

Sauvignon blanc: Past and Present

by Nancy Sweet, Foundation Plant Services



THE BROAD APPEAL OF THE SAUVIGNON VARIETY is demonstrated by its worldwide popularity. Sauvignon blanc is tenth on the list of total acreage of wine grapes planted worldwide, just ahead of Pinot noir. France is first in total acres planted, followed in order by New Zealand, South Africa, Chile, Australia and the United States (primarily California). *Boursiquot, 2010*. The success of Sauvignon blanc following migration from France, the variety's country of origin, was brought to life at a May 2010 seminar *Variety Focus: Sauvignon blanc* held at the University of California, Davis. Videotaped presentations from this seminar can be viewed at UC Integrated Viticulture Online <http://iv.ucdavis.edu> under 'Videotaped Seminars and Events.'

HISTORICAL BACKGROUND

As is common with many of the ancient grape varieties, the precise origin of Sauvignon blanc is not known. The variety appears to be indigenous to either central France (the Loire region) where most of the variations are located or southwest France (Bordeaux). The origin of the name is from the French words 'sauvage' (wild) and 'blanc' (white). *Galet, 1998*.

The first mention appeared in France during the reign of Henri IV in the late 16th century, when the grape was known as Surin. The variety is now known in France as simply 'Sauvignon,' with synonyms such as Blanc fumé (in the Loire), Fié, Sauvignon blanc, Sauvignon jaune, and Sauvignon vert (not to be confused with Muscadelle in California). *Boursiquot, 2010*. Robert Mondavi adopted the name Fumé blanc for his Sauvignon blanc wines in the 1960's to suggest the dry style of the Loire Valley wines.

Some familial ties to Sauvignon blanc have been discovered. DNA profiling in Austria suggested that Sauvignon blanc might be related to Chenin blanc and Traminer. *Robinson, 2006*. Microsatellite analysis from INRA Montpellier and Domaine de Vassal in France shows that Sauvignon is a seedling (progeny) of Savagnin blanc (Traminer blanc) from the Jura. Savagnin blanc is one parent of the following varieties, which are either full or half siblings: Sauvignon, Chenin, Grüner Veltliner (Austria), Verdesse (Alpes), Verdejo blanco (Spain), and Verdelho da Madeira (Portugal). *Boursiquot, 2010*. The second parent for each of these varieties is still unknown. In 1997, John Bowers and Carole Meredith at UC Davis published evidence that a spontaneous cross of Sauvignon blanc with Cabernet Franc occurred most likely in Bordeaux to produce what

is arguably the most highly regarded red wine grape, Cabernet Sauvignon.

CULTURAL TRAITS

Jean-Michel Boursiquot, well-known ampelographer and viticulturalist with the Institut Français de la Vigne et du Vin (IFV) and Montpellier SupAgro (the University at Montpellier, France), spoke at the *Variety Focus: Sauvignon blanc* seminar about 'Sauvignon and the French clonal development program.' After discussing the historical context of the variety, he described its viticultural characteristics and wine styles in France.

Sauvignon blanc is known for its small to medium, dense clusters with short peduncles, that make it appear as if the cluster is attached directly to the shoot. The stem and peduncles are green, and the leaves are bullate (bumpy surface) and ruffled on the margins. The small to medium size leaves create a very dense canopy on a very vigorous Sauvignon blanc vine. *Boursiquot, 2010*.

Some of the characteristic aromas of wine made from the Sauvignon grape have been described as black currant bud, boxwood, broom, figs, citrus (grapefruit), passion fruit, white peach, gooseberry, green fruits, flint, rhubarb, tomato leaf, aspergillus, grassy, herbaceous, and green bell pepper. *Boursiquot, 2010; Dubourdieu et al., 2006*.

Boursiquot commented that Sauvignon blanc is a technically demanding cultivar that requires balanced conditions and vigor control. Changes in cultural practices and conditions can alter the aromatic quality of Sauvignon wines. One of the challenges with Sauvignon is control of vine vigor through canopy management and use of moderate to low-vigor rootstock. Too much vegetation can cause a strong herbaceous quality to the wine because the berries do not fully ripen. *Boursiquot, 2010; Robinson, 2006*. A bell pepper or grassy vegetal aroma caused by methoxypyrazine compounds can occur in the wine when grape maturity is insufficient. *Dubourdieu et al., 2006*. Exposure of the clusters to sunlight can also significantly affect fruit flavors. Finally, it is thought that the strong varietal character is more pronounced in cooler climates than in warmer climates. *Boursiquot, 2010; Smith, 2003*.

Sauvignon has two notable color mutations. Sauvignon rouge has reddish black berries and is found among isolated Sauvignon blanc vines. Sauvignon gris (Sauvignon rosé) differs from Sauvignon blanc by its pinkish grey berries. In France, Sauvignon gris has been less productive than Sauvignon blanc. *ITV-INRA-Supagro-Viniflor*, 2006 ; *Galet*, 1998.

SAUVIGNON IN FRANCE

There are currently around 65,000 acres of Sauvignon blanc planted in France, with significant plantings in the Languedoc where the variety is used for *vin de pays* (almost 16,000 acres), Bordeaux (15,000 acres), Sancerre (10,000 acres) and the Loire Valley (9,500 acres). *Boursiquot*, 2010.

In the Loire Valley region, the characteristic dry and perfumed white wine varieties have been produced on limestone soils in areas such as Pouilly-sur-Loire, Sancerre, and Quincy. (*Galet*, 1998) The Sauvignon variety is known in the Pouilly area by the synonym name Blanc fumé, after the 'smokey' colored or gray bloom that grows on the Sauvignon grape. *Seely*, 1989. Loire Valley wine is made with a lower alcohol level (11%), and is named Pouilly-Fumé or Blanc fumé de Pouilly in the Pouilly-sur-Loire area. *Robinson*, 2006.

Sauvignon has been grown in southwest France in Bordeaux since at least the 18th century, where it is frequently blended with Sémillon. *Bowers and Meredith*, 1996. The Gironde *département* is one of the biggest in France. In that *département*, Sauvignon blanc is an ingredient in the dry wines of Graves and Entre-Deux-Mers, as well as the sweeter wines made in Sauternes. *Bolter*, 1988.

In the Sauternes area of Bordeaux, the mild, humid autumn weather encourages *Botrytis cinerea* (*la pourriture noble*, or, noble rot), a fungus that starts to attack the Sauvignon blanc and Sémillon grapes around September. This action produces a must that is enriched in sugar without a significant change in acidity. The harvest process in Sauternes includes late harvesting and selective picking (passing through the vines on several occasions). *Olney*, 1986; *Benson and MacKenzie*, 1979. As a result, in Sauternes, Sauvignon blended with Sémillon produces very sweet white wines with a minimum of 13% alcohol with low maximum yields. *Robinson*, 2006 (*Sauternes*); *Galet*, 1998; *Benson and MacKenzie*, 1979.

Some of the finest examples of this sweeter style of wine have been made since the 18th century at Château d'Yquem in the Sauternes region. *Olney*, 1986. The château property containing the vineyard and winery was acquired by the Lur-Saluces family in 1785 by marriage into the Yquem family. George Washington stocked the presidential cellar with a 1787 Yquem, at the recommenda-

tion of Thomas Jefferson, the Ambassador to France. The golden sweet Château d'Yquem wine made from overripe grapes affected with noble rot received the classification of *Premier Cru Supérieur* ('Great First Growth') in 1855. The highest price paid for any French white wine is said to be a tonneau (900 litre tun) of 1847 Château d'Yquem (Sémillon blended with Sauvignon blanc) which the Marquis de Saluces sold in 1859 for 20,000 francs to Grand Duke Constantine, brother to the Emperor of Russia, at the time of his visit to Bordeaux. The price was four times the amount paid for a French white wine until that time. Amédée de Lur Saluces was the Marquis in 1884 when Charles Wetmore visited Château d'Yquem to collect French varieties for his vineyard in Livermore, California. *Bolter*, 1988; *Olney*, 1986.

SAUVIGNON BLANC IN CALIFORNIA

In the 1860's, Californians believed that the best white wine from Bordeaux came from the French region called Sauternes, and 'Sauterne' or 'Haut Sauterne' later became standard generic labels on bottles of dry or sweet wine in California. *Sullivan*, 1994 and 2008. The Sauvignon (blanc) grape came to California sometime in the second half of the 19th century. There is evidence showing that the variety was imported by J.-B. J. Portal to the Santa Clara Valley in the 1870's, and was definitely in collections in Napa (H.W. Crabb, Gustav Niebaum) and Sonoma (J.H. Drummond) in the 1870's and 1880's, when Sauvignon blanc first became popular in California. *Sullivan*, 1998.

Charles Wetmore was the Chief Executive Officer to the Board of State Viticultural Commissioners for the years 1882–1884. In an *Ampellography* written in 1884, he dedicates only a few words to the 'Sauterne type' white wines: "The noblest French and Spanish [white wine varieties] are scarcely known, which is to be regretted, as we are thereby prevented at present from reproducing the Sauterne and sherry types." *Wetmore*, 1884. He also refers to the 'true Sauvignon recently imported' and compared to another California vine (which turned out not to be Sauvignon) and the necessity of importing Sauterne varieties, including Sauvignon blanc, directly from France in order to have adequate stocks of the varieties.

Wetmore is relevant to the Sauvignon blanc collection at Foundation Plant Services because he was responsible for bringing the original source material for Sauvignon blanc FPS 01 to California from France in the early 1880's. Although the story will be told in greater detail below in connection with Sauvignon blanc FPS 01, Wetmore travelled to Bordeaux with a letter of introduction to the owner of Château d'Yquem and was able to bring back to California cuttings of Sauvignon blanc, Sémillon and Muscadelle du Bordelais.

By the end of the 1880's, northern California winemakers were producing sauterne wine that was praised at the 1888 Viticultural Convention in San Francisco. This northern California 'Sauterne' or 'Haut Sauterne' was not the very sweet style characteristic of French Sauternes, because Californians were unaware at that time of the noble rot mechanism. *Sullivan, 1994, 2008.*

Frederic T. Bioletti, head of the University of California Department of Viticulture, researched the appropriate varieties for California in the late 19th and early 20th centuries. Both he and Eugene Hilgard recognized value in Sauvignon blanc at that time. *Amerine and Winkler, 1944.* Hilgard planted Sauvignon blanc at the University of California Experiment Stations by 1890. In a 1907 Experiment Station bulletin, Bioletti recommended planting Sauvignon blanc, along with Sémillon and Colombar (Sauvignon vert), in the coastal counties for fine dry wines. He noted that "Sauvignon blanc increases the quality of the wine ...but requires careful cutting, selection and pruning to give satisfactory crops." *Bioletti, 1907.* Bioletti seems to have considered Sauvignon blanc as a support grape for blending with Sémillon, which he described as the characteristic Sauternes grape with true Sauternes aroma. *Bioletti, 1929 rev. 1934.*

UC Professors Maynard Amerine and A.J. Winkler explicitly stated in a 1944 publication that Sauvignon blanc made a high quality white table wine, appropriate for Winkler regions I, II and III, either *by itself as a varietal* or for blending. *Amerine and Winkler, 1944.* Sauvignon blanc was recommended for high quality dry table wines in regions I and II. Amerine and Winkler noted a distinct and strong aromatic flavor and an overabundance of sugar in both cool and warm regions, and recommended the variety for naturally sweet wines in warm seasons and region III. *Amerine and Winkler, 1944.* Amerine was quoted as saying that Sauvignon blanc is California's greatest white grape but that its strong aromas needed tempering for mass appeal. *Robinson, 2006.*

Producers such as Wente in Livermore and Beaulieu in Napa maintained quality sauterne wines in California after Prohibition. Wente's 1932 Sauvignon blanc varietal is thought to be the first time the variety name (instead of the more generic term Sauterne) appeared on a California wine bottle. At that time, the number of true Sauvignon blanc acres planted in California remained very small. The amount is not well known in part due to the fact that, until 1966, government officials grouped that variety with the acreage for the unrelated variety, Sauvignon vert. *Sullivan, 1998.* In 1945, it was estimated that there were 82 acres planted in California in the Sauvignon vert/Sauvignon blanc grape category. *California Crop and Livestock Report for 1945.*

Bob Steinhauer, grape grower and viticultural consultant in Napa County, was the keynote speaker at *Variety Focus: Sauvignon blanc* in Davis. In his talk 'Looking Backwards at Trends in Vineyard Management of Sauvignon blanc,' Steinhauer described the history of Sauvignon plantings in California beginning with 1971, when fewer than 2,000 acres of Sauvignon blanc grapes were planted in California. By 1974, plantings had increased to 3,193 acres. The variety surged in popularity as the acreage planted to Sauvignon blanc grapes reached the high of 15,383 acres in 1985. Steinhauer attributes that increase to recognition by growers that certain soils were not desirable for Cabernet Sauvignon, increased consumer demand for white wine, and a recognition that quality wine was being produced in California. *Steinhauer, 2010.*

One of the significant influences on increased consumer demand for quality wine made from the Sauvignon blanc grape was Robert Mondavi's production in 1966-67 of a white wine in the dry style of Loire Valley Sauvignon wines, which Mondavi called Fumé blanc in deference to the Blanc fumé of the Pouilly-sur-Loire region of France. Mondavi felt that the name 'Sauvignon blanc' was not a good marketing name because it was difficult to pronounce and had previously been identified with sweet wines. The Fumé blanc wine was developed in part from an insight into approaching consumer acceptance of dry wines to be consumed with food. Mondavi intended to create a more distinctive, complex wine, using primarily the Sauvignon blanc grape. The new, drier wine was fermented in temperature-controlled stainless-steel tanks to dryness and then aged in small French oak barrels. By 1968, there was a 'tremendous demand' for the new Fumé blanc wine. *French, S., 1983.* The United States Alcohol and Tobacco Tax and Trade Bureau approved Fumé blanc as a synonym for Sauvignon blanc for use on wine labels in the United States.

After 1985, Sauvignon blanc acreage declined until 1997, when it again resurged to 15,414 acres in 2008. Plantings on the North Coast constituted about 50% of the total acreage in that year. Steinhauer attributed the increased acreage from the low in 1997 (11,380 acres) to 2008 to improved quality in wine production, making Sauvignon blanc one of the 'blue ribbon California varietals'. Vineyard practices used to achieve vine balance and reduce the vegetative character of the grapes included: movement to warmer climates (from Winkler region I to a region II or III); increased yields to between 5 and 7 tons per acre; canopy management and leaf removal to moderate cluster exposure; irrigation and fertilizer management; and trellising and training. He also cited the blending of Sémillon into the wines as an improvement in wine quality. *Steinhauer, 2010; Bledsoe et al., 1988.*

SAUVIGNON BLANC IN NEW ZEALAND

Mike Trought, Director of Plant and Food Research, Marlborough Wine Research Center, New Zealand, spoke at *Variety Focus: Sauvignon blanc* on 'Soils, sunshine and serendipity: the success of New Zealand Sauvignon blanc.'

Sauvignon blanc was introduced to New Zealand in 1970 when six cuttings of a selection called 'UCD 1' were imported to Marlborough from Foundation Plant Services at the University of California, Davis. Those cuttings (now known as Sauvignon blanc FPS 01) formed the basis of the New Zealand Sauvignon blanc industry. It eventually became apparent that the vines suffered from leafroll virus, but a persistent and lengthy selection process has kept that disease to a minimum. *Trought, 2010; Perry and Norrie, 1991; Hubscher, 1988.*

Sauvignon blanc is the most important of the wines exported from New Zealand. Trought stated that New Zealand's unique climate impacts its Sauvignon blanc wine style, which began to receive international acclaim at the *Sunday Times* wine festival in London in 1986, where it won the first of a series of awards. The unoaked Sauvignon blanc was characterized as a 'new or different style' of wine. Quality Marlborough Sauvignon blanc is composed of both good ripe aromas (e.g., passion fruit, tropical flavors) and unripe aromas (e.g., herbaceous) and acidity. *Trought, 2010; Parr et al., 2007.*

The unique climate in Marlborough has been likened to that in Bordeaux, France—both have a maritime influence and a long growing season. The cool but sunny autumn allows for late ripening. *Perry and Norrie, 1991.* Marlborough is also the same latitude as California but differs in that New Zealand is an island in the middle of an ocean. The mountain range along the backbone of the south island protects Marlborough from the strong northwesterly winds in the spring. Temperatures are moderated by the oceanic influence and rarely exceed 80 degrees F (day) or drop below 26 degrees F (night). The sunlight in Marlborough is intense with a high ultra-violet light component on the exposed berries, possibly influencing the flavor profile. *Trought, 2010.* The Marlborough vineyards are mostly located on alluvial but gravelly flood plains, that provide enough drainage so that over-vigorous growth is minimized. *Perry and Norrie, 1991.*

SAUVIGNON BLANC IN SOUTH AFRICA

Sauvignon blanc is one of the most important white wine cultivars grown in South Africa. Phil Freese is a consultant (WineGrow) and winegrape grower in Sonoma County, California, and South Africa (Vilafonte). He spoke about Sauvignon blanc in South Africa at *Variety Focus: Sauvignon blanc*.

The premier grape growing region in South Africa is near Stellenbosch, which also is the home of an agricultural university with a viticulture program like that at UC Davis. Stellenbosch is located a bit inland from Cape Town on the southwest tip of the continent. The western side of South Africa on the Atlantic Coast is exposed to a cool upwelling (wind) from Antarctica, that has a dramatic effect on winegrowing. Freese likened the climate of this area to that of Santa Barbara, California. Wine is also grown in the Paarl region, which is a warmer region further inland. *Freese, 2010.* The climatic regions in South Africa vary from Winkler regions II to IV. *Marais et al., 1999.*

White wines, driven by Chenin blanc, dominated the early days of the South African wine industry. Sauvignon blanc began to compete for popularity with Chenin blanc during 1950's and 1960's. *Freese, personal communication.* The area planted to Sauvignon blanc in South Africa increased from 5570 acres in 1985 to 22,425 acres in 2009. *Freese, 2010; Marais et al., 1999.* The variety was so important to the wine industry in South Africa that substantial government resources were devoted to a study of this single cultivar, focusing on varietal characteristics and expression and methods for optimal wine production in South Africa. *Marais et al., 1999; Marais, 1998; Marais, 1994.* Cultivation in cool areas or against cooler slopes in warm areas, combined with manipulation of methoxypyrazines by viticultural practices related to temperature and solar radiation within the canopy, were recommended by the government study. *Marais, 1994.*

SAUVIGNON BLANC IN CHILE AND AUSTRALIA

Nick Goldschmidt of Goldschmidt Vineyards has experience growing grapes and making wine in Chile, Australia, New Zealand and California. He related some of those experiences at *Variety Focus: Sauvignon blanc*.

Chile

Sauvignon blanc is dominant in Casablanca, a subregion of the Aconcagua Coast and one of the newer wine regions in Chile on the coast near Valparaiso. Casablanca is in Winkler climate region I, as a result of the cool wind and fog. *Robinson, 2006.* Goldschmidt indicated that the climate frequently mirrors that of northern California. The success of the green Sauvignon blanc wines (called *vinho verde*) in Chile is measured by sales in the United Kingdom, where it has achieved much acclaim. *Goldschmidt, 2010.*

Australia

Sauvignon blanc has been grown in the cooler sites in Australia since the 1990's after initial efforts to grow the variety in warmer areas resulted in some wines with an oily taste. *Robinson, 2006.* In 2008, Australia had 17,322 acres of Sauvignon blanc, which was still fewer acres than Chardonnay. *Boursiquot, 2010.*

SAUVIGNON CLONES AT FOUNDATION PLANT SERVICES

At *Variety Focus: Sauvignon blanc*, FPS Director Deborah Golino provided the historical background for the Sauvignon blanc and Sauvignon gris clones available at Foundation Plant Services. Sauvignon blanc has been among the registered varieties at Foundation Plant Services since 1966. The FPS collection contains plant material from California, France, Italy and Chile.

Sauvignon blanc FPS 01 (Château d'Yquem-Wente)

Sauvignon blanc FPS 01 has the longest history in the FPS program. The history of the selection can be traced directly back to Bordeaux. As noted above, Charles Wetmore commented in 1884 that it would be necessary to bring plant material directly from France for California growers to have an adequate stock of the Sauternes varieties. The State Board of Viticultural Commissioners charged Wetmore with travelling to Europe to obtain better varieties.



He consulted with a Livermore Valley grower, Louis Mel, before going to France for plant material. *Stoll, 1935.*

Louis Mel was a wealthy man when he purchased the W.G. Crow ranch south of Livermore in 1884. He renamed the ranch El Mocho and planted grapevines. Mel's French-born wife was a friend of the Marquise de Lur-Saluces, the owner of Château d'Yquem in Bordeaux. When Wetmore decided to travel to France in the early 1880's to retrieve plant material for the State Board of Viticultural Commissioners, he asked Mel for a letter of reference to the Lur-Saluces family. The letter was provided and Wetmore visited Château d'Yquem, from where he brought the Sauternes varieties Sauvignon blanc, Sémillon and Muscadelle du Bordelais back to California. *Sullivan, 1998.* At the time Wetmore took the cuttings that became FPS 01, the vines at Yquem consisted of old vines on their own roots. *Olney, 1986.* Upon his return to California, Wetmore provided some cuttings of the material to Mel, who planted them at El Mocho. *How Livermore's Fame For Its Sauterne Wines Was Established, The Livermore Herald, February 24, 1933.* [In addition to Sauvignon blanc FPS 01, Sémillon FPS 02 may also be from this original French source.]

According to Philip Wente, of Wente Vineyards in Livermore, California, the Wente family acquired the El Mocho vineyard with the original Sauvignon blanc vines sometime before 1925. *Nelson-Kluk, 2002; Stoll, 1935.* The Sauvignon blanc vines did well in the Livermore Valley because of the soil and climate, which is similar to the Sauternes region in Bordeaux. *Wente, Ernest A., 1971.* UC Davis Professor of Viticulture & Enology, Dr. Harold Olmo, collected the source material for Sauvignon blanc FPS 01 from the Wente vineyards in Livermore in 1958.

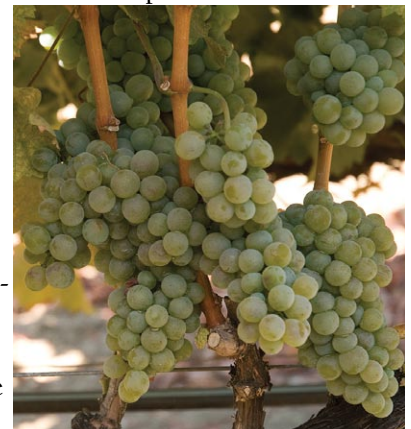
Sauvignon blanc FPS 01 received heat treatment for 82 days when it arrived at FPS. It first attained registered status in the California Grapevine Registration & Certification Program in 1967 (it was also known at FPS as #117, a number assigned to it by Curtis Alley, then-manager of FPS). In a concern over leafroll virus, that registration was suspended in 1980 and all the vines were removed from the foundation vineyard. The Sauvignon blanc vines in the foundation vineyard were undergoing retesting at the time. Two of those original foundation vines were found not to be infected with leafroll virus. Plant material from one of the two clean vines (FV F4 v8) was later located at John Gist's increase block in Davis. That material was retested, and the results confirmed that vine FV F4 v8 was not infected with leafroll virus. *Goheen, 1982.* Sauvignon blanc FPS 01 reappeared on the registered list in 1987.

For many years (from 1967 to the late 1990's), FPS 01 was the only registered selection available at FPS. This clone performed well in California, but it is perhaps best known as the basis of the very successful New Zealand Sauvignon blanc industry (where it is known as UCD 1). *Smith, 2003.*

Sauvignon blanc FPS 03/29 (Foothill Experiment Station)

Another Sauvignon blanc selection with longevity at FPS is the former Sauvignon blanc FPS 03, now Sauvignon blanc FPS 29. It was initially harvested from the former University of California Foothill Experiment Station in Jackson, California.

Eugene W. Hilgard, UC's first Professor of Agriculture and Director of Experiment Stations, established a small demonstration vineyard with 73 grapevines on the Berkeley campus in 1874-75. Hilgard's reports on the vineyard do not list the



source material for the 73 grapevines, although it is clear from documents in FPS files that the source material for what later became Sauvignon blanc FPS 03/29 originated from that Berkeley station. *Hilgard, 1890.*

Hilgard also implemented a series of University Experiment Stations in the late 1880's. The small vineyard at Berkeley was designated the 'Central Experiment Station.' The 'Sierra Foothill Experiment Station' was located 4½ miles northeast of Jackson in Amador County, California. In 1890, Hilgard caused Sauvignon blanc ('Savagnin blanch') cuttings to be taken from the Central Station and planted in Block S, row 15, vines 1–10 of the Sierra Foothill Station. *Goheen, 1982^a.*

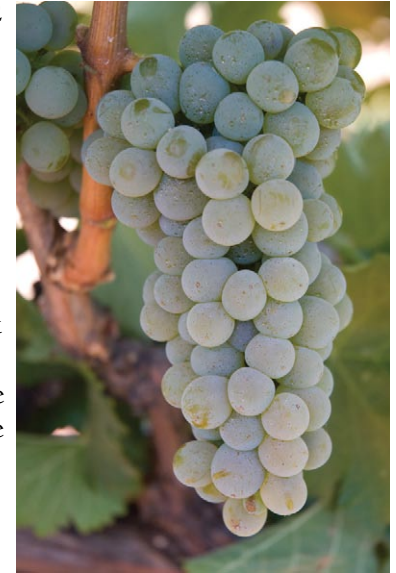
The Sierra Foothill Station was abandoned by the University of California in 1903. However, the vineyards were not removed. Dr. Austin Goheen, USDA-ARS scientist stationed in the Plant Pathology department at Davis, 'rediscovered' the old overgrown vineyards in 1963 and later obtained a map of the 1889-1892 plantings from the archives of the University of California library at Berkeley. The complete story of Goheen's rediscovery of the vineyard is contained in the 2006 *FPS Grape Program Newsletter*.

Although several Sauvignon blanc selections were collected from the Jackson vineyard, only one exists in the foundation collection today. That one (FPS 03/29) was initially collected by Goheen under another variety name. Goheen wrote: "in what I thought was row 18 of block S, I collected a vine which the records indicated should be Herbemont. Herbemont is an American bunch grape of Professor [T.V.] Munson, an early grape breeder from Texas. The grape I obtained turned out to be Sauvignon blanc. My collection was apparently three rows off from the original plan, an easy mistake when one considers the abandoned state of the planting at the time of my visit." *Goheen, 1982^a.*

The selection first identified as Herbemont was tested for virus disease and later renamed Sauvignon blanc FPS 03. By 1973, FPS 03 was added to the list of registered selections in the R&C Program, where it remained until 1983, when leafroll was detected in the selection when it was being retested using the field indicator Cabernet Franc. The selection then underwent microshoot tip tissue culture disease elimination therapy and was renamed **Sauvignon blanc FPS 29**. It was re-released in the program in 2005-2006. *Nelson-Kluk, 2002.*

Sauvignon blanc FPS 22 (Oakville)

Sauvignon blanc FPS 22 came to Davis around 1990 from a very old head-trained, gnarled and neglected vine in the southeast corner of the UC Davis Oakville field station. Phil Freese, former vice president of Wine Growing at Robert Mondavi Winery, encouraged FPS to preserve this selection because he suspected that the vine might have been part of a very old vineyard that originated before the



UC importation programs and modern Sauvignon blanc introductions. Pierre Galet looked at this vine during one of his trips to California in the 1980's and told Freese that it was 'true Sauvignon blanc.' *Nelson-Kluk, 2002.* At the time Galet visited California, Sauvignon vert (Muscadelle) was cultivated alongside true Sauvignon blanc, which was sometimes referred to as Savagnin musqué. *Galet, 1998.*

Initial testing at FPS showed that the original material was infected with leafroll virus as well as Rupestris stem pitting virus. Microshoot tip tissue culture disease elimination therapy was performed on the selection around 2000. DNA testing at FPS verified the identity of the plant material. Sauvignon blanc FPS 22 was first included on the list of registered vines in the R&C Program in 2001–2002.

Sauvignon blanc FPS 23 (Howell Mountain, Napa)

Sauvignon blanc FPS 23 was donated to the FPS public collection in 1999 by Daniel Roberts at Kendall-Jackson Vineyards. The plant material originated from the Keyes vineyard section of the Howell Mountain property. The Kendall-Jackson Sauvignon blanc vines were planted in that vineyard around 1987 or 1988. Roberts said, "According to our winemakers, this Sauvignon was the best fruit in our program. But a large part of the quality was the soil (well drained fractured volcanic rock) and the climate (cool mountain vineyard). The earlier source is very vague....some people said Dry Creek and others said Russian River." *Nelson-Kluk, 2002.*

The cuttings that came from Kendall-Jackson were negative on all the tests for virus conducted at FPS, so no disease-elimination treatment was necessary. Sauvignon blanc FPS 23 was placed on the R&C Program registered list in 2001–2002.

Sauvignon blanc FPS 26 (Napa County)

Sauvignon blanc FPS 26 was selected in 1997 out of a well-respected Napa County vineyard that was probably planted around 1945. The wines made from it are reported to be distinctive, with intense varietal character. Due to the vineyard age, it is thought that the source of this selection may be other than Sauvignon blanc FPS 01. *Nelson-Kluk, 2002*. The original material initially tested positive for leafroll and corky bark virus. The selection underwent microshoot tip tissue culture disease elimination therapy at FPS in 2001. Sauvignon blanc FPS 26 was first registered in the R&C Program in 2001–2002.

Sauvignon blanc FPS 27 (the musqué clone)

Although the FPS Sauvignon musqué clone has been known by several names at UC Davis, the selection's identity was validated as Sauvignon blanc by DNA tests.

In the 1960's, Dr. William Hewitt, UC Davis Department of Plant Pathology, held the importation permit for bringing foreign grapes to Davis. In 1962, he imported cuttings from the Viticoles d'Arboriculture Fruitiere, a viticulture station at Pont-de-la-Maye in the Gironde region (Bordeaux) of France. One group of cuttings was labeled with the name Savagnin musqué (USDA Plant Identification number 279503). The selection was initially given the name Savagnin musqué FPS 01 (group 2955) and was planted in the foundation vineyard in 1967. The plant material did not undergo treatment at FPS and was first registered in 1974 under that original name.

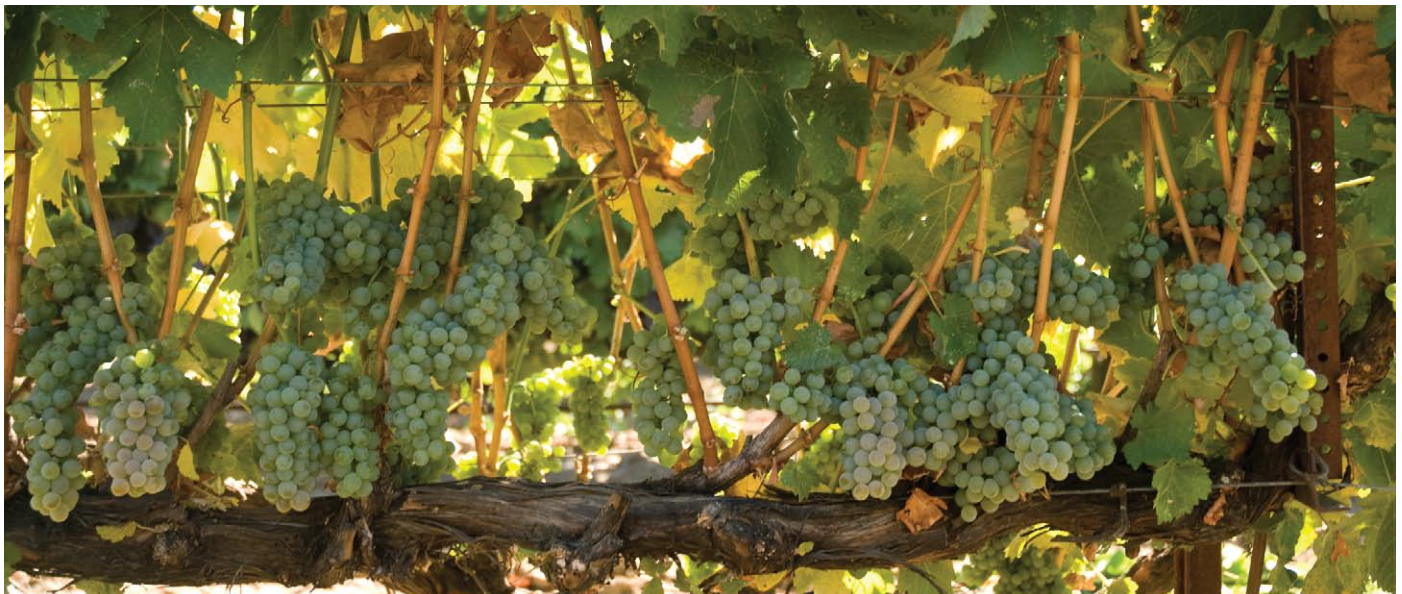
Savagnin musqué FPS 01 disappeared from the registered list and was removed from the foundation vineyard in 1978. Index testing in the late 1970's revealed a stem pitting problem, which at the time disqualified

plant material from the California Grapevine Registration & Certification Program. The plant material thereafter underwent heat treatment for 80 days and reindexing between 1983 and 1986, after which it was renamed Savagnin musqué FPS S1.

About this time, the correct identity of the selection came into question. Clarification of the identity of Savagnin musqué FPS 01/S1F goes back to a T-bud and varietal trial planted in Monterey County in the 1970's by Curtis Alley, UC Davis viticultural extension specialist, and Terrel West, formerly with Arroyo Seco Vineyards. The Savagnin musqué selection was among the varieties Alley took from the UCD collection to plant in the trial; that selection originated from the same source vine as FPS Savagnin musqué 01. *Olmo, Harold, source cards for Wine Grapes, in FPS files.*

Doug Meador, president of Ventana Vineyards, was interested in using a Sauvignon blanc clone other than the 'Wente clone (Sauvignon blanc FPS 01)', which he had observed growing in Monterey but was not satisfied with its performance at his site. He took an interest in the FPS/UCD Savagnin musqué clone in the Monterey varietal trial and made experimental wine from it in 1978, which he found more desirable and non-vegetal even in the cool climate of Monterey. *Meador, 1988.*

French ampelographer Pierre Galet visited California in 1982. Suspecting that the Savagnin musqué vines in the Monterey trial were really Sauvignon blanc, Meador showed Galet shoots and clusters from that selection without telling him anything about the material, and Galet identified it as Sauvignon blanc. He indicated at that time that there was no variety name Savagnin musqué in



Sauvignon blanc FPS 27 (the musqué clone) in the Foundation Vineyard at FPS, UC Davis.

Europe. *Nelson-Kluk, 2002*. In his later book about grape varieties, Galet noted that there was true Sauvignon blanc in California, but for some strange reason it was called Savagnin musqué. *Galet, 1998*.

Galet visited California again in 1985. This time, Meador again took shoots of Sauvignon blanc FPS 01 (Wente) and the FPS Savagnin musqué clone (sometimes referred to by growers as Sauvignon musqué) to show Galet, without providing any information on source or variety. Galet identified both as Sauvignon blanc. Coincidentally, the same day, Monterey County Farm Advisor Larry Bettiga brought samples of the same two selections to show Galet, who again identified both as Sauvignon blanc. *Nelson-Kluk, 2002; Bettiga, 2002*. Shortly thereafter, Bettiga wrote a letter to FPS urging a change of name from Savagnin musqué to Sauvignon blanc for the “FPS selection currently undergoing heat treatment.” *Bettiga, 1986*.

Savagnin musqué, the selection that underwent heat treatment and reindexing between 1983 and 1986, again tested positive for RSP virus in 1987 and underwent microshoot tip tissue culture disease elimination therapy. It was renamed Savagnin musqué FPS S1F (FPS group 5571) and then Sauvignon musqué FPS S1F in 1992.

In 1998–1999, Dr. Carole Meredith, UC Davis professor of Viticulture and Enology, performed a DNA analysis comparing the variety known at FPS as Savagnin/Sauvignon musqué with Sauvignon blanc. She found both vines shared the same DNA profile, and concluded Sauvignon musqué should be considered a form of the variety Sauvignon. *FPS Grape Program Newsletter, October 1999*.

Based on this scientific data, the name of this selection was changed in 2001 to Sauvignon blanc FPS 27. It was returned to the list of registered selections in 2002–2003.

Sauvignon blanc FPS 30 (Larry Hyde)

Sauvignon blanc FPS 30 is a California field selection of a musqué-type Sauvignon blanc. The selection was donated to the FPS public collection by Larry Hyde, a Carneros region grape grower well known for his collection of wine grape varieties and clones. He made the selection from Sauvignon musqué plant material from Arroyo Seco in Monterey County. It was labeled ‘Sauvignon musqué’ in the Hyde vineyard. The name was changed to Sauvignon blanc at FPS because DNA analysis showed that the Hyde Sauvignon musqué matched the profile for Sauvignon blanc.

Sauvignon blanc FPS 30 did not undergo treatment at FPS, although the selection has tested positive for RSP virus. The selection attained registered status in the R&C Program in 2007.

Other French clones at FPS

Jean-Michel Boursiquot described the clonal development programs in France in his talk at the Variety Focus: Sauvignon blanc.

Official French clones

The agency formerly known as The Etablissement National Technique pour l’Amélioration de la Viticulture (ENTAV) was an official agency certified by the French Ministry of Agriculture and was responsible for the management and coordination of the French national clonal selection program. ENTAV recently merged with ITV France; the new entity is called the Institut Français de la Vigne et du Vin (IFV). IFV continues with the responsibilities formerly administered by ENTAV, including maintenance of the French national repository of accredited clones and the ENTAV-INRA® Authorized clone trademark to protect the official French clones internationally. The trademark is a good indication that the clonal identity of a vine is correct. Trademarked importations come directly from official French source vines. IFV retains the exclusive rights to control the distribution and propagation of its trademarked materials which are only available to the public from nurseries licensed by IFV.

In the French system, clonal material is subjected to extensive testing and certification; there are now 20 Sauvignon (blanc) clones that are officially certified by the French Department of Agriculture and Fisheries. The most important of those clones are 108, 242, 297 and 316, which represent over 55% of the acreage planted in increase blocks. Clone 108 from the Bordeaux area is the most important clone in France; it produces aromatic and typical wines. Emphasis is now being devoted in the clonal development program to clones 905 and 906. Boursiquot describes clone 906 (also a Bordeaux clone) as having an earlier maturity, good tolerance to bunch rot, very aromatic producing full and balanced wines. The goal of the future development program is to maintain clones with the highest diversity and aromatic potential. *Boursiquot, 2010*.

FPS has four official French Sauvignon (blanc) clones in the foundation collection—clones 241, 376, 530 and 906. The selection numbers used to identify authorized French clones in the FPS collection equate to the same numbers used by the official trademarked clones. For example, the four official Sauvignon clones are labeled Sauvignon ENTAV-INRA® 241, 376, 530, and 906. Those clones are proprietary to IFV and are distributed in the United States through licensed nurseries.

Generic French clones

In addition to the official French certified clones, the FPS foundation collection includes apparent French clones that were received prior to the initiation of the ENTAV-INRA® trademark program. That material is public and considered by FPS to be ‘generic’ French clones. The source for generic French clones is indicated on the FPS database using the following language: “reported to be French clone xxxx.” This language is used to distinguish the generic clonal material from trademarked clones that are authorized by ENTAV (now IFV) and sent from the official French vineyards and from other sources. Generic clones are assigned an FPS selection number that is different from the reported French clone number. There is no guarantee of authenticity for generic French clones.

Many of the generic clones came to FPS in the 1980’s through a program referred to as the ‘Winegrowers’ Project.’ In the mid-1980s, the Oregon Winegrower Association and Oregon State University (OSU) collaborated on a project related to a mutual interest in European clonal material. David Adelsheim of Adelsheim Vineyard in Oregon and Ron Cameron at OSU worked together and successfully established relationships with viticulturalists in public programs in France. The OSU program (who at that time had a permit to import grapevine materials from abroad) was able to import many varieties and clones from French vineyards. Mr. Adelsheim appeared in California at a 1985 meeting of University and grape industry personnel and explained the OSU importation project. In response to interest from the California grape and wine industry, OSU agreed to make some of the clones available for the public collection at FPS in 1987–88.

Later, FPS was able to arrange for direct shipment of clones to FPS from France as part of this project, which was sponsored by Winegrowers of California. When Dr. Cameron retired from OSU, he made a special effort to ensure that FPS received all OSU imports that were not yet available at FPS.

In the winter of 1988-89, FPS received five Sauvignon blanc clones and one Sauvignon gris clone directly from M. Jean Cordeau, INRA, Chambre d’Agriculture de la Gironde, in Aquitaine, France. The Chambre d’Agriculture is a type of semi-governmental agency that exists in France in each geographical area. The Sauvignon blanc clones were labeled 108, 316, 317, 242, and 378. The Sauvignon gris clone was 253 (later renumbered 917 in France). The generic clones all tested positive for virus at FPS and underwent microshoot tip tissue culture disease elimination therapy at FPS. They became registered in the program in 2001–2002.

Generic clone 316 (**Sauvignon blanc FPS 14**) is a Bordeaux clone that tested positive for leafroll 2 in France, where it is one of the most popular clones due its quality—it is productive and makes high quality wines. Generic clone 317 (**Sauvignon blanc FPS 18**) possesses qualities similar to 316 except that its cluster weight may not be as good as 316. Generic clone 242 (**Sauvignon blanc FPS 20**) was evaluated in the Loire Valley and is a productive clone that makes balanced and typical wines in France when the yield is controlled. Generic clone 378 (**Sauvignon blanc FPS 21 and 25**) is highly productive with superior fertility but yields must be controlled to produce non-common wines. *Boursiquot, 2010; ITV (ENTAV)-INRA-Supagro-Viniflor. 2006.*

Sauvignon blanc FPS 31 was donated to the FPS public collection in 1999 by a Canadian nursery. It is reported to be French clone 297, which has loose bunches and produces typical wines in France. The selection underwent microshoot tip tissue culture therapy and first appeared on the list of registered varieties in 2003.

Italian Sauvignon blanc clones

Sauvignon blanc is most successful in Italy in the far north east (Friuli) with fine fruit also being grown in Alto Adige (Trentino) and Collio (Lombardy). *Robinson, 2006.* The FPS public collection has five Italian clones.

Four Italian clones were imported directly to FPS in the spring of 1988 as part of the Winegrowers’ Project. The four clones were sent by the Istituto Sperimentale per la Viticoltura (ISV) in Conegliano, Italy. The ISV clones are all reportedly susceptible to botrytis. *Calò, 2001.*

Three of the four clones contained the letters ‘CPF’ (Centro Potenziamento Friuli) within the clonal name, indicating that they were developed in the Friuli region. **Sauvignon blanc FPS 06** (formerly Sauvignon blanc FPS 03) is clone ISV-CPF-5. **Sauvignon blanc FPS 07** (formerly Sauvignon blanc FPS 04) is clone ISV-CPF-2. Both clones underwent microshoot tip tissue culture disease elimination therapy and first appeared on the list of registered vines in 1997 and 1998, respectively. **Sauvignon blanc FPS 24** is clone ISV-CPF-3, which underwent disease elimination therapy and appeared on the registered list in 2001–2002.

Another Italian clone imported in spring 1988 was ISV Conegliano 1, which became **Sauvignon blanc FPS 17**. The selection underwent microshoot tip tissue culture disease elimination therapy and became a registered selection in the 2001–2002 season.

Many of the finer Sauvignon blanc wines from the north-east region of Italy are made from the “extremely pungent

and recognizable R3 clone” of the Rauscedo vine nursery. *Robinson, 2006*. Sauvignon blanc clone R3 was imported for the FPS public collection in 1994 from the Rauscedo Nursery in Italy. The original material tested positive for virus and underwent microshoot tip tissue culture therapy. It became available as **Sauvignon blanc FPS 28** on the registered list in the 2003–2004 season.

FPS received cuttings from Rauscedo in 1994 for a second R3 selection, that ultimately became **Sauvignon blanc FPS 09**. FPS 09 was available for only a short time in the late 1990’s through 2002. The vines were planted at Davis in a vineyard near where virus was discovered in 2002. FPS 09 plant material tested negative for all viruses except that it was positive for RSP virus. The Sauvignon blanc 09 vines, along with the other vines in that vineyard, were all removed out of an abundance of caution. Sauvignon blanc FPS 09 is no longer available through FPS since it is not likely that it differs significantly from Sauvignon blanc FPS 28.

Sauvignon gris clones

Sauvignon gris is a berry-color mutation of the Sauvignon blanc variety. Although additional clones are currently undergoing testing and development, there is currently only one recommended official French clone of Sauvignon gris (917). *ITV-INRA-Supagro-Viniflor, 2006 ; Galet, 1998*. FPS has four Sauvignon gris selections, three of which originated in France.

Sauvignon gris FPS 01 was imported from Viña Macul in Santiago, Chile, in 1980. Lloyd Lider, then-Professor in the UC Davis Department of Viticulture & Enology, requested the variety for the Department’s permanent collection. FPS records suggest that he believed that the ‘pink selection from a Sauvignon blanc planting’ seemed to have a more intense Sauvignon aroma. The selection underwent heat treatment for 194 days. It first appeared on the list of registered vines in the California Grapevine R&C Program in 1987.

Sauvignon gris FPS 03 vine in the Foundation Vineyard at FPS. Foundation Plant Services vineyards are managed for the healthy production of budwood rather than for fruit qualities.

All photos in this article by Deborah Lamoreux, Winters, California.

Sauvignon gris FPS 03 and 04 are cuttings from separate vines of generic French clone 253, which FPS received in winter of 1988–89 from the Chambre d’Agriculture de la Gironde in Aquitaine, France, as part of the Winegrowers’ Project. Sauvignon gris clone Bx 253 was evaluated in the Gironde region of France and was certified in 1987. At a later date, ENTAV changed the number to Sauvignon gris clone 917. *ENTAV-INRA-ENSAM-ONIVINS, 1995*. Both selections underwent microshoot tip tissue culture disease elimination therapy at FPS, and appeared on the list of registered selections in 1998–99 and 2001–2002, respectively.

FPS has in its collection authorized French clone 917 in **Sauvignon gris ENTAV-INRA® 917**, which was imported in 2003. Clone 917 is reported to have superior sugar content when compared with Sauvignon blanc and produces very aromatic dry wines and pleasant sweet wines in France. *ENTAV-INRA-ENSAM-ONIVINS, 1995*. This proprietary selection is available through ENTAV (IFV) licensees such as Sunridge Nurseries.



Sauvignon gris FPS 03



UC SAUVIGNON BLANC CLONAL AND TRELLIS TRIAL

Glenn McGourty, Winegrowing and Plant Science Advisor for the University of California Cooperative Extension in Mendocino and Lake Counties, California, manages ongoing clonal and trellis evaluations of 12 FPS Sauvignon blanc clones at Fetzer Valley Oaks Ranch in Hopland, Mendocino County, California. He provided an update on the trials at *Variety Focus: Sauvignon blanc* entitled 'Improving Yield and Quality of Sauvignon blanc,' and brought experimental wines made from the clones by Nick Dokoozlian of Gallo Winery.

Clonal Trial

McGourty first described the clonal trial that includes FPS Sauvignon blanc selections 01 (Wente/Château d'Yquem), 06 and 07 (Friuli region, Italy), 14 (generic French clone 316), 17 (Italy), 18 and 20 (generic French clones 317 and 242), 22 (Oakville heritage clone), 23 (Kendall-Jackson Howell Mountain), 25 (generic French clone 378), 26 (Napa County heritage clone), and 27 (Sauvignon musqué clone). Clusters from all twelve entries were displayed side by side and included large clusters (e.g., FPS 01, 06, 20, 23) and smaller more open clusters that are more suitable for growing in cooler areas where crop ripening may be an issue (e.g., FPS 14).

The vines were planted at Fetzer Valley Oaks Ranch in Hopland in Spring 2004, as green growers on 101-14 rootstock using a VSP trellis system. The randomized complete block design included 5 vines per replicate and 8 replicates per entry. The vines are cane-pruned and drip irrigated. The soil is Russian River loam; deep, fertile and abundant in available water during the growing season.

McGourty displayed data for three years of the trial (2007, 2008, 2009). 2008 was a very challenging year because there were 29 freezing nights plus forest fires that caused smoked taint in many vineyards in the region. The yield results for the trial, both for the total crop and yields per selection, meter of cordon and vines per acre, reflected the difficult growing season with much lower yields in 2008 than 2007 and 2009. The conclusion from the data is that the various clones show diversity in yields across the 12 entries, with the consistently highest yielders being FPS 01 and 25 and medium yielders being FPS 06, 17, 18, 20, and 26. FPS 07 and 14 tended toward the lower-yielding end of the data.

The average number of clusters per vine was 'fairly similar' but with some statistical differences. The clones with higher cluster count (e.g., FPS 01, 17, 18, 22, 25, 26) experienced good fruit set. FPS 07 and 14 were consistently smaller in cluster weight than the others. The clones with the highest Brix at harvest (target 21.5 to 23°) usu-

ally had the smallest clusters. The trial is in Winkler heat summation zone 3 (3100 degree hours). The yield to pruning weight data (all under 4) indicate that the vines in the trial are being undercropped.

The berry weight data was surprisingly similar across the clones, as was the fruit pH data. In region 3, the growers expect to pick Sauvignon blanc at a fairly low acid level e.g., pH 3.2.-3.3. The pH levels at harvest in the trial were in excess of 3.6 across the clones for years 2007 and 2008 and were generally 3.4 or less for 2009. 2009 was a more representative year for the growers in the area.

McGourty summarized the clonal trial by stating that there is a diversity of clones at FPS from which to choose to suit an individual grower's climate and growing conditions. There is a wide range of character to the 12 clones. FPS 01 (Wente) and FPS 20 (generic French clone 242) are good clones based on yield. *McGourty, 2010*. The trial is scheduled to continue until 2012.

Trellis Trial

The second part of the Fetzer trial involves trellising. The objectives of the trellising were to maximize yield, achieve uniform ripening, yield high quality fruit and facilitate mechanized harvesting. McGourty concluded that these goals pointed toward VSP architecture.

Five trellising methods are included in the trial: (1) VSP, spur pruned; (2) VSP, 4 canes stacked (the method used in New Zealand); (3) VSP, spur pruned, floppy – a parasol effect to shade the fruit in summer to avoid burning; (4) VSP, hybrid cane system; and (5) VSP, 4 canes parallel.

He observed that with the spur pruned vines (#1 and #3), the vine is loaded with fruit toward the center of the plant, and the clusters congregate 'fruit on fruit'. Trellis system #2 (4 canes stacked) is a little more open but the clusters are still concentrated in the same area somewhat. Trellis #4 (hybrid cane system) results in a continuous line of fruit in a single line under the canopy, which facilitates hand and mechanical harvesting. The fruit is well spaced, and doesn't end up stacked on top of itself as much as is the case with spur pruning systems.

The 4 Parallel Canes trellis (Trellis #5) displays the fruit at the same level but separates them into two parallel rows, allowing space between the rows of fruit, which facilitates ripening and improves yields. Trellis system #5 scored highest on cluster count per vine, overall yield and yield to pruning weight ratio, indicating that the vines put on more fruit than with the other systems. The fruit in system #5 had bigger clusters with larger berries. However, the Trellis #5 Brix was in the lower range because of the high crop load. *McGourty, 2010*.

McGourty explains, “It is clear that yield potential is an important factor when choosing a trellising system for Sauvignon blanc. Trellis systems that allow more buds to be retained following pruning will yield more, but it will also take longer for fruit to ripen. In areas where the growing season is shorter, it may be better to choose a trellis system that will have fewer buds following pruning and promote quicker ripening.” The trellis trial will also continue to 2012.

ACKNOWLEDGMENTS

All photos in this article were taken by Deborah Lamoreux, a professional photographer based in Winters, California. The clusters and vines were photographed in the FPS Foundation Vineyard. See the story on page 9 for a description of her work for the National Grape Registry.

I would also like to express my appreciation to the following people who contributed information and advice for this article: Jean-Michel Boursiquot, IFV and SupAgro (Montpellier, France); Phil Freese, consultant with WineGrow and owner of Vilafonté; Glenn McGourty, Winegrowing and Plant Science Advisor for the University of California’s Cooperative Extension in Mendocino and Lake Counties; Susan Nelson-Kluk, former FPS Grape Program Manager and author of ‘Sauvignon blanc selections at FPMS,’ *FPMS Grape Program Newsletter*, October 2002; librarians Axel Borg (Viticulture and Enology Section) and John Skarstad (Special Collections) of Shields Library at UC Davis; Bob Steinhauer, Napa County winegrowing consultant; and Richard Arnold and Susan French for the information about Robert Mondavi Winery’s Fumé blanc wines.

REFERENCES

- Amerine, M.A. and A. J. Winkler. 1944. Composition and Quality of Musts Wines of California Grapes, *Hilgardia* vol 15(6): 504-550.
- Asher, Gerald. 1996. *Vineyard Tales, ‘California Sauvignon blanc: A Cinderella Story’*, Chronicle Books, 275 Fifth Street, San Francisco, California 94103.
- Benson, Jeffrey and Alastair Mackenzie. 1979. *Sauternes, A study of the great sweet wines of Bordeaux*, Sotheby Parke Bernet Publications, Russell Chambers, Covent Garden, London WC2, England.
- Bettiga, Larry. 2002. Letter from Bettiga, Viticultural Farm Advisor, to Susan Nelson-Kluk, Grape Program Manager, Foundation Plant Services, dated August 30, 2002.
- Bettiga, Larry. 1986. Letter from Bettiga, Viticultural Farm Advisor, Monterey County, to Susan Nelson-Kluk, Grape Program Manager, Foundation Plant Services, dated January 29, 1986.
- Bioletti, Frederic T. 1929, rev. 1934. *Elements of Grape Growing in California*, California Agricultural Extension Service, Circular 30, March 1929, rev. April 1934.
- Bioletti, Frederic T. 1907. *The Best Wine Grapes for California*, California Agricultural Experiment Station bulletin no. 193, University of California Publications, Berkeley, California, November, 1907.
- Bledsoe, A.M., W.M. Kliewer, and J.J. Marois. 1988. Effects of Timing and Severity of Leaf Removal on Yield and Fruit Composition of Sauvignon blanc Grapevines, *Am.J.Enol. Vitic.* 39(1): 49.
- Bolter, William. 1988. *The White Wines of Bordeaux*, Octopus Books Limited, Michelin House, 81 Fulham Road, London SW3, England.
- Boursiquot, Jean-Michel. 2010. ‘About Sauvignon and its Clonal Development Programs in France’, presentation at *Variety Focus: Sauvignon blanc*, May 6, 2010, in Davis, California – the entire presentation is accessible on videotape at UC Integrated Viticulture Online, <http://iv.ucdavis.edu>, in the section entitled Videotaped Seminars and Events.
- Bowers, J.E. and C.P. Meredith. 1997. The parentage of a classic wine grape, Cabernet Sauvignon, *Nature Genetics* 16: 84.
- Bowers, John E. and Carole P. Meredith. 1996. Genetic Similarities among Wine Grape Cultivars Revealed by Restriction Fragment Length Polymorphism (RFLP) Analysis. *J. Amer. Soc. Hort. Sci.* 1219(4): 620-624.
- Calò, Antonio. 2001. *Vitigni d’Italia*, Edagricole-Edizioni Agricole della Calderini s.r.l., Via Emilia Levante, Bologna, Italia. (in Italian)
- Dubourdieu, Denis, Takatoshi Tominaga, Isabelle Masneuf, Catherine Peyrot des Gachons, and Marie Laure Murat. 2006. The Role of Yeasts in Grape Flavor Development during Fermentation: The Example of Sauvignon blanc, *Am.J.Enol.Vitic.* 57: 1.

- ENTAV-INRA-ENSAM-ONIVINS. 1995. *Catalogue of Selected Wine Grape Varieties and Certified Clones Cultivated in France*, Comité Technique Permanent de la Sélection (CTPS), Ministry of Agriculture, Fisheries and Food.
- French, Susan. 1983. Unpublished paper authored by Susan French of Robert Mondavi Winery, dated January 4, 1983.
- Freese, Phil. 2010. Global Perspectives on Sauvignon blanc, South Africa, presentation at *Variety Focus: Sauvignon blanc*, May 6, 2010, in Davis, California – the entire presentation is accessible on videotape at UC Integrated Viticulture Online, <http://iv.ucdavis.edu>, in the section entitled Videotaped Seminars and Events.
- Galet, Pierre. 1998. *Grape Varieties and Rootstock Varieties*. OENOPLURIMÉDIA sarl, Château de Chaintré, 71570 CHAINTRÉ, France.
- Goheen, A.C. 1982. Letter to D.Y. Rosenberg, California Department of Food and Agriculture, dated March 10, 1982.
- Goheen, A.C. 1982^a. Letter to Susan French, Robert Mondavi Winery, dated December 9, 1982.
- Goldschmidt, Nick. 2010. Global Perspectives on Sauvignon blanc—Chile, Australia, New Zealand and California, presentation at *Variety Focus: Sauvignon blanc*, May 6, 2010, in Davis, California – the entire presentation is accessible on videotape at UC Integrated Viticulture Online, <http://iv.ucdavis.edu>, in the section entitled Videotaped Seminars and Events.
- Hilgard, Eugene W. 1890. The Central Experiment Station, Report on the Agricultural Experiment Stations of the University of California for the Years 1888-1889.
- Hubscher, P.V. 1988. Experiences with Sauvignon blanc in Marlborough, Proceedings of the 2nd International Cool Climate Viticultural & Oenological Symposium, Auckland, New Zealand, January 1988.
- ITV (ENTAV)-INRA-Supagro-Viniflor. 2006. *Catalogue officiel des variétés de vigne cultivées en France, 2ème édition*, Ministère de l'Agriculture et de la Pêche, CTPS (in French).
- Marais, J., J.J. Hunter, and P.D. Haasbroek. 1999. Effect of Canopy Microclimate, Season and Region on Sauvignon blanc Grape Composition and Wine Quality, *S.Afr.J.Enol.Vitic.* 20(1): 19.
- Marais, J. 1998. Effect of Grape Temperature, Oxidation and Skin Contact on Sauvignon blanc Juice and Wine Composition and Wine Quality, *S.Afr.J.Enol.Vitic.* 19(1): 10.
- Marais, J. 1994. Sauvignon blanc Cultivar Aroma – A Review, *S. Afr.J.Enol.Vitic.* 15(2): 41.
- McGourty, Glenn. 2010. 'Improving Yield and Quality of Sauvignon blanc', presentation at *Variety Focus: Sauvignon blanc*, May 6, 2010, in Davis, California – the entire presentation is accessible on videotape at UC Integrated Viticulture Online, <http://iv.ucdavis.edu>, in the section entitled Videotaped Seminars and Events.
- Meador, Doug. 1988. Sauvignon blanc: 'a marvelous creation', *Wines & Vines*, April, 1988.
- Nelson-Kluk, Susan. 2002. Sauvignon blanc Selections at FPMS, FPMS Grape Program Newsletter, October 2002.
- Olney, Richard. 1986. YQUEM, Dorling Kindersley Publishers Limited, 9 Henrietta Street, London WC2E, England.
- Parr, Wendy V., J.A. Green, K. Geoffrey White, Robert R. Sherlock. 2007. The distinctive flavor of New Zealand Sauvignon blanc: Sensory characterization by wine professionals, *Science Direct, Food Quality and Preference* 18: 849-861.
- Perry, Peter John and Brendon Paul Norrie. 1991. The Origins & Development of a New World Vignoble: Marlborough, New Zealand, 1970-90, *Journal of Wine Research* 2(2): 97-114.
- Robinson, Jancis. 2006. *The Oxford Companion to Wine*, 3rd ed. Oxford University Press, Great Clarendon Street, Oxford, England.
- Seely, James. 1989. *The Loire Valley and its Wines*, Leonard Publishing, Oxford, England.
- Smith, Rhonda. 2003. *Wine Grape Varieties in California*, eds. L. Peter Christensen, Nick K. Dokoozlian, M. Andrew Walker, and James A. Wolpert, University of California Agriculture and Natural Resources, Publication 3419.
- Steinhauer, Bob. 2010. 'Looking Backwards at Trends in Vineyard Management of Sauvignon blanc', presentation at *Variety Focus: Sauvignon blanc*, May 6, 2010, in Davis, California – the entire presentation is accessible on videotape at UC Integrated Viticulture Online, <http://iv.ucdavis.edu>, in the section entitled Videotaped Seminars and Events.
- Stoll, H.F. 1935. How the Choice Sauterne Grapes Were Introduced into California, *Wines and Vines*, October 1935.
- Sullivan, Charles L. 1998. *A Companion to California Wine*, University of California Press, Berkeley and Los Angeles, California.
- Sullivan, Charles L. 1994, 2008. *Napa Wine, A History from Mission Days to the Present*, 2nd ed., The Wine Appreciation Guild, 360 Swift Avenue, South San Francisco, California.
- Trought, Mike. 2010. 'Soils, sunshine and serendipity: the success of New Zealand Sauvignon blanc', presentation at *Variety Focus: Sauvignon blanc*, May 6, 2010, in Davis, California – the entire presentation is accessible on videotape at UC Integrated Viticulture Online, <http://iv.ucdavis.edu>, in the section entitled Videotaped Seminars and Events.
- United States Department of Agriculture and California Department of Agriculture. 1945. Preliminary Estimates of California Grape Plantings in 1945, California Crop and Livestock Reporting Service, Bureau of Agricultural Economics and Statistics, December 17, 1945 (referred to herein as California Crop and Livestock Report for 1945).
- Wente, Ernest A. 1971. Wine Making in the Livermore Valley, California Wine Industry Oral History Project, Regional Oral History Office, Regents of the University of California, Berkeley, California.
- Wetmore, Charles A. 1884. *Ampelography of California*. Reproduced and Revised from the San Francisco Merchant of January 4 and 11, 1884. 

Sauvignon Selections at Foundation Plant Services

Name	FPS Selection #	FPS Status	Treatment	Source
Sauvignon blanc FPS 01	0000-0-2055-01	R	Heat treatment 82 days	Originally from Château d'Yquem in Sauternes, Gironde region, France in 1884 via Wente Vineyards in Livermore, CA; to FPS in 1958
Sauvignon blanc FPS 06	1988-0-5212-06	R	Microshoot tip tissue culture	Sauvignon FPS 03; originally ISV-CPF-5 from the Istituto Sperimentale per la Viticoltura, Conegliano, Italy, in 1988
Sauvignon blanc FPS 07	1988-0-5213-07	R	Microshoot tip tissue culture	Sauvignon FPS 04; originally ISV-CPF-2 from the Istituto Sperimentale per la Viticoltura, Conegliano, Italy, in 1988
Sauvignon blanc FPS 14	1989-0-6611-14	R	Microshoot tip tissue culture	Reported to be French clone 316, from the Chambre d'Agriculture de la Gironde, France, in 1989
Sauvignon blanc FPS 17	1988-0-6882-17	R	Microshoot tip tissue culture	ISV Conegliano 1, from the Istituto Sperimentale per la Viticoltura, Conegliano, Italy, in 1988
Sauvignon blanc FPS 18	1989-0-6883-18	R	Microshoot tip tissue culture	Reported to be French clone 317, from the Chambre d'Agriculture de la Gironde, France, in 1989
Sauvignon blanc FPS 20	1989-0-6961-20	R	Microshoot tip tissue culture	Reported to be French clone 242, from the Chambre d'Agriculture de la Gironde, France, in 1989
Sauvignon blanc FPS 21	1989-0-6962-21	R	Microshoot tip tissue culture	Reported to be French clone 378, from the Chambre d'Agriculture de la Gironde, France, in 1989
Sauvignon blanc FPS 22	0000-0-6963-22	R	Microshoot tip tissue culture	From very old head trained, gnarled and neglected vine in the SE corner of UC Davis Oakville field station in 1990; recommended by Phil Freese
Sauvignon blanc FPS 23	1999-11-6537-23	R	None	Kendall-Jackson's Howell Mountain vineyard, Napa, in 1999
Sauvignon blanc FPS 24	1988-0-7090-24	R	Microshoot tip tissue culture	ISV-CPF-3, from the Istituto Sperimentale per la Viticoltura, Conegliano, Italy, in 1988
Sauvignon blanc FPS 25	1989-0-7146-25	R	Microshoot tip tissue culture	Sauvignon blanc FPS 04; reported to be French clone 378 from the Chambre d'Agriculture de la Gironde, France, in 1989
Sauvignon blanc FPS 26	1997-0-7148-26	R	Microshoot tip tissue culture	Napa County heritage clone introduced to FPS in 1997

Key: Proprietary selections are indicated in boldface type

FPS Status: R=on the registered list for the California Grapevine R&C Program

Name	FPS Selection #	FPS Status	Treatment	Source
Sauvignon blanc FPS 27	0000-0-7323-27	R	Microshoot tip tissue culture; heat treatment 80 days	'The musqué clone'; from the viticulture station at Pont-de-la-Maye, Gironde region, France, in 1962; originally known at FPS as Savagnin musqué; DNA identification as Sauvignon blanc in 1999
Sauvignon blanc FPS 28	1994-0-7361-28	R	Microshoot tip tissue culture	Clone R3, from Rauscedo in Italy in 1994
Sauvignon blanc FPS 29	0000-0-7433-29	R	Microshoot tip tissue culture	Former UC Foothill Experiment Station in Jackson, CA, in 1965; originally planted at station in 1890; known at one time at FPS as Sauvignon blanc FPS 03
Sauvignon blanc FPS 30	2002-04-7252-30	R	None	Collected by Larry Hyde (Hyde Vineyards, Napa) from a vineyard in Arroyo Seco in Monterey County, CA; clone was labelled 'Sauvignon musqué' in Hyde vineyard; DNA identification at FPS in 2003 showed it to be Sauvignon blanc
Sauvignon blanc FPS 31	1999-13-8105-31	R	Microshoot tip tissue culture	Reported to be French clone 297; donated to FPS by a Canadian nursery in 1999
Sauvignon blanc, FPS group 8246	2007-01-8246-	Pipeline	Tissue culture plants in testing	Jorge Boehm, Viveiros Plansel S.A., in 2007
Sauvignon blanc ENTAV-INRA® 241	2000-07-7620-241	R	None	Authorized French clone Sauvignon b. 241 from ENTAV
Sauvignon blanc ENTAV-INRA® 376	1997-0-6573-376	R	None	Authorized French clone Sauvignon b. 376 from ENTAV
Sauvignon blanc ENTAV-INRA® 530	1999-12-7619-530	R	None	Authorized French clone Sauvignon b. 530 from ENTAV
Sauvignon blanc ENTAV-INRA® 906	2005-10-8454-906	R	None	Authorized French clone Sauvignon b. 906 from ENTAV
Sauvignon gris FPS 01	0000-0-2022-01	R	Heat treatment 194 days	Viña Macul, Santiago, Chile, in 1980
Sauvignon gris FPS 03	1989-0-5075-03	R	Microshoot tip tissue culture	Reported to be French clone 917, from the Chambre d'Agriculture de la Gironde, France, in 1989
Sauvignon gris FPS 04	1989-0-7149-04	R	Microshoot tip tissue culture	Reported to be French clone 917, from the Chambre d'Agriculture de la Gironde, France, in 1989
Sauvignon gris ENTAV-INRA® 917	2003-10-8442-917	R	None	Authorized French clone Sauvignon gris 917 from ENTAV