was needed. Working in the industry itself was another way to gain experience. He said “[when] I was promoted to professor they couldn’t give us a raise. They said they’d remember us the next year—well, they didn’t. So I took the job with United Vintners in California as director of research, and that was two years of tremendous experience, because I learned that you either improve the quality of the wine at the same cost, or you reduce the cost of the wine and maintain quality.”[26] Luckily for WSU, the job in California was not what Nagel expected, and he returned to the University—finally getting the raise that would have kept him from leaving in the first place.

Clore continued consulting into the 1990s. As the best-known name in Washington wine research, he continued to hear from people from all over. He wrote to the Washington Wine Commission about the concerns of Gerard Bentryn of Bainbridge Island Winery, who had written Clore that the Puget Sound grape growing area was being squashed by “Big-Money Corporations…overplanting grapes and making more wine that can be sold.” Clore answered Bentryn that it was easier to grow grapes than market wine, and many grape growers were in financial difficulties; the only varieties paying their way in eastern Washington were Chardonnay, Cabernet Sauvignon, Merlot, and Pinot Noir. Large wineries were able to market out of state, which brought recognition to all Washington wines. In his letter to the Commission, Clore wrote about microclimates, the misunderstandings between eastern and western Washington, and the choice of descriptive terms used in promoting all Washington wines. ”[27] His expertise was especially valued on vineyard sites and operations.

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[25] Charles W. Nagel, interview by author, tape recording, Pullman, WA, 25 July 2005. There is a draft of a Nagel memo that expresses his unhappiness with the share of research grants WSU took, another problem that contributed to his decision to join United Vintners, Inc. in California (not to be confused with the Washington United Vintners). Memo from Nagel, “Morale problems of a dedicated researcher,” 24 May 1971, draft, Charles W. Nagel Papers 1964-1991, Folder 128, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[26] Charles W. Nagel, interview by author, tape recording, Pullman, WA, 25 July 2005.

[27] Bentryn to Clore, n.d.; Clore to Bentryn, 14 February 1990; Clore to WWC, 14 February 1990, Walter J. Clore Papers 1961-1999, Folder 6, Box 1, Cage 668, MASC, WSU Libraries, Pullman.

International, national, and state connections

Washington was developing an international reputation in winemaking by the mid-1980s and its improved standing was partly due to the involvement of WSU scientists. Hugh Johnson's 1971 *World Atlas of Wine* had not even mentioned Washington, but the 1985 edition had—in three small paragraphs. (The 2001 and 2005 editions devoted two full pages to the state.)[28] Presentations at conferences in New Zealand and France helped to spread the word about the research being done at WSU and to draw the attention of wine professionals. Nagel was contacted by Hans Joachim Louis Guntrum of Louis Guntrum Weinkellerei in Nierstein am Rhein, Germany, on the recommendation of Dr. Helmut Becker of Geisenheim. Guntrum wanted to produce a German-style Riesling or Müller-Thurgau from U.S. or Canadian grapes, and needed names of growers; Becker was to visit Washington on behalf of Guntrum in the near future. [29] Another international expert, Patrick J. Williams of the Australian Wine Research Institute, informed Nagel that he was going to be in the U.S. for the American Society of Enology and Viticulture meeting and wanted to visit Washington. Dr. K. Fartzov, of the Institute D'Oenologie, Sofia, Bulgaria asked for Nagel's help after reading his work on anthocyanins, flavonoids, and other pigments.[30]

Dr. R. G. Goldy of North Carolina State University's Department of Horticultural Science contacted Nagel regarding a study on type and quantity of pigments and asked for help locating co-investigators. Nagel responded knowledgably with a list of people working on anthocyanin pigments, including researchers at the University of Missouri and at the Canadian Research Station in Manitoba.[31] Nagel was invited to speak at the 193rd American Chemical Society meeting in 1987 on the "Chemistry and Applications of Polyphenolics in Plants." Correspondence with other North American researchers

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[28] Hugh Johnson, *World Atlas of Wine* (New York: Simon and Schuster, 1971, 1975; London: Mitchell Beazley, 2001, 2005).

[29] Guntrum to Nagel, 30 August 1985, 19 September 1985, Nagel to Guntrum, 19 September 1985, Charles W. Nagel Papers 1964-1991, Folder 15, Box 1, Cage 639, MASC, WSU Libraries, Pullman.

[30] Patrick J. Williams to Nagel, 10 April 1985, Charles W. Nagel Papers 1964-1991, Folder 15, Box 1, Cage 639, MASC, WSU Libraries, Pullman.

[31] Goldy to Nagel, 29 October 1985, Nagel to Goldy, 18 November 1985, Charles W. Nagel Papers 1964-1991, Folder 15, Box 1, Cage 639, MASC, WSU Libraries, Pullman.

included questions on yeast, glycerol, urethane, and filtering techniques; Washington was becoming recognized as an emerging center for many sorts of wine and grape research.

More national and international exposure did not mean less involvement in the state for WSU scientists. During the late 1980s Nagel alone was in contact with many vineyards and wineries: Arbor Crest (Scott Harris), Blackwood Canyon (Michael Taylor Moore), Bookwalter Winery (Jerrold R. Bookwalter), Champs de Brionne (Cameron Fries), Columbia Crest (Joy Anderson), Coventry Vale (Bill Bagge), Hinzerling Vineyards (Michael Wallace), Hogue Cellars (Rob Griffin), Kiona Vineyards (J. Holmes and J. Williams), Langguth Winery (Betsy McCann and Max Zellweger), Latah Creek Winecellers (Mike Conway), Mt. Baker Vineyards (Brent Charnley), Neuharth Winery (E. Neuharth), Preston Cellars (Thomas Sans Souci), Quail Run (Wayne Marcil), Saddle Mountain Vineyards (Dick Owings), Ste. Michelle (Doug Gore), Staten Hills (Rob Stuart), Stewart Vineyards (Mike Januik), Stimson Lane (Joy Anderson), Tucker Cellars (Dean Tucker), and Weinbau Vineyard (L. Winslow Wright), Yakima River Winery (John Rauner), as well as Bainbridge Island, Cavatappi, French Creek, Charles Hooper, L'Ecole 41, Lost Mountain, Paul Thomas, Woodward Canyon. Other WSU researchers were very involved with answering questions for growers and winemakers throughout Washington too.

There were also ongoing connections between WSU researchers and several wine industry groups, among them the Washington Wine Advisory Board, Washington Wine Institute, Washington Wine and Grape Growers Council, and Washington Association of Wine Grape Growers.[32] Wade Wolfe, chair of the Washington Wine Advisory Board, wrote to IAREC Superintendent Lin Faulkner shortly after the group's first meeting in 1986 about times to meet with researchers and WSU administrators. A few months later he wrote to the members of the board with the results of a survey of grape research needs

[32] There were many industry groups concerned with grapes and wine in Washington over the years, and their similar names are confusing. The first, the Washington Wine Producers Association, was established in 1935. The Washington Wine Council was formed in 1939; it segued into the Washington Wine and Grape Growers Council in 1960 and ceased in 1969, done in by the change in legislation that reduced the number of wineries in the state to two. The Washington State Grape Society was established in the fall of 1971, and the Washington State Concord Research Council in 1973. The Washington Association of Wine Grape Growers started in 1983 and the Washington Wine Institute, an advocacy and lobbying group, in 1984. The Washington Wine Commission, a state agency dedicated to the promotion and development of the industry, was created in 1987 to represent the interests of both *vinifera* growers and wine producers. (Irvine in *The Wine Project*, 379, gives the date as 1983, but the Commission itself says 1987). The Commission has a Wine Advisory Committee. To make matters even more confusing, sometimes names of groups were conflated, or misused, making it difficult from some references to determine who was actually involved.

that would be forwarded to WSU for new proposals for coming year. For viticulture, crown gall disease was the top concern, then irrigation, fertilization, and herbicides; other topics were canopy management, crop levels, critical temperatures, site selection, and 2,4-D injury compensation. For enology, high pH/high TA was still the top problem, followed by must nutrition, delivery delay, and yeast adaptation. For industry education, wine processing was the greatest need, then canopy management and wine laboratory techniques. Additionally there were research needs involving marketing and economics.[33] In another case, Simon Siegl of the Washington Wine Institute enlisted Nagel's expertise on the Washington State Liquor Control Board's proposed changes in chemical analysis fees and procedures. The institute did not like the proposal and Nagel agreed. None of what the Liquor Control Board checked was capable of detecting public health hazards, Nagel explained, and federal regulations already covered the same things anyway. [34]

Another industry group with which WSU was closely involved during the 1980s was the Washington Association of Wine Grape Growers. This group published a newsletter with information on economic and legislative issues. In 1988 the newsletter urged a "yes" vote on the upcoming referendum on taxing grapes to help fund marketing and research. Previously wine producers had paid a tax, but growers had not. The Association argued the $3.00 per ton assessment was low compared to the one that funded the apple and dairy commissions, and the benefits included a voice in the future of Washington wines.[35] Later in the year they expressed even more concern for research support, observing that, "While our attention was largely focused on the Commission, time has marched on, and we are now dangerously close to the sunsetting of funds from the wine tax used to support winegrape research. We are in danger of losing the few capable people now engaged in research . . . industry

[33] Wolfe to Faulkner, Superintendent, IAREC, 20 March 1986, Wolfe to board members, 25 August 1986, Charles W. Nagel Papers 1964-1991, Folder 125, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[34] Washington Wine Institute to Liquor Control Board, 2 August 1988, Nagel to Liquor Control Board, 9 August 1988, Charles W. Nagel Papers 1964-1991, Folder 15, Box 1, Cage 639, MASC, WSU Libraries, Pullman.

[35] *Washington Association of Wine Grape Growers* [newsletter] 5, No. 4 (August 1988). Charles W. Nagel Papers 1964-1991, Folder 117, Box 2, Cage 639, MASC, WSU Libraries, Pullman. According to the Association, the twelve main varieties being grown in Washington were Cabernet Sauvignon, Merlot, Pinot Noir, Grenache, Lemberger, Chardonnay, Chenin Blanc, Gewurztraminer, Muscat Blanc, Sauvignon Blanc, Semillon, and Riesling.

attention needs to be focused on research." The concern was that Grape and Wine Research funds for WSU were scheduled to revert back to the State General Fund on January 1, 1990, and the the association recommended that members make their needs known to the WSU administration and to legislators.

The Wine Advisory Board met with WSU researchers in December of 1987 to review the year's progress on various projects and to evaluate the eleven 1988 proposals. Two of the existing projects (on grape tissue culture and western Washington grape research) were terminated; two new proposals (on herbicides and wine marking) were rejected due to low priority and lack of funds. Of the seven remaining, five received full funding and two half, for a total of $170,300. Funded were WSU proposals from Robert Wample on the effects of cultural practices on vine physiology and winter hardiness; Robert Evans on the effects of cropping levels and irrigation regimes on productivity and hardiness; Wyatt Cone on the biology and control of insect pests; Sara Spayd on factors influencing wine and grape quality; Nagel on enological concerns; Ray Folwell on economics; and one non-WSU proposal, Tom Burr of Cornell University on indexing of grape propagation material for crown gall. [36]

The first 1989 newsletter emphasized the importance of the Washington Wine and Grape Growers Council as a lobbying group. The previous season had seen many mildew outbreaks, increasing mealybug infestations, and the occurrence of Phylloxera in eight of 109 sites surveyed, all of which were problems for which WSU scientists could help find answers, but the Council was worried about funding for research. The wine tax had brought in $1,077,000 over seven years: $637,000 had gone to Prosser, $400,000 to Pullman, and $40,000 out of the state, but the tax was again due to expire, this time in 1991. The work done included starting a virus-free foundation block at Prosser analysis of variable weight and soluble solids, studies of the effects of how long the must stayed on the grape skins, varietal evaluations for 1974-1989, and work on cold hardiness, leaf hoppers, and Phylloxera. WSU had sponsored an Agriculture Outlook seminar where a speaker had predicted that the by-word of the 1990s would be "food safety . . . the way that we use chemicals and which chemicals we use to produce a quality grape crop is increasingly coming under scrutiny from the State

[36] *Washington Association of Wine Grape Growers* [newsletter] 5, No. 6 (December 1988), Charles W. Nagel Papers 1964-1991, Folder 117, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

and federal government, farm labor, and consumer groups." Growers were concerned over the recent Alar panic,[37] the use of pesticides in viticulture to control cutworms, thrips, leafhoppers, mealybugs, and Phylloxera, and the demand for more "natural " products. WSU research on such problems was publicized through a series of Grape Spray Guides, along with all the other publications that derived from research done under wine tax funding.[38]

Outreach

Seminars and publications such as these were just two of the ways WSU shared research results. Shortcourses were another. The Bureau of Alcohol, Tobacco and Firearms contacted Sara Spayd in 1985 about putting on a special shortcourse in procedures for wine analysis.[39] Throughout the 1980s WSU scientists offered a series of sessions covering wine-related topics, such as the May 1980, "Fundamentals of Home Winemaking" with Powers and Nagel. The PNW Grape Short Course held 17-18 February 1981 included sessions on basic plant physiology by Robert Wample, soils and nutrition by Irving Dow, irrigation systems by David Evans, site selection and propagation by Mohammed Ahmedullah, grape pests by Wyatt Cone, weed control by WSU Cooperative Extension weed specialist Robert Park, quality control of juice by Sara Spayd, costs of production by Raymond Folwell, and a wrap-up by Nagel. Later in the year Nagel wrote Spayd and Ahmedullah that he and Folwell wanted to organize a reporting session with the wine-grape industry people. Formerly there had been an annual meeting the day after the Washington Grape Society meeting, but not in recent years, " . . . and it is apparent from Monday's meeting that this has been a serious mistake." Nagel suggested the four of them

[37] Alar was a trade name for daminozide, a plant growth regulator sprayed on fruit to control growth and ripening, make harvest easier, and enhance color. It was licensed by the FDA from 1963 to 1989, when a *60 Minutes* broadcast highlighted a study showing it could cause cancer in mice. For some time consumers rejected all apples and apple juice, causing heavy losses to the industry. As it was later revealed, the amount that would have to be ingested to increase risk was extraordinarily high, and the apple industry sued for defamation. Subsequently "food libel laws" were introduced in several states.

[38] *Washington Association of Wine Grape Growers* [newsletter] 6, No. 3 (May 1989), Charles W. Nagel Papers 1964-1991, Folder 117, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[39] Spayd to Faulkner, 1 February 1985, Charles W. Nagel Papers 1964-1991, Folder 99, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

meet in January to plan such a meeting and to formulate research plans for 1982.[40] The list of completed research that had not yet been reported to the industry included new site studies, high pH/high TA grape studies, the influence of pH and titratable acidity on the sensory properties of white wines, maturation patterns of grapes, acid adjustment of wines and juices, and costs associated with alternative management practices in vineyards.[41]

Spayd surveyed the industry to find out what topics would be of most interest in a shortcourse on laboratory analysis of wine and must, but different segments had different ideas.[42] Even scheduling the annual Grape School risked causing friction, as it did in 1983. The wine grape people wanted to hold the School in conjunction with the Tri-Cities Wine Festival in late July, but the Concord grape people were afraid the School was oriented too much toward wine grapes already. Nagel thought their concerns were valid, so he offered to limit the School to wine grapes and have another session for Concords, especially since the annual December meeting of the Washington Grape Society generally concentrated on Concords.[43] The 1983 PNW Grape Shortcourse ended up being held in early August, with Ahmedullah moderating a panel on the establishment and management of vineyards, Nagel moderating one on grape quality, and John Watson moderating one on economics. In their evaluations of the Shortcourse, 80 percent of attendees indicated that they would make changes in their practices as a result of what they learned, a testimony to the effectiveness of the format for sharing research results.[44]

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[40] Nagel to Spayd and Ahmedullah, 17 December 1981, Charles W. Nagel Papers 1964-1991, Folder 99, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[41] WSU personnel would end up speaking at Washington State Grape Society Annual Meetings in the early 1980s on a host of topics: home wine making and late harvest wines, the economic outlook for grapes, insects, nematodes, weeds, diseases, integrated pest management, Alar, the role of WSU Extension in the grape industry, sprayer calibration, mechanical damage to vines during harvest, symptoms and control of Eutypa dieback, wine grape varietal adaptability, foliar feeds, 2,4-D damage, drip irrigation, trellising systems, processing wine and juice – almost all facets of grape growing. Charles W. Nagel Papers 1964-1991, Folder 118, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[42] Spayd to commercial firms, 23 February 1982, Charles W. Nagel Papers 1964-1991, Folder 99, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[43] John Watson, Area Extension Agent, Benton Co., to Nagel, 24 February 1982, Nagel to Watson, 3 March 1982, Charles W. Nagel Papers 1964-1991 Folder 99, Box 2, Cage 639, MASC, WSU Libraries, Pullman. Benton County includes Prosser, Pasco, and Kennewick, prime grape growing and wine making country.

[44] Watson to Shortcourse speakers, 15 August 1983, Charles W. Nagel Papers 1964-1991 Folder 99, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

Other avenues for sharing information on the research done at WSU included judging wines and giving talks at wine events, such as the Pacific Northwest Enological Society gatherings in Seattle or the Tri-Cities wine festivals, and more general gatherings, such as the Central Washington State Fair. In the spring of 1986, WSU started a semi-annual *Wine Grape Research Newsletter* for "wine grape growers, wineries, nurserymen, and other individuals involved with the wine grape industry. The purpose of the newsletter will be to: 1) report the most recent trends in wine grapes and wine: and 2) provide a means by which WSU researchers can give a synopsis of their research efforts and a list of recently available publications."[45] The *Newsletter* had sections on Current Trends and Observations, Agricultural Economics Research, Food Science and Human Nutrition – Pullman, Food Science and Human Nutrition – Prosser, Horticulture, and Mt. Vernon. By the spring of 1989 the *Newsletter* was already running reports on organic viticulture, a topic that has been of increasing interest.

By the end of the 1980s WSU had devoted over 50 years to work on grape growing and wine making, and the expertise developed by its scientists, especially Clore and Nagel, was recognized throughout the industry. The Tri-Cities Wine Festival had set up awards for red and wine wines in their names.[46] In 1977, the year after his retirement, Clore was honored with the establishment of a Washington State Grape Society annual award in his name. In 1983 Nagel was made a Supreme Knight of the Brotherhood of the Knights of the Vine,[47] and he was invited to speak at the 100th anniversary of the founding of the University of California-Davis campus, which was known for its wine grape research. Many Washington wineries honored both scientists with special vintages, and in 1995 both Nagel and Clore received the Merit Award of the American Society for Enology and Viticulture, recognizing their outstanding individual achievement. Such tributes from both professional organizations and the grape

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[45] Wine Grape Research Newsletter, Spring 1986, Charles W. Nagel Papers 1964-1991, Folder 87, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[46] Nagel wrote Maury Balcom of the Tri-Cities Visitor and Convention Bureau on 2 July 1980, saying, "I am truly honored that you people would choose to set up an award in my name for the outstanding red wine at the judging. I am sure Walt Clore feels the same concerning his for white wines." Charles W. Nagel Papers 1964-1991, Folder 15, Box 1, Cage 639, MASC, WSU Libraries, Pullman.

[47] The Brotherhood of the Knights of the Vine is an American non-profit corporation dedicated to "wine professionals and wine enthusiasts." It was a charter member of the Fédération Internationale des Confréries Bachiques, created in 1964. Its website says "In the tradition of wine brotherhoods around the world we seek to promote our own American wine industry and educate our members to the benefits and enjoyment of wine." http://www.kov.org (accessed 6.18.08).

and wine industry in the state underlined the contribution made to the development of fine wines in Washington by exacting and persistent research, careful attention to immediate needs and imminent problems, and efforts to share information with growers and winemakers by WSU scientists.

Chapter 7

Coming of Age: The Early 1990s and After

PS. I'm no spring chicken either.

Walt Clore[1]

There were many indications of the coming of age of the Washington wine industry by the 1990s. If funding was an indication, it was significant that WSU Project 4744, Wine and Grape Research, with Nagel as principal researcher, had a budget for 1990-1991 of $115,530, up $15,000 from the previous year. [2] If international involvement was a measure of maturity, then it should be noted that Nagel started the 1990s with a sabbatical stay in Bordeaux, France, and on his return he persuaded Paul Pontallier of Chateau Margaux to come to America to serve as a judge at the PNS Enological Society festival in Seattle and to tour the Washington wine industry.[3] If publications and presentations were a measure of research and results, the over 360 items written by WSU faculty and staff between 1980 and 1992 show what topics were important to the industry. If success could be measured in professional recognition, both awards to individuals and medals from wine competitions tell a story of the growing reputation of Washington as a wine producer. More than a half century had passed since Walt Clore began variety trials at the WSU Prosser station, and a quarter century since Chas Nagel started working with wine. Consumers and experts alike were coming to appreciate the change in Washington wines from cheap, overly-sweet, low-quality jug wines to top-of-the-line premium vintages.

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[1] Clore to Washington Wine Commission Directors, 16 January 1992, Walter J. Clore Papers 1961-1999, Folder 30, Box 2, Cage 668, MASC, WSU Libraries, Pullman.

[2] Sponsored project allocation, Food Science and Human Nutrition, Project 4744, wine and grape research, 13 April 1990, Charles W. Nagel Papers 1964-1991, Folder 6, Box 1, Cage 639, MASC, WSU Libraries, Pullman.

[3] Nagel to and from Pontallier, November 1990 to July 1991, Charles W. Nagel Papers 1964-1991, Folder 77, Box 2, Cage 639, MASC, WSU Libraries, Pullman. Pontallier was able to accept, and gave a talk at the Central Washington Wine Technical Group Shortcourse on red wine production in July of 1991. The Shortcourse included sessions moderated by Sara Spayd on winemaking in the vineyard, microbiology of red wines moderated by Charles Edwards, and aging and color in wine with Nagel as a panelist.

Time for History

If maturity means recognizing there is history involved, then the Washington wine industry had matured by the 1990s, over fifty years since work had begun at WSU's Prosser center on *vinifera* varietals suitable for Washington's climate. By the early 1990s the Washington Wine Commission was interested in compiling historical information and capturing the remembrances of those involved in the development of the fine wine industry in the state. Obviously, WSU scientists and researchers would be a major part of any such history. In 1991 WSU history professors Drs. Jerry Gough and Orlan Svingen drafted a research proposal that involved students in a graduate seminar as researchers and sent it to Simon Siegl of the Commission. They proposed to cover Washington's historical geography, climatic conditions, early records of grape growing, industry development from the 1960s on, and wine production technology. Meanwhile, wine salesman and magazine writer Ronald Irvine had conceived his own plans for a history of the Washington Wine Industry. He had interviewed Clore, and involved him as a consultant/coauthor for the project. Nagel wrote to Allen Shoup, President of Ste. Michelle, about the various efforts to compile a history, saying he had been approached by Gough and Svingen, who he thought would do a professional job and "not have an ax to grind." He was less positive about Irvine, saying that while he had been involved in wine sales for years, his record for writing history was uncertain (he had never written a book). Irvine would also require a salary to work on the book, while the WSU team would need minimal financial support.[4] Early in 1992 Clore wrote the Directors of the Wine Commission regarding such support, saying " . . . this letter concerns the partial funding of the proposal for writing a book on Washington State's Wine History." He pointed out the effort started the previous year at the urging of people in the industry, and noted that the passage of time would decrease the authenticity. He himself had accumulated much material, but no interviews, and Irvine needed funding to work on project, which Clore hoped the Commission would consider providing. He ended his letter saying, "PS. I'm no spring chicken either." [5]

[4] Nagel to Shoup, 23 August 1991, Charles W. Nagel Papers 1964-1991, Folder 82, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[5] Clore to Washington Wine Commission Directors, 16 January 1992, Walter J. Clore Papers 1961-1999, Folder 30, Box 2, Cage 668, MASC, WSU Libraries, Pullman.

Siegl wrote back to Gough and Svingen in October of 1991 to say, "The Washington Wine Commission has not yet determined which approach and what timing it may take to develop a history of our industry, but having your project description and sample has been very helpful."[6] He later wrote to Nagel to say that the time was not right to publish a history of the industry, but the experiences and observations of the leaders and researchers who founded the industry should be recorded. To that end, the Commission had hired Gene Ford Productions to create a videotape archive, and Nagel would be contacted for an interview.[7] In another take on the same issue, John N. Anderson of the Washington Wine Commission wrote Clore to say there was interest in a history of industry, but in discussions the Commission had shied away from book version. Several of the commissioners felt it was too early for such a project, while others thought it too expensive, as industry finances had been weakened by the crop of 1991. They had decided the best historical archive would be series of videotaped interviews, and had requested proposals from several video experts.[8]

Irvine applied for the videotape archive project job, which he was not awarded, but he had begun gathering material anyway, largely from Clore. Irvine had interviewed Clore in 1991 as part of a series of tapes, which were to be donated to the Prosser public library.[9] In April of 1992, Irvine wrote Nagel to ask him to meet with Svingen about partnering in the project, saying, "I could use some help with the legwork his students can offer and I think that there is room for at least two books on this subject."[10] This collaboration did not come to pass, but Clore played a major part in the pulling together the rather chatty

[6] Siegl to Svingen, 9 October 1991, N81 Charles W. Nagel Papers 1964-1991, Folder 81, Box 2, Cage 639, MASC, WSU Libraries, Pullman. Despite this lack of encouragement, Svingen's public history class seminar did work on the Washington State wine industry during 1993 and 1994, and Clore contributed various background materials including a list of clients he had worked for since his retirement. He wrote Svingen in 1997 that he thought the grape juice industry in Washington deserved a separate book. Walter J. Clore Papers 1961-1999, Folder 254, Box 5, Cage 668, MASC, WSU Libraries, Pullman.

[7] Siegl to Nagel, 7 April 1992, Charles W. Nagel Papers 1964-1991, Folder 81, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

[8] Anderson to Clore, 23 January 1992, Walter J. Clore Papers 1961-1999, Folder 30, Box 2, Cage 668, MASC, WSU Libraries, Pullman.

[9] Irvine to Clore, 4 June 1991, Walter J. Clore Papers 1961-1999, Folder 30, Box 2, Cage 668, MASC, WSU Libraries, Pullman.

[10] Irvine to Nagel, 17 April 1992, Charles W. Nagel Papers 1964-1991, Folder 81, Box 2, Cage 639, MASC, WSU Libraries, Pullman.

overview of winemaking in Washington, mixed with a travelogue of Irvine's research trips around the state, that was finally published in 1997.[11] Clore was involved as source, contact, coauthor, and technical editor. He did much of the research (spending considerable time searching his files), compiled the chronology, scanned the *Grandview Herald* from 1934-73, and even put up $10,000 as a loan against the publication of the book. As an example of his help with making contacts, Clore wrote Julio Gallo, reminding him of a visit to IAREC in 1971 and asking questions about the Gallo company's early purchases of Concord juices from Washington as background for the book.[12]

Clore and Irvine continued their historical research over some five years. In 1994 Clore noted he had received 32 responses from a number of sources to queries about the first year different grape varieties were planted.[13] He was a strict editor, both of Irvine's style and especially of content. In one letter Clore wrote that Irvine's writeup of the Island Belle grape was simply not credible, pointed out the very good reasons why WSU had not considered a grape breeding program (it was expensive, time consuming, and required special training and techniques), and took issue with Irvine's reflections on horticulturists.[14] He was adamant that the book should be accurate, telling Irvine that they had a responsibility to their readers. When *The Wine Project* was published in 1997 it offered some tantalizing peeks at many aspects of the industry in Washington from the viewpoint of the scientists, growers, entrepreneurs, vintners, and ultimately the consumers, although many topics were only touched upon.

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[11] Irvine and Clore, *The Wine Project*.

[12] Clore to Gallo, 27 April 1992, Walter J. Clore Papers 1961-1999, Folder 30, Box 2, Cage 668, MASC, WSU Libraries, Pullman. Clore went on to say he was still recommending the Lemberger Gallo had tasted and liked in 1971, the vines of which had survived the 1990-91 freeze better than Cabernet or Merlot; he called it Washington's answer to Zinfandel.

[13] Clore to Irvine, 4 March 1994, Walter J. Clore Papers 1961-1999, Folder 30, Box 2, Cage 668, MASC, WSU Libraries, Pullman. Another letter from Clore to Irvine enclosed an eight page edited list of grape varieties grown in the state, deleting 12 varieties because of their insignificance but marking five others to save as they were at one time in commercial acreage. Clore to Irvine, 30 March 1997 and 11 March 1997, Walter J. Clore Papers 1961-1999, Folder 231, Box 5, Cage 668, MASC, WSU Libraries, Pullman. This information was incorporated into an appendix, "Grape Varieties Grown in Washington State," 433-437, in *The Wine Project*.

[14] Clore to Irvine, 22 March 1994, Walter J. Clore Papers 1961-1999, Folder 30, Box 2, Cage 668, MASC, WSU Libraries, Pullman. In regard to the Island Belle grape, Irvine had repeated the story that it was a locally developed Puget Sound variety; Clore took the more scientific view, since borne out by DNA analysis, that it was really just a synonym for Campbell Early.

Assessing the importance of the contributions WSU scientists made to the development of the wine industry in Washington, 2007: 70 years of scientific experience

In 2007, Washington State's wine grape crop totaled 127,000 tons from over 30,000 acres, the second largest in the nation. The 1937 wine grape crop had been so small it was not even tallied. Also in 2007, WSU-IAREC associate Markus Keller and Research Technology Supervisor Lynn J. Mills published an article on pruning cold-injured Merlot vines which won the American Journal of Enology and Viticulture "Best Viticulture Paper" award.[15] (This was not an isolated honor for WSU: in 1990 the ASEV Award went to Charles Edwards for "Production of Decanoic Acid and Other Volatile Compounds and the Growth of Yeast and Malolactic Bacteria During Vinification"). WSU's Viticulture and Enology program was well established, offering both undergraduate and graduate degrees. Over two dozen faculty were associated with the program, from Crop and Soil Sciences, Entomology, Food and Environmental Quality, Food Science, Horticulture and Landscape Architecture, Plant Pathology, the USDA, and WSU Extension. There was even an organized group of winemakers with WSU affiliations.[16] Just as Washington had come into its own as a fine-wine producing state, Washington State University had achieved a solid reputation for wine research and education.

The reason for research

In 1975, WSU College of Agriculture Dean J.S. Robins' analysis of research and the Washington grape industry was published in the Washington State Grape Society's *Proceedings of the Grape School and Annual Meeting*. He noted the importance of the Concord industry in central Washington as well as the recent work on wine grape production and wine making, including irrigation and fertilization, insect and weed control, evaluation of varieties, training and trellising, pruning and harvesting, processing, and product quality.[17] Robins also noted the low level of WSU salaries compared to peers, and he asked for the industry's support in addressing the gap along with other research and extension funding programs.

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[15] Markus Keller and Lynn J. Mills, "Effect of Pruning on Recovery and Productivity of Cold-Injured Merlot Grapevines," *American Journal of Enology and Viticulture* 58, no. 3, (2007) : 351-357.

[16] www.wlnebycougars.com (accessed 26 June 2008).

[17] J. S. Robins, "Research and the Washington Grape Industry," in *Proceedings of the 1974 Grape School and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1975), 45-47.

Ten years later, J.L. Ozbun was Dean of the College of Agriculture and Home Economics, and he presented his views on the future of grape research.[18] He believed that wine grape production had the "potential" to surpass juice grapes by 1990 or 1995, and he noted that Washington white wines were earning recognition—although "our production conditions and vinting [sic] requirements may make the red wine market less attractive." He went on to say that cold hardiness was still an issue, especially for being able to produce a reliable crop of grapes annually, and marketing and promotion would be essential to the growth of the industry. Ozbun stated categorically that, "There would be no wine industry in Washington if it were not for research done by WSU faculty member Walt Clore," and he noted the expansion of the University's involvement in wine work to eight faculty plus Extension personnel. Because its climate was so different from Europe, the eastern U.S., California and even Oregon, Washington could not rely on research information from other areas. Then came the pitch for funding: the U.S. Department of Agriculture had never provided much money for Washington grape research, and federal money was getting tighter. Washington State research funds for agriculture were lower than even those of North Dakota, while diversification of commodities in the state was far greater and therefore competition for money among agricultural crops that much stiffer. Ozbun thought a wine grape commodity commission would be one way for the industry to help increase funds for grape research (the Washington Wine Commission would be formed in 1987). Regarding WSU's long-term commitment, he would not even speculate, but it was clear there was an ongoing need for research to help the Washington grape and wine industry continue to progress. The recurring theme in these and other statements was the essential nature of the research WSU did on grapes and wines for the benefit of the citizens and industries of Washington.

The early 1990s

Many of the topics of interest to the wine industry in the early 1990s (and since) have been mentioned earlier in this study. The *WSU Wine Grape Research News* in 1990 carried information on recommended guidelines for spraying, malolactic fermentation, and a laboratory techniques shortcourse. In 1991 publications by WSU scientists covered winter damage, wine prices, estimation of malic and lactic

[18] J. L. Ozbun, "The Future of Grape Research," in *Proceedings of the 1985 Grape Seminar and Annual Meeting* (Grandview, WA: Washington State Grape Society, 1986), 35-37.

acid content, quarantines, a winemaking shortcourse, and nitrogen fertilization. Once again, the WSU budget situation was a problem, and the wine industry was asked to contact the College of Agriculture and the University Administration to let them know the importance of research and Extension programs for grapes and wine. The following year, 1992, stuck fermentations and drought were topics of particular interest. The Washington Wine and Grape Growers Council *Newsletter* reported on WSU research on the effects of irrigation on winter hardiness and fruit quality, leafhoppers and other insects, problems related to red wine production, and the microbiology of wine fermentation. Other industry concerns included winter damage to grapes, regulations on herbicide applications, Bureau of Alcohol, Tobacco and Firearms testing of wine for pesticide residue, funding for herbicide drift research, and the wine grape research which had been accomplished with revenues from the Washington wine tax.

Of particular interest were topics the WWGGC had asked IAREC in 1991 to concentrate on, particularly herbicide drift. The Council emphasized: 1) better identification and specification of symptoms of various herbicides on grapes ("We would like to be sure which herbicide is causing a problem . . . "); 2) alternative mechanisms of application and sprayer technology ("We strongly feel that if more attention is paid to ground application techniques, especially in the area of ground speed and nozzle pressure, much of the drift from Horse Heaven can be eliminated."); 3) other sources of drift (the road department, irrigation districts, the Hanford nuclear reservation). The WWGGC *Newsletter* announced in 1991 that, "several Washington Associations are joining together to sponsor a WSU Research Review Workshop." The Council also supported the WSU drip irrigation research project on early season irrigation management to help control canopy development that was being done under a visiting scientist in Robert Wample's laboratory at IAREC. Growers were concerned about the continuation of a *vinifera* winegrape acreage survey, completed by Folwell after the 1988 harvest; research funding was no longer adequate to do a survey regularly.[19] Clearly the industry as exemplified by the WWGGC understood and appreciated the value of the research that had been done by WSU over the years.

Two out of many

This study has concentrated on the work of two men, Walter J. Clore and Charles W. Nagel, to illustrate the work done by many WSU scientists and researchers who played a large part in making the

[19] WWGGC *Newsletter* 7, No. 4 (October 1991).

Washington wine industry what it is today. Their work would not have had the impact it did without the contributions of their WSU faculty and staff colleagues in many disciplines: soil science, irrigation, entomology, virology, plant pathology, food science, microbiology, climatology, engineering, and economics. As the earlier grape and wine workers retired, others had joined in, among them Mohammed Ahmedullah, Sara Spayd, Charles Edwards, and Mercy Olmstead.

Clore published over 160 journal articles, bulletins, circulars, leaflets proceedings and articles for grower magazines during his career. He traveled widely to study horticulture and grape growing: to Japan several times, to Germany, Alsace, Austria and Yugoslavia, to France, Spain and Portugal, and to Australia, New Zealand and South Africa. He had a worldwide reputation for grape research, for his role in developing the industry in Washington State, and for the conviviality he and his wife Irene brought to wine research gatherings from Prosser to Cape Town. His awards included official recognition for his research contributions to Washington viticulture from the Washington State Legislature in 2001 as the "Father of the Washington State Wine Industry," and the prestigious American Society of Enology and Viticulture Merit Award. Walter Clore died 3 February 2003 at the age of 91.

Charles Nagel shared the 1995 American Society of Enology and Viticulture Merit Award with Clore. In his presentation at the ceremony, he invoked Isaac Newton, saying, "I rode on the shoulder of giants." He talked about being approached in 1964 by a colleague, horticulturist Cyril Woodbridge, about a Dr. Walter Clore who had been growing wine grapes at Prosser and who needed to know if they made good wine. Since Nagel was from the Napa Valley and a graduate of the University of California-Davis, it was assumed he was wine expert—which he was not. Nonetheless, he agreed to spend ten percent of his time making and evaluating wines. He decided to standardize procedures, rather than varying by variety. For two years he made wines in Pullman, then gladly handed that responsibility over to chemist George Carter in Prosser so that he could concentrate on evaluation and amelioration. Nagel started wine evaluation at WSU by trained amateur panelists, some of whom ended up serving on his panels for over 20 years. He and his graduate students worked on analyses of wines to determine the causes of unsatisfactory flavors and then on techniques, both field and laboratory based, to ameliorate problems such as the anomalous high acidity/high pH seen in some Washington wines. He and his wife Bea anchored the Pullman WSU wine group as Walt and Irene Clore did in Prosser. "In reviewing the

development of the Washington wine industry," Nagel said, "it still amazes me that [such a large amount of] research was produced with the meager resources available. There was very little industry to support it (eight wineries or less and less than 500 acres of grapes.) In my opinion there were two major factors, Walter Clore and the University." Charles W. Nagel died 5 July 2007 at the age of 80.

More—and better—wine

From being a miniscule part of the state's overall grape production, wine grapes have steadily increased in acreage, tonnage, and value to become a major segment of Washington's agriculture.

Year	Tons harvested
2006	120,000
2005	116,760
2004	100,500
2003	108,500
2002	109,750
2001	100,000
2000	84,500
1999	65,000
1998	71,000
1997	62,000
1996	34,000
1995	62,000
1994	44,000
1993	62,000
1992	50,000
1991	26,000
1990	38,000
1989	43,000
1988	46,000
1987	46,000

Figure 4. Harvest Data for Vinifera Grapes, 1987-2006.
Source: Washington Wine Commission, http://www.washingtonwine.org/washington-wine/vintages.php

The increase in quantity and value of Washington wine grapes is of course related to the increase in the quality of the state's wines. At the 2008 Riverside International Wine Competition, Washington wines took numerous awards: The Sweepstakes Award for Best White Wine went to Chateau Ste. Michelle for its 2007 Dry Riesling; the Double Gold Award to Maryhill Winery's 2006 Winemaker's Red; and Golds went to Canyon's Edge Winery's 2002 Aldercreek Vineyard Red and Syrah, Horse Heaven Hills AVA; Chateau Ste. Michelle's 2005 Indian Wells Cabernet Sauvignon, Columbia Valley AVA; and

Kiona Vineyards Winery's 2003 Syrah, Red Mountain AVA, among others. Washington wines frequently earn ratings of over 90 points out of a hundred from two of the top wine drinkers' magazines, *Wine Enthusiast* and *Wine Spectator.* Barnard Griffin's 2007 Sangiovese rosé took the award for the top rosé in the 2008 San Francisco Chronicle Wine Competition, the largest wine competition in North America.[20]

With over 550 wineries and 350 growers, the Washington wine industry has achieved an international reputation. It currently provides 19,000 fulltime-equivalent jobs and contributes over $3,000,000,000 to the state's economy annually. Part of the credit for the industry's success must go to the work done at Washington State University to solve the problems that faced—and still face—viticulturists and enologists in Washington. It is fitting that WSU is working with the Washington grape and wine industry to create the Walter Clore Wine and Culinary Center near Prosser to help tell the story of the "quality and diversity of Washington State's food and wine products." Construction is scheduled to begin in the spring of 2009. WSU Dean of Agriculture, Human Resources and Natural Resources Daniel Bernardo said of the Center "Washington desperately needs an icon that can represent the diversity and quality of its agricultural enterprise . . . the science behind the food is a critical, compelling story to tell. With the completion of the Clore Center, we will have a world-class stage, in eastern Washington, on which to present our heritage as well as the evolving research that will improve our future."[21] WSU researchers at Pullman, IAREC, and WSU-Tri Cities will develop and sustain educational programming for the Clore Center, including workshops, lectures and exhibits, with WSU viticulturist Mercy Olmstead and horticulturist Markus Keller leading the Center's exhibits committee. It is fitting that these scientist/ educators will be the ones telling the story of the research Washington State University scientists carried out on grape variety trials, cultural management, vineyard problems, and winemaking experiments to determine the best grape varieties, viticultural practices, and winemaking techniques, and how they shared their research results with the Washington wine industry and the citizens of the state. The mission of a land grant university lies in research, education, and outreach, and the story of WSU and the Washington wine industry exemplifies the value of such efforts to the citizens of the state.

[20] "Wine Press Northwest," http://www.winepressnw.com (accessed 24 June 2008).
[21] http://cahnrsnews.wsu.edu/reportertools/news/2008/clore-center-2008-02.html, (accessed 6.25.2008).

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In the course of this study the author, who is a science librarian with a Master’s degree in Information Science and is thus much interested in making published literature readily available to potential users, has located over 960 publications by WSU faculty and staff scientists and researchers dealing with the science and technology of viticulture and enology. Because of the large number of publications, the complete list will not be included here. The database, WSU Viticulture and Enology, is available at http://lib4.wsulibs.wsu.edu:808/rmwp?&func=advSearch, It will be updated and expanded as new materials by WSU personnel are published.

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Yakima Morning Herald, 9 December 1966.

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Following is a list of the most important journals surveyed for publications by WSU authors on grapes and wine.

Acta Horticulturae
Agrichemical and Environmental News
Agricultural and Forest Meteorology
Agricultural Water Management
American Journal of Enology and Viticulture
Annals of the Entomological Society of America
American Vineyard
Applied Engineering in Agriculture;
Arboretum (University of Washington)
Australian & New Zealand Grapegrower and Winemaker
Australian Journal of Grape and Wine Research
Australian Viticulture
California and Western States Grape Grower
Eastern Grape Grower and Winery News
Environmental Entomology
Fruit Varieties and Horticultural Digest
Fruit Varieties Journal
Geoscience Canada
Good Fruit Grower/Goodfruit Grower
Goodgrape Grower
Grandview Herald (Grandview, Washington)
Grape and Wine Forum

Grape Grower
Grape Vine Notes (Washington State Grape Society)
Hilgardia
HortScience
HortTechnology
International Journal of Acarology
International Journal of Systematic and Evolutionary Microbiology
Journal – American Wine Society
Journal of Agricultural and Food Chemistry
Journal of Agricultural and Urban Entomology
Journal of Agricultural Entomology
Journal of Applied Microbiology
Journal of Chromatography
Journal of Economic Entomology
Journal of Experimental Botany
Journal of Food Quality
Journal of Food Science
Journal of Horticultural Science
Journal of Nematology
Journal of Phytopathology
Journal of Small Fruit and Viticulture
Journal of the Air Pollution Control Association
Journal of the American Society for Horticultural Science
Journal of the Entomological Society of British Columbia
Journal of Wine Research
Lebensmittel Wissenschaft U. Technologie
Mycotaxon
Northwest Science
Phytochemistry (Oxford)
Phytopathology
Plant Disease
Practical Winery and Vineyard
Record-Bulletin (Prosser, Washington)
Scientia Horticulturae (Amsterdam)
Small Fruits Review
South African Journal of Enology and Viticulture
Transactions of the American Society of Agricultural Engineers
Vignevini (Bologna)
Vineyard and Winery Management
Vitis
Washington Association of Wine Grape Growers [newsletter]
Weed Science
Weed Technology
Weeds
Wein-Wissenschaft
Wine Enthusiast
Wine Spectator
Wines and Vines
WSU Wine and Grape Research Newsletter
Yakima Herald (Yakima, Washington)
Yakima Morning Herald (Yakima, Washington)

Proceedings

The following are cited in the text. For a complete listing of papers dealing with viticulture and enology given at conferences by WSU scientists 1937-1992, see the author's database, *WSU Viticulture and Enology*, at http://lib4.wsulibs.wsu.edu:808/rmwp?&func=advSearch

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Washington State University Publications

Please see **Appendix B**, or for the most recent information on WSU publications dealing with viticulture and enology, see the author’s database, *WSU Viticulture and Enology*, at http://lib4.wsulibs.wsu.edu:808/rmwp?&func=advSearch

Websites

It is a bit unsettling for someone trained in librarianship and the preservation of knowledge for future generations to give references to such ephemera as websites, but such is the nature of current publication practices that sometimes the most authoritative source is found online. The extensive database compiled by the author of WSU publications on wine is online in order to facilitate both updating and the ease of access for researchers everywhere. This dissertation itself will be one of the first at Washington State University which will not be submitted to the Graduate School on paper at all: recently policies have changed so that all dissertations will be in electronic format only.

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Appendix A

WSU Theses Related to Wine, 1948-1992

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5. Bonorden, William Reynolds. “The Reduction of pH and Titratable Acidity in High pH-high T.A. Dry White Wine.” M.S. thesis, Washington State University, 1984.

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Appendix B

WSU Wine Publications

Extension publications are often revised or updated and issued with the same title and number. Alternately, revisions may be given a new number; at least once, the same title was used for two quite different publications with different numbers. Authors may be listed for revised editions long after they have left the University.

Titles are in chronological order within series.

Extension, Popular, Research and Technical Bulletins

1. Vincent, Chester L., Walter J. Clore, and Chester D. Schwartze. *Small Fruit Varieties for Home and Commercial Gardens in Eastern, Central and Western Washington*. Popular Bulletin 168. Pullman: State College of Washington, Agricultural Experiment Station, 1943.

2. Snyder, John C. and David H. Brannon. *Growing Grapes in Washington.* Extension Bulletin 271. Pullman: Extension Service, Institute of Agricultural Sciences, Washington State University, 1961.

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Appendix C

Biographical Sketches

Ackley, William B. Chair, Department of Horticulture, Pullman 1964-1974.

Ahmedullah, Mohammed Extension Horticulturist, IAREC. Ahmedullah studied the physiology of grapes as well as blackleaf, powdery mildew, crown gall, and trellising and training regime.

Allison, J. Lewis Superintendent, IAREC, 1969-1975. Allison was Superintendent during the last years before Clore's retirement.

Allison, Victor Vintner for Nawico. He, Howard Somers, and Lester Fleming were all important in the development of the Washington wine industry through their association with American Wine Growers, which became Chateau Ste. Michelle.

Anderson, Frank Cooperative Extension Service area agent, Benton County. Anderson was active in grape research issues important to his service area, which included Prosser, Richland and Kennewick.

Blodgett, Earle C. Plant Pathologist, IAREC. Blodgett was hired in 1946 jointly by the Washington State Department of Agriculture (WSDA) and WSU to work primarily on virus-free fruits at Prosser. He supervised the Plant Introduction and Quarantine Station at Moxee, several miles west of Prosser.

Bowman, George Research Editor, College of Agriculture, Pullman. Bowman was responsible for vetting papers by WSU scientists before publication.

Bridgman, William B. Lawyer, viticulturist, and winemaker, Sunnyside. Bridgman was a proponent of growing *vinifera* grapes in Washington and founder of Upland Winery in Sunnyside. He imported stock from Europe and much of Clore's earliest work on grape varieties period involved him.

Brummund, Vere P. Senior Experimental Aide, IAREC. Brummund was an important part of the research Clore and others carried on at IAREC and wrote or collaborated on over 24 publications. He was born and raised on a farm in eastern Washington and began working with Clore in 1957. He got permission to use some of the grapes grown at the Center to experiment with wine making at home. He retired in 1977.

Carter, George Senior Experimental Aide, IAREC. Carter started working for WSU in 1966. He had a degree in chemistry from the University of California-Los Angeles and had worked for the U.S. Department of Agriculture Agricultural Research Service's Fruit and Vegetable Products Laboratory in Pullman before it moved to Prosser in 1951 and closed in 1965. Carter conducted numerous experiments on grape varieties and winemaking, and made all the WSU experimental wines from 1966 until his retirement.

Church, M. H. Businessman. Church developed a major Concord grape juice processing firm at Kennewick in the early decades of the 20th century.

Clore, Walter J. Horticulturist, IAREC. Clore began work on grapes at IAREC in 1937 and was the leader in grape research in Washington until his retirement in 1976.

Cone, Wyatt W. Entomologist, IAREC. Cone worked closely with viticulturists on grape pests such as nematodes, grape leafhoppers, Phylloxera, grape mealybugs, cutworms, thrips and black vine weevils.

Dailey, Richard T. Agricultural economist, Pullman. Dailey was educated at Pennsylvania State University and joined WSU in 1968. He collaborated with Raymond Folwell on several important wine-

related reports in the early 1970s when the industry was just beginning to realize the potential for fine wines in the state. He taught at both WSU and the University of Idaho before moving to the University of Montana in 1981.

Dow, Irving A. Extension soil scientist and agronomist, IAREC. Dow researched plant nutrition and deficiency diseases, including boron deficiency and iron chlorosis.

Edwards, Charles Food Scientist, Department of Food Science & Human Nutrition, Pullman. Edwards, who came to WSU in 1989, worked on wine microbiology and chemistry.

Faulkner, Lindsey R. Superintendent, IAREC, 1 July 1976 – 30 November 1990. Faulkner started work at Prosser as a nematologist in 1959 and left in 1973 to go to Kansas State University. He returned to be IAREC Superintendent during the years Nagel and others were working to improve the quality of Washington wines and other WSU scientists were dealing with the problems of a rapidly expanding wine grape industry in the state.

Fay, R. D. Research technologist, IAREC. Fay coauthored papers on cold hardiness, propagation, yield, and growth hormones.

Folwell, Raymond Agricultural Economist, Pullman. Folwell was the foremost economist of the developing wine industry in Washington, publishing over 100 articles, papers and reports. He came to WSU in 1968 and over the course of an extremely productive career received numerous awards.

Glawe, Dean Plant pathologist, formerly Pullman, now Puyallup. Glawe received his M.S. and Ph.D. in Plant pathology from WSU and is currently with the WSU-Puyallup Research and Extension Center where he works on diseases such as powdery mildew.

Huber, Glenn Plant pathologist, Pullman and Puyallup. Huber received his Ph.D. in Plant Pathology at WSU in 1931, and served as Instructor until 1934 when he went to Puyallup as Plant Pathologist. He worked extensively with fungicides on ornamentals.

Mink, Gaylord I. Plant pathologist, IAREC. Mink dealt with diseases such as dying-arm.

Nagel, Charles W. Food scientist, Department of Food Science and Technology, Pullman. Nagel spent nearly 30 years working on improving the quality of wines made from Washington grapes, and in the process educated many WSU students and winemakers in the state.

Nelson, Emil C. Acting Superintendent, IAREC. Nelson served between Robins and Allison, from 1 April 1967 to 31 June 1969.

Norton, Robert A. Superintendent and horticulturist, Mt Vernon. Norton worked on the problem of which grape varieties were suitable and the best cultural practices for the moister and warmer western parts of Washington

Ogg, Alex G. Plant Physiologist, USDA/IAREC. Ogg worked on 2,4-D damage to grapes and other plants.

Powers, Joseph R. Department of Food Science & Technology, Pullman, graduate student, then assistant food scientist. Powers specialized in wine chemistry, especially enzymes which cause changes during processing and storage.

Proebsting, Edward L. Horticulturist, Acting Superintendent, IAREC. Proebsting evaluated vineyard sites and worked on cold hardiness. He served as Interim Superintendent for IAREC the first six months of 1976 and again from 1 December 1990 to 28 February 1993.

Robins, John (Jack) S. Superintendent of IAREC 1965-1967; Dean of Agriculture, Pullman, 1973. Robins worked at Prosser from 1951 to 1956, left, returned as Superintendent in 1965 for just 21 months, then went to Pullman as Director of the Washington Agricultural Experiment Station. After some time working for the USDA, he came back to WSU yet again to be Dean.

Santo, Gerald S. Nematologist, IAREC.

Singleton, Harold P. IES superintendent 1929-1965. After serving in World War I Singleton worked his way through Washington State College to earn a degree in Farm Crops in 1920 and a Masters in Crops and Soils. He started at IES in 1921. He took over the WSC-Prosser station after the first superintendent, Roy Bean, was killed by a dairy bull. He hired Clore and encouraged his early work with grapes.

Skotland, Calvin B. Plant Pathologist, IAREC. Skotland worked on plant diseases such as dying arm and sooty mold.

Snyder, John C. Extension Horticulture Specialist, Pullman. Snyder earned his Ph.D. at Iowa State 1932 and began work at the State College of Washington in 1934 as a horticultural specialist. He retired in 1965.

Somers, Howard Realtor, enologist. Somers began working in his father's St. Charles Winery on Stretch Island in Puget Sound around 1933. St. Charles was purchased by Alhambra in 1965. Somers was enology and assistant manager for American Wine Growers, which created Ste. Michelle Vintners. His brother Bill was also involved in grape growing and winemaking.

Spayd, Sara Food scientist and enologist, IAREC. Spayd came to WSU-IAREC in 1980, when Washington had only 15 wineries and 4,500 acres of wine grapes, and undertook research in all aspects of viticulture, from growth in the field to processing at the winery.

Tchelistcheff, André Internationally renowned enologist who was brought to the U.S. by Georges de Latour of Beaulieu Vineyards in 1938. He consulted for several Washington state wineries.

Tukey, Ronald B. Extension horticulturist, Pullman. Tukey's work with grapes centered on fertilizer issues.

Wallace, Mike A. Senior Experimental Aide, IAREC; President, Hinzerling Vineyards. Wallace worked on cold hardiness with Clore in the early 1970s.

Wample, Robert Horticulturist, IAREC. Wample came to WSU in 1987 and worked on vineyard crop loads, use of grow tubes, cold hardiness, growth regulators, and irrigation until 2000. He was WSU's Chateau Ste. Michelle Distinguished Professor of Viticulture for five years.

Watson, John (Jack) Extension horticulturist, Benton Co. Watson worked on plant diseases, pests such as Phylloxera, and cultural practices.

Woodbridge, Cyril G. Horticulturist, Pullman – Woodbridge worked on mineral and other grape nutrition needs.

Woodburne, Lloyd Dean of the University of Washington's College of Arts and Sciences, later winery manager and winemaker. Woodburne began winemaking as a hobby in the early 1950s and went on to be one of the founders of Associated Vintners, which became Columbia Winery.

IAREC Superintendents

Roy P. Bean, Superintendent 5/1/1919 – 6/11/1929
(Killed by a dairy bull)

Harold P. Singleton, Superintendent	7/12/1929 to 5/31/1965
John ‘Jack’ S. Robins, Superintendent	6/1/1965-3/31/1967
Emil C. Nelson, Acting Superintendent	4/1/67-6/31/1969
J. Lewis Allison, Superintendent	7/1/1969-12/31/1975
Edward .L. Proebsting, Interim Superintendent	1/1/1976-6/30/1976
Lin R. Faulkner, Superintendent	7/1/1976 – 11/30/1990
Edward .L. Proebsting, Interim Superintendent	12/1/1990-2/28/1993

Appendix D
Changes Over Time in Vinifera Grape Varieties Recommended for Washington State

1941[22]

Zinfandel
Alicante Mouschet
Malvoisie (Cinsaut)
Mataro
Ribier
Malaga
Flame Tokay
Thompson Seedless
Muscat of Alexandria
Johannesberger [sic] Riesling
Franken Riesling (Sylvaner)

1970[23]

Reds:
- Cabernet Sauvignon
- Limberger
- Pinot noir

Rosés:
- Chauche noir
- Gamay Beaujolais
- Meunier

Whites:
- Chardonnay
- Chenin blanc
- Mueller-Thurgau [sic]
- Helena
- French Colombard
- White RIesling

1976[24]

Reds:
- Cabernet Sauvignon
- Early Burgundy
- Limberger
- Merlot
- Nebbiolo

[22] John Snyder, *Growing Grapes in Washington*, Extension Bulletin 271 (Pullman: Extension Service, State College of Washington, August 1941), 28-30.

[23] Walter Clore, Charles Nagel, Vere Brummund, and George Carter, *Grape Variety Responses and Wine-Making Trials in Central Washington,* Circular 524 (Pullman: Washington Agricultural Experiment Station, Washington State University, 1970), 1.

[24] Walter Clore, Charles Nagel and George Carter, *Ten Years of Grape Variety Responses and Wine-Making Trials in Central Washington,* Bulletin 823 (Pullman: College of Agriculture Research Center, Washington State University, 1976), 1.

Zinfandel

Rosés:

Chauche noir
Gamay Beaujolais
Grenache
Pinot Meunier
Pinot noir

Whites:

Chardonnay
Chenin blanc
Delight
Müller-Thurgau
Gewürztraminer
Grey Riesling
Helena
French Colombard
Muscat Ottonel
Melon
Pinot blanc
Semillon
Sylvaner
White Riesling

2007[25]

The following varieties are currently most popular in Washington.

Reds:

Cabernet Sauvignon
Merlot
Syrah
Cabernet Franc
Lemberger (Blue Franc)
Malbec
Sangiovese
Pinot noir
Zinfandel

Whites:

Chardonnay
Riesling
Sauvignon blanc
Gewürztraminer
Semillon
Aligote
Madeleine Angevine
Muscat Canelli
Müller-Thurgau
Pinot gris
Siegerrebe
Viognier
Roussanne

[25] Washington Wine Commission, http://www.washingtonwine.org/washington-wine/varieties/index.php, accessed 8.28.08