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Wine Grape Performance of 32 Cultivars in Western Colorado 1982-1986

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Abstract

Must analyses, yields, harvest dates, and winter injury of 32 vinifera and hybrid grape cultivars were evaluated at Colorado State University's Orchard Mesa Center over a 5-year period. The 27-year average heat unit accumulation (10°C base) at this site was 3,284, with 163 frost free days (0°C base). *Vitis vinifera* cultivars that were consistently productive, had excellent fruit quality, low incidence of winter injury, and generated very acceptable enological characteristics were 'White Riesling,' 'Chardonnay,' 'Muscat Blanc,' 'Limberger,' 'Cabernet Sauvignon,' 'Merlot' and 'Cabernet Franc.' The best French hybrid cultivars evaluated were 'Seyval blanc,' 'Vidal blanc,' Chancellor' and 'Rougeon.'

Introduction

Grapes have been cultivated in western Colorado since the late 1800's (6). Earlier studies (3) have shown that certain *Vitis vinifera* and French hybrid cultivars can produce wines of commercial quality in Colorado. Interest in the area's potential to commercially produce wine grapes has continued to increase. Wine grape acreage in western Colorado has grown from less than 20 acres in 1980 to over 250 acres in 1990. Considerable grower interest exists in identifying cultivars that will produce profitable yields, high quality wines and will tolerate winter conditions that typically exist in this area. The following publication summarizes 17 years' of weather data and 5 years (1982-1986) of wine grape cultivar evaluations for wine quality, yields and winter injury.

Materials and Methods

Data were recorded at Colorado State University Orchard Mesa Research Center (OMRC), elevation 1414 meters. The test vineyard consisted of self-rooted *Vitis vinifera* and French hybrid cultivars planted between 1975 and 1979. The vineyard was planted on an 2.5 meter by 3.7 meter spacing, head-trained and cane-pruned on a two wire vertical trellis with wires at 107 cm and 152 cm above the ground. Four French hybrid vines and twelve vinifera vines of each cultivar were evaluated. The soil is a Mesa Clay loam. The average precipitation for this area is 212 mm. The vineyard was furrow-irrigated as needed and standard vineyard maintenance procedures (10) were used. Weather data were recorded at OMRC using official National Oceanic and Atmospheric Administration (NOAA) climatological instruments (i.e. minimum and maximum mercury thermometers and a hygrothermograph). Observations for each day were made for the preceding 24-hour period. Date of last spring frost and date of first fall frost were recorded for both 0°C and -1.67°C. A temperature of -1.67°C will trigger freezing in plant tissue and may cause visible injury to most non-acclimated growing tissues (2, 4). Growing degree day (GDD) units were calculated from mean daily temperatures above 10 degrees C with the following formula: Heat Unit = ((daily maximum temp. + daily minimum temp.)/2) - 50. This (GDD) method, developed in California, helps determine varietal suitability for a given location (9).

Harvest date was determined by taking a 50-berry/cultivar sample once

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Table 1. Harvest dates, yields, must analyses and winter damage ratings at Orchard Mesa Research Center, Grand Junction, CO.

Cultivar	Harvest Date	Yield[a] mt/ha	Must Analyses °Brix	Must Analyses Titratable Acid g/liter	Must Analyses pH	Winter Damage[b]
Red V. vinifera						
Barbera	27/09	2.1(.49)	23.7(.74)	1.2(.17)	3.2(.04)	1.0(.00)
Cabernet Franc	25/09	1.7(.35)	22.8(1.30)	0.7(.07)	3.3(.13)	1.4(.48)
Cabernet Sauvignon	27/09	1.3(.50)	23.6(.88)	0.8(.10)	3.4(.04)	1.6(.48)
Gamay	05/10	1.4(.25)	19.8(1.35)	1.0(.28)	3.0(.08)	1.3(.47)
Limberger	24/09	1.5(.45)	22.5(2.20)	0.8(.06)	3.2(.08)	1.0(.00)
Merlot	14/09	1.5(.21)	23.4(.88)	0.7(.09)	3.2(.02)	1.5(.50)
Nebbiolo Fino	04/10	1.1(.25)	23.3(.08)	1.0(.08)	3.3(.08)	2.5(.50)
Petite Sirah	25/09	1.7(.16)	20.5(1.30)	0.8(.11)	3.2(.04)	2.2(.40)
Pinot Noir	18/09	1.1(.41)	21.6(1.10)	0.8(.02)	3.3(.01)	1.4(.48)
Syrah	26/09	1.7(.58)	23.9(1.70)	0.8(.12)	3.2(.16)	2.0(.63)
Zinfandel	04/10	1.9(.56)	19.6(1.70)	0.9(.16)	3.2(.14)	2.0(.63)
Red F. Hybrids						
Chambourcin (J.S. 26-205)	09/10	1.4(.40)	22.3(.71)	1.4(.21)	3.3(.18)	1.8(.74)
Chancellor (Seibel 7053)	29/09	1.7(.16)	21.3(.72)	0.8(.08)	3.3(.06)	1.0(.00)
Dechaunac (Seibel 9549)	27/09	4.0(1.60)	22.6(1.08)	0.9(.15)	3.4(.11)	1.0(.00)
Foch (Kuhlmann 188-2)	05/09	1.6(.86)	23.5(1.16)	0.8(.06)	3.5(.18)	1.0(.00)
Rougeon (Seibel 5898)	25/09	2.1(.90)	22.1(.84)	0.8(.14)	3.4(.06)	1.0(.00)
White V. vinifera						
Chardonnay	21/09	1.7(.65)	23.1(.78)	1.0(.12)	3.2(.05)	1.2(.43)
Chenin Blanc	27/09	2.3(.63)	21.5(.29)	0.9(.06)	3.3(.06)	2.0(.00)
Fendant (Chasselas)	08/09	1.5(.48)	19.3(1.20)	0.5(.08)	3.4(.04)	2.0(.82)
French Columbard	10/10	3.5(.89)	22.5(.32)	1.3(.07)	3.1(.15)	2.0(.00)
Gewurztraminer	10/09	2.1(.38)	20.0(.88)	0.7(.05)	3.3(.11)	1.2(.43)
Muscat Blanc	10/09	1.9(.14)	21.4(.90)	0.7(.06)	3.1(.05)	1.2(.43)
Rkatsitelli	01/10	2.2(.26)	21.6(.98)	1.0(.13)	3.1(.10)	1.0(.00)
White Riesling	30/09	2.0(.18)	20.8(.76)	0.9(.14)	3.1(.06)	1.2(.40)
Sauvignon Blanc	13/09	1.6(.54)	21.2(1.40)	0.9(.11)	3.2(.07)	2.2(.43)
Semillon	22/09	2.1(.50)	20.5(.88)	0.8(.05)	3.2(.11)	1.7(.43)
Siegerrebe	28/08	1.1(.09)	20.9(2.10)	0.5(.10)	3.4(.20)	1.3(.47)
White F. Hybrids						
Aurore (Seibel 5279)	29/09	1.8(.21)	20.3(.62)	0.7(.09)	3.4(.09)	1.3(.47)
Seibel 10868	11/09	1.3(.08)	20.1(1.60)	0.7(.03)	3.4(.08)	1.2(.40)
Seibel 13047	05/09	1.5(.23)	21.5(1.70)	0.7(.10)	3.5(.10)	1.4(.48)
Seyval Blanc	07/09	2.0(.64)	22.7(2.20)	0.8(.17)	3.3(.07)	1.2(.40)
Vidal Blanc	24/09	1.8(.66)	22.0(1.30)	0.9(.18)	3.3(.07)	1.2(.40)

[a]Vines were head trained cane pruned on a 2.5 meter by 3.7 meter spacing. The soil was irrigated 2-4 times per season. mt/ha = metric tons per hector. Numbers in each column are means followed by (standard deviations).
[b]Winter damage ratings: 1 = no apparent damage, 2 = some death of buds or canes observed, 3 = most above ground tissue is dead.

a week and testing for sugar (soluble solids), total acidity and pH. At harvest the yield of each cultivar was determined and a juice (must) sample was taken to determine sugar (°Brix, using a hand held refractometer), pH, and titratable acidity (titration with 0.133 N NaOH to end point pH 8.4). Bird

netting was used for orange or red-black skinned cultivars that attracted birds. Winter damage observations were recorded in June of each year to allow for latent bud development. Observations were made on each vine and the average rating per cultivar per year was summarized (Table 1). Descriptive statistics (range, means and standard deviations) was used to analyze data (7).

Climate

Based on the UC Davis regional heat summation method, the climate in the Grand Junction area fluctuates between Region II and Region III (9). Climatic observations at OMRC the past 27 years indicate the average Growing Degree Day (GDD) accumulation (10°C base) was 3,284 (Table 2). The average number of frost free days (0°C base) was 163 with the range from 132 to 201 days. Based on -1.67°C, the 27 year average number of frost free days was 190 with a range from 151 to 226 days. The number of frost free days (0°C Base) for this 5 year study (1982-1986) ranged from a low of 153 in 1984 to a high of 170 in 1983. The range of frost free days for the 5-year study using -1.67°C Base is 171 to 215 days. The lowest yearly GDD accumulation for the period of this study was 3,075 in 1982, well within the range of ripening early to mid-season maturing grapes (8). The lowest 27-year GDD accumulation occurred in 1965 with 2,816 GDD, which is still above the cool region (Region I) category. Harvest, depending on cultivar and site, usually begins the end of August and ends in mid to late-October. The average October heat unit accumulation (126 GDD) is not high enough for late harvests and therefore will be infrequent. The range of the last two spring frosts (0°C Base) for the 27 year period occurred between 1 April and 27 May with the average last spring frost date 4 May. Based on -1.67°C the range was between 16 March and 9 May with the average last spring frost date April 8. The range of the first two fall frosts (0°C Base) for the 27 year period occurred between 18 September and 11 November with the average first fall frost on 20 October. For the -1.67°C Base, that range occurs between 18 September and 17 November with the 27 year average first fall frost on 24 October. During the 5-year study, the earliest fall frost (0°C Base) occurred on 29 September in 1984-85 but was not severe enough to cause injury or leaf fall and allowed fruit maturity to continue until 24 October when -1.67°C was recorded. The earliest fall frost for the -1.67°C Base during the 5-year study was 9 October, 1982.

The topography of the grape growing areas of western Colorado varies enough to dramatically influence temperature changes. Temperature inversions can occur in these areas (1) and temperatures at some sites can vary 10-15°C from one end of the vineyard to the other. An inversion occurred at OMRC on 18 May 1983 which killed buds .3 meters above the ground but left fruiting buds (107 cm above ground) virtually uninjured. Minimum temperatures of January 1984 were the lowest for this 5-year study, drop-

Table 2. Heat Unit Accumulation (10°C Base) at Orchard Mesa Research Center, Grand Junction, CO 1964-1990.

Data for 1964 to 1990	April	May	June	July	August	Sept.	October	Total
Range	0-216	207-476	401-768	772-930	620-869	341-615	0-284	2816-3659
Mean	75	339	624	853	776	489	126	3284
Median	71	323	620	853	784	480	133	3246
Standard Deviation	67	76	89	43	61	74	81	220

ping to -22 and -25°C. January consistently appeared to be the coldest month and temperatures in January of -22°C of colder have occurred 6 out of the 27 years recorded at OMRC. Most *V. vinifera* cultivars will be injured between -22 and -26°C (8). Temperatures in February of 1989 were the lowest at temperatures recorded at OMRC (-29°C). Some sites recorded higher temperatures this same date, however vine trunk renewal was necessary at all sites.

Grape Variety Performance

Table 1 shows wine grape variety harvest dates, yields, must analyses and winter damage ratings for both red and white-fruited varieties. Most white cultivars obtained sugar levels of 20-22° Brix. 'Fendant' (chasselas) developed the lowest average sugar level 19.3° Brix which is not uncommon for this early-maturing cultivar (10). The earliest maturing cultivars were 'Aurore' and 'Siegerrebe,' the latter having an average harvest date of 28 August. Overall, total titratable acid levels for the white cultivars were sufficient (0.6 g/100 ml or higher) for winemaking (5). Titratable acid levels for 'Siegerrebe' and 'Fendant' were typically low because harvest was delayed in an effort to increase sugar levels. The average titratable acid level for 'French Colombard' (1.3 g/100 ml) was the highest of all white cultivars and considered undesirable for winemaking purposes (5) Most white cultivars had desirable pH levels of 3.4 or lower and the highest average pH level for white cultivars was 3.5 (Seibel 13047). The highest yielding white cultivar was 'French Colombard' with an average yield of 3.5 mt/ha. The lowest yielding white cultivar was 'Siegerrebe' with an average yield of 1.1 mt/ha.

Sugar levels for all red cultivars generally fell within the desired range (20-23.5°) except for 'Zinfandel' (19.6°) and 'Gamay' (19.8°). 'Foch' (Kuhlmann 188-2) was the earliest maturing red cultivar having an average harvest date of 5 September. Dechaunac (Seibel 9549) was the highest yielding 4.0 mt/ha and 'Pinot Noir' and 'Nebbiolo Fino' were the lowest with an average yield of 1.1 mt/ha. In most years, high pH and high titratable acid levels were common with cultivars 'Chambourcin,' 'Barbera,' and 'Gamay.'

Winter damage was more apparent with *Vitis vinifera* than the hybrid cultivars. Severe bud, cane and trunk injury and major yield reduction was observed in 1984 with 'Sauvignon Blanc' and in 1983 with 'Fendant.' Major yield reduction from winter injury was also observed in 1984 and 1986, with cultivars 'French Colombard' and 'Chenin Blanc,' respectively, but trunk injury was not apparent.

The most noteworthy winter damage occurred in February of 1989, (data not shown), when temperatures fell to -29°C and colder. Nearly all above-ground tissue of all cultivars in Table 1 were killed, with the exception of 'Rougeon' and several 'Riesling' vines. Latent buds survived near the head of the trunk. 'Rougeon' (Seibel 5898) sustained very little damage during this Arctic freeze and had only minimal bud injury and no trunk injury.

Except for 'Chambourcin,' all red hybrids were generally less susceptible to winter injury than were red vinifera cultivars. This winter injury resulted in subsequent vigorous vegetative growth and may partially explain the high pH and acid levels of 'Chambourcin.' With 'Limberger' and 'Barbera,' winter damage was minimal. The most severely winter-injured red vinifera cultivars were 'Nebbiolo Fino,' 'Petite Sirah,' 'Syrah' and 'Zinfandel.'

In summary, most hybrids appeared to be more cold hardy than most vinifera. 'Seyval blanc,' 'Vidal blanc,' 'Chancellor' and 'Rougeon' were productive under these climatic conditions, averaging better than 1.7 mt/ha

with virtually no winter damage and produced desirable sugar, acid and pH must parameters. The vinifera cultivars 'White Riesling,' 'Chardonnay,' 'Muscat Blanc,' 'Cabernet Sauvignon,' 'Merlot,' 'Limberger' and 'Cabernet Franc' survived these winters with minimal damage and produced favorable yields with excellent sugar, acid and pH balances. The high elevation of this site is accompanied by dry climatic conditions, intense sunlight and large daily temperature fluctuations. These conditions favor high pigment concentration and high acid retention which may partially explain the excellent enological characteristics in certain areas of Colorado. Winters in Colorado can damage grapevines and the temperatures may not always be as moderate as the years observed during this study.

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40 Years of Plum Breeding in Romania

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Abstract

The plum (*Prunus domestica* L.) is an important fruit species in Romania. A breeding program aiming at improving the plum cultivars available in Romania was started in 1950 using traditional cultivars 'Tuleu gras' and 'Grase romanesti' as the initial parents. Forty years of research has resulted in the development of 20 new plum cultivars with high quality fruit, ripening season from July 1-5 to September 15-20 and resistance or tolerance to plum pox virus. The working stages and the main agronomical and technological characteristics of some of the cultivars already widely commercialized on the market are described.

This article will describe the historical progress of the breeding program as well as the characteristics of the major commercial cultivars developed.

The European plum *(Prunus domestica)* is widely spread (over 50% of the trees produced yearly in the nurseries and about 60% of the annual fruit production) throughout Romania. The native cultivars have always been prevalent and their main destination was the production of plum brandy although some very good cultivars for fresh market have been grown in Romania, e.g. 'Tuleu gras,' 'Grase romanesti,' etc.

Although some cultivars such as 'Anna Spath,' 'Agen,' 'Vinete de Italia' and more recently 'Stanley' have found

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