OREGON'S CLIMATIC SUITABILITY FOR PREMIUM WINE GRAPES

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Interest in the production of premium wines in Oregon is increasing while many areas of premium wine grape production in California are being threatened by urbanization.[1] Ten years ago there were fewer than 100 acres of wine grapes in Oregon. A period of rapid expansion began about five years ago and today there are some 1,000 acres of which approximately 100 are bearing.[2] Most of these vineyards are located in the Willamette, Rogue and Umpqua valleys with centers of production being situated around the cities of Roseburg and Forest Grove.

While most of Oregon's wine production is sold locally, there is increasing interest in expansion to other markets.[3] Climate is the most important factor in determining both the success of the grapevine and the quality of the grape produced.[4] However, it remains unclear whether Oregon's climate is suitable for production of premium wine grapes in competition with California or as a replacement for California vineyards that are displaced by a more intensive land use. In trying to answer this question, the present study has investigated climatic elements that are important for premium wine grape production and then comparatively applied these data to relevant growing areas in California and Oregon.

1. *Degree heating days.* All varieties of premium wine grapes grown and considered for California and Oregon become dormant during the winter. During the growing season, generally from April 1 to October 30 (there is some variability in these dates depending upon variety and season; in cool years the start of the growing season may be delayed) wine grapes need from 1,600 to 3,500 degree heating days to mature. Most of the premium wine grapes being planted in, and considered best for, Oregon require

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a minimum of around 2,100-2,200 degree heating days. A degree heating day for grapes is a day, during the growing season, when the mean temperature is above 50°F. (A day with a mean temperature of 65°F results in 15 degree heating days.) The correlation between accumulated degree heating days and fruit maturation is imperfect, since late-season warmth can more effectively mature the fruit ("the catch up factor"). Despite this, the number of degree heating days will generally indicate the suitability of an area for a specific crop.

Cool summer conditions under which ripening proceeds slowly is desirable for the production of premium dry table wines. The cool weather tends to foster a high degree of acidity, good color and aroma and aids in the development of desirable flavoring constituents. In warm climates, the aromatic qualities of premium dry table wine grapes lose delicacy and richness, and the other constituents of the fruit are less balanced; hence the resulting table wines, even from the best grape varieties, cannot compare with the best wines of cooler regions. In very hot regions, where growth and ripening proceed rapidly, the bouquet of most dry wines is harsh and coarse, and the other components are so poorly balanced that in most years only common dry wines can be made.[5] However, the abundant heat which makes these regions poorly suited for dry wines makes them ideal for such dessert wines as port, muscatel and sherry.[6]

2. *Precipitation.* Rains during bloom, ripening or harvesting can cause problems. If there is heavy rainfall in May and June when the anther sacs are releasing their pollen grains, the pollen may be washed away, resulting in a poor set. Rains during the period of maturation, particularly during September and October, may promote disease and wash away sprays applied for such diseases as mildew and botrytis or for pest control. Rains occurring during the last phase of maturation are particularly harmful. During this phase the grape skin becomes markedly less pliable and the sugar content increases rapidly. Water remaining on the fruit will enter the grape by osmosis, creating pressure that may cause the grape skin to break open and expose the interior of the fruit to rot and disease.

3. *Humidity.* Humid conditions combined with high temperatures reduces grape quality and increases losses due to fruit droppage. (The exception to this general rule would be *Vitis rotundifolia* which thrive in the southern United States.) However, in cooler regions a higher humidity can be tolerated. High humidity is usually associated with the growth of micro-organisms (which cause rot, mildew deterioration and other diseases) and insect pests.

4. *Cloudiness.* A high percentage of cloud cover or heavy shading as from a windbreak or by the vine itself, will reduce the soluble solid (essentially the sugar) content of the grape, resulting in an inferior product.

5. *Temperature for pollen tube development.* Grapes, unlike most other deciduous fruit crops, are self-pollinating (need no bees for pollination). However, perhaps as an atavism, the best temperature for both pollen tube development and bee activity is 60 to 80°F. Cool weather in May and June will slow and/or hinder proper pollen tube development and may result in a smaller set.

6. *Frosts.* Frosts can be harmful during most stages of fruit development. Even during dormancy, temperatures below 10°F can be detrimental. In areas experiencing cold temperatures during winter, protective measures such as smudging, sprinkling or burying of the vines, if prolonged periods of intense cold weather are anticipated, can be employed. Production can be reduced by frosts occurring shortly before harvest, and by the killing of fruitful shoots by frosts after vine growth starts in spring.

7. *Chilling.* Grapes are in rest, and thus cold hardy, generally from early November to late February or early March. During rest chilling temperatures (temperatures below 45°F[7]) promote hormonal and physical changes necessary for continued growth in spring. The actual number of chilling hours required varies considerably with the variety. Grape vines will remain in rest only until their chilling requirement has been satisfied, after which they will commence growth in response to warm temperatures, becoming increasingly frost-sensitive.

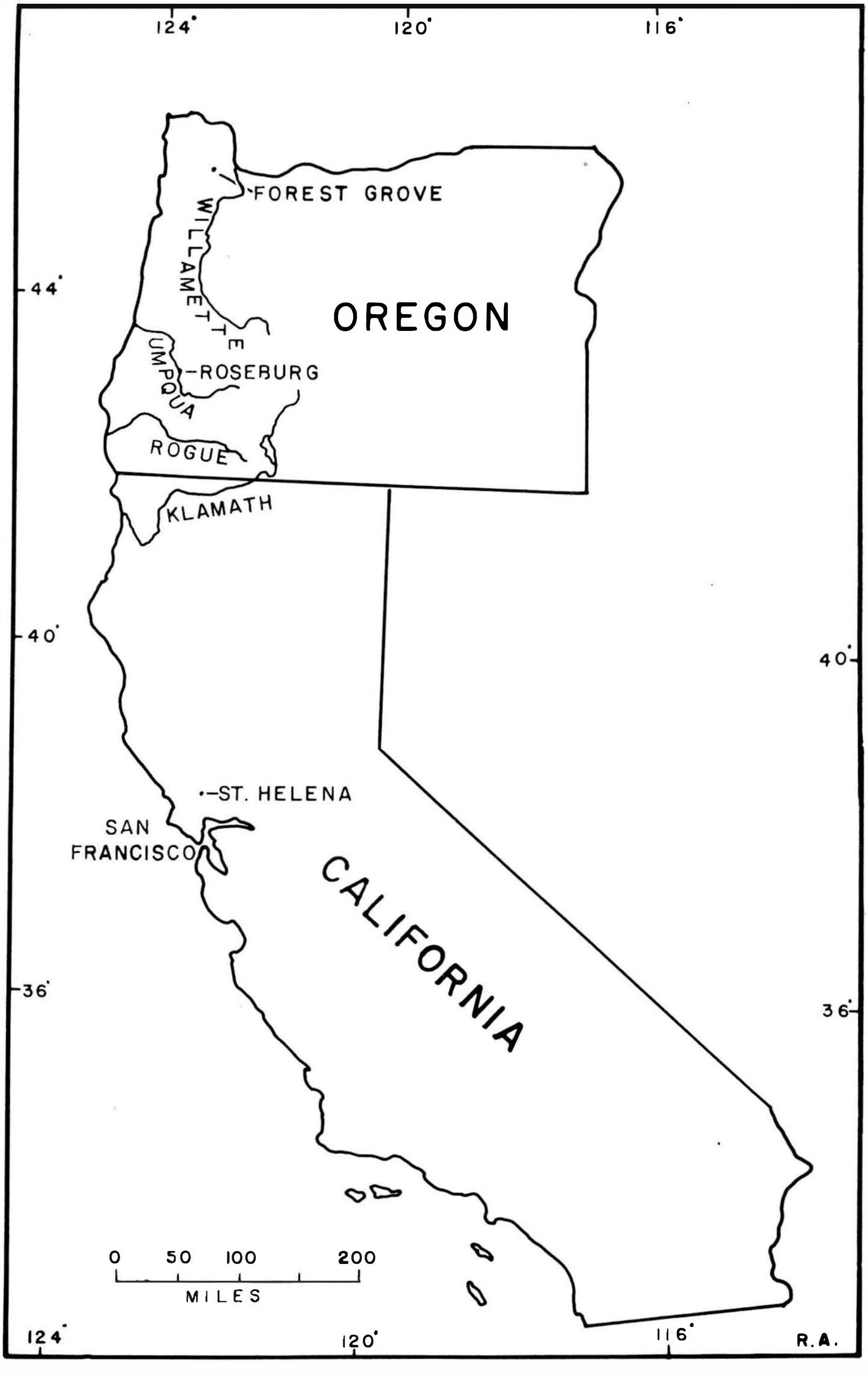

Figure 1. California and Oregon wine country location map.

Comparison of the Climates of St. Helena, California and Roseburg, Oregon

St. Helena, in the Napa Valley, is representative of the north coastal valley wine district, which is the traditional focus of the premium dry table wine industry in California. The Roseburg area, in the Umpqua Valley, is one of the primary wine grape growing areas under consideration, and is representative of other potential wine growing areas in Oregon. Therefore the climates of these two regions are compared to aid in determining Oregon's suitability for premium wine grape production.

The climates of Roseburg and St. Helena mave many similarities. Both areas are inland, with a low range of mountains separating them from the ocean. Each is adjacent to low passes, through which marine air intrudes, suppressing the maximum temperature in summer and elevating the maximum temperature in winter. Oregon, however, is farther north, and while both regions are dominated by the influence of the subtropical high in summer, there is a greater duration and strength of cyclonic storms in Roseburg. Although Roseburg's climate during the growing season has a regimen similar to St. Helena, it is definitely cooler, with more days of precipitation, and with less sunshine (Table 1).

Roseburg receives on the average only 2,100-2,200 degree heating days, over 1,000 less than St. Helena. Though this cooler growing season is ideal for the slow maturation of dry premium wine grapes, years that are cooler than average, such as 1975, may result in low sugar concentrations. Oregon law permits sugar to be added to the must (crushed grapes ready for fermentation) so that a sufficiently potent wine can be obtained in cool years. However, since flavor components, bouquet, and other aspects of the wine reach their peak about the same time as the sugar, years when sugar must be added to obtain proper potency will usually be years of inferior vintage. In Roseburg the best years will probably be the warmer ones when there is sufficient heat for maturation. Deficits in degree heating days can be mitigated by planting vineyards on south or southwest facing slopes or on conical mounds.[12]

TABLE 1. A COMPARISON OF THE MEAN CLIMATIC PARAMETERS OF St. HELENA, CALIFORNIA[8] AND ROSEBURG, OREGON[9]

Month	Monthly Mean Temperature (°F)		Degree Heating Days		Days with Precipitation	
	Roseburg	St. Helena	Roseburg	St. Helena	Roseburg	St. Helena
Jan	41.8	46.3	--	--	18	12
Feb	43.7	49.7	--	--	16	11
Mar	45.7	52.0	--	62	18	12
Apr	51.5	56.7	45	201	12	7
May	56.7	61.8	208	366	11	5
Jun	61.6	67.5	348	525	8	3
Jul	68.2	71.3	564	660	2	0
Aug	67.1	69.8	530	614	4	1
Sep	63.3	68.2	399	546	6	1
Oct	54.2	61.4	130	353	12	5
Nov	45.8	53.0	--	90	16	7
Dec	42.3	47.9	--	--	18	11
Total			2224	3417	141	75

Month	Chilling Hours[10]		Percentage of Possible Sunshine		Daily Solar Radiation (in Langleys)[11]	
	Roseburg	St. Helena	Roseburg	St. Helena	Roseburg	St. Helena
Jan	548	343	24	50	100	150
Feb	434	234	33	55	200	250
Mar	379	208	40	62	300	350
Apr			52	68	450	520
May			57	70	550	600
Jun			60	75	600	650
Jul			78	80	675	675
Aug			77	80	610	625
Sep			69	65	400	450
Oct			41	70	275	325
Nov	351	179	28	55	125	200
Dec	521	308	17	42	75	125
Total	2233	1272			4360	4920

Frosts	Roseburg			St. Helena		
	32°	28°	24°	32°	28°	24°
Mean last date in spring	3/27	2/15	1/15	3/15	1/29	1/6
Mean first date in fall	11/13	12/9	12/22	11/18	12/11	---
Mean number of occurrences	29	22	12	26	18	4

In St. Helena many growing seasons are too warm for optimum production of premium dry wine grapes. Thus, north and northeast facing slopes, or other cooler areas, are desirable for this type of grape.

The greater frequency of rains in Roseburg (Table 1) may cause problems in spring during pollination and in fall, particularly in cooler years, when the grapes need to stay longer on the vines to ripen. In Roseburg significantly more damage can be expected in both spring and fall due to rains falling at undesirable times than in St. Helena.

Roseburg experiences cooler and more humid springs and falls than St. Helena. This should result in a somewhat smaller average set (due to pollination problems) and greater disease problem.

Roseburg's greater cloud cover and lower intensity of solar radiation (Table 1), while in themselves not too significant, may aggravate the effect of insufficient heat for maturation.

The shorter average interval between killing frosts in Roseburg may result in losses, particularly in cooler years when the grapes must remain on the vine longer to mature. In both Roseburg and St. Helena grapes are grown in the foothills to take advantage of air drainage. One grower in the Roseburg area[13] has produced wine grapes for 13 years without frost protection equipment of any kind. Only in one year (1972) did he suffer significant losses due to frosts, with his expected production reduced by about one-third. However, frost problems in Roseburg may be more severe not only because freezing temperatures are more common but also because the chilling requirement may be satisfied earlier in the season, leaving the vines vulnerable to frosts following warm periods in early spring. Efforts may therefore be needed to obtain grape varieties with relatively high chilling requirements either in the initial varietal selected or through breeding programs. To date most years in Oregon have been satisfactory for premium wine grape production. The only climatic problems of which the author is aware have been associated with the frost in 1972 and the slightly cooler than desired temperatures in 1975. Oregon viticulturists' primary problems seem to be associated with their lack of experience and the usual difficulties in establishing new vineyards.

Conclusion

Some areas of Oregon seem to be climatically suited to certain wine grapes, particularly premium dry table varieties such as White Riesling, Chardonnay, Cabernet Sauvignon and Pinot Noir,[14] owing to their relatively low heat requirement. Because Oregon's vineyards will tend to have greater problems with frost damage, inadequate heat for crop maturation, untimely rains, cool springs and high humidity, the best areas of Oregon are less suitable for premium wine grape production than the best areas of California. Nevertheless, the relocation of some of California's wine production to Oregon may be favored by the elimination of climatically superior vineyards through urbanization, or because of increased costs of production due to high taxes and/or air pollution. However, independent of California, Oregon can continue to successfully produce and expand production for its local market.

NOTES

[1]Mary L. Brugo, "Selected Regional Forces in the Land Use System of the Upper Napa Valley of California Since 1950." Unpublished Masters Research Paper, Department of Geography, Oregon State University, 1967, p. 13.

[2]Personal interview with Ralph Garren, Professor of Horticulture, Oregon State University, 1973.

[3]Personal interview with Richard Sommers, owner and manager of the Hillcrest Winery, Roseburg, Oregon, 1973.

[4]Philip Wagner, "Wines, grape vines and climate," *Scientific American*, Vol. 230, No. 6, June 1974, pp. 106-15.

[5]A. J. Winkler, *General Viticulture*, Berkeley and Los Angeles University of California Press, 1962, pp. 55-56.

[6]*Ibid.*, p. 56.

[7]R. M. Samish, "Dormancy in Woody Plants." *Annual Review of Plant Physiology*, Vol. 5, 1954, p. 199.

[8]U. S. Department of Commerce. U. S. Weather Bureau. *Climatography of the United States No. 86-4 Decennial Census of United States Climate - Climatic Summary of the United States Supplement for 1951 through 1960 - California.* Washington, D.C.: Government Printing Office, 1968.

[9]U. S. Department of Commerce. U. S. Weather Bureau. *Climatography of the United States No. 86-34 Decennial Census of United States Climate - Climatic Summary of the United States Supplement for 1951 through 1960 - Oregon.* Washington, D.C.: Governement Printing Office, 1968.

[10]Estimated by means of formulas presented in Robert Aron, "Chilling as a Factor in Crop Location with Particular Reference to Deciduous Orchards in California." Oregon State University Ph.D. Dissertation (unpublished), 1974, p. 90.

[11]U. S. Department of Commerce. Environmental Science Service Administration. *Climatic Atlas of the United States.* Washington, D.C.: Government Printing Office, 1968, p. 69.

[12]N. Wegner. Boden Temperaturen Im Beeten Verschiedener Form V. Richtung. *Meteorologische Rundschaau*, Vol. 2, 1949, pp. 291-95.

[13]Richard Sommers, *op. cit.*

[14]Ralph Garren, Personal Communication, Oregon State University, 1972.