Foundation Plant Services

FPS GRAPE PROGRAM NEWSLETTER

November 2007 http://fps.ucdavis.edu UCDAVIS

FPS Offers New Grape Selections for 2007–2008

A list of all registered grape selections offered by FPS in the 2007-2008 dormant season is available from the FPS office or online at *http://ucanr.org/fpsreggrapes*. Order forms and a price list for grape materials are also available on the FPS web site *http://fps.ucdavis.edu*. Dormant cuttings in short supply will be allocated among the orders that are confirmed by November 30, 2007.

New public selections on the registered list for 2007-08 include Alvarinho FPS 01 and Arinto FPS 01 from Portugal; Coda di Volpe FPS 01 and Sangiovese FPS 24 from Italy; Pinot gris FPS 12 from Germany; and Riesling FPS 20 from Alsace, France. There are also many new privately-controlled selections including 20 ENTAV-INRA trademarked clones and Montepulciano VCR 461 (FPS 04) from the Vivai Cooperativi Rauscedo (VCR) Nursery in Italy.

Selections planted into the FPS Foundation block in 2007 have passed all of the disease tests required for Foundation stock status in the California Registration and Certification (R&C) Program for Grapevines. However, recently planted vines are not mature enough to be professionally identified, so they are assigned Provisional Foundation stock status. Selections with Provisional status are shown on the "New Materials Available from FPS in the 2007-08 Season" list. This list is available from the FPS office and on the Web at *http://ucanr.org/fpsnewgrapes*.

Customers may order Provisional status mist-propagated plants from the new materials list. If mother vines are professionally identified in the future, they will be advanced to Foundation status and retroactive Foundation stock tags will be issued to FPS customers upon request.

Short histories for many of the new Provisional and Registered selections available from FPS in 2007 are given below. All the selections below have Provisional Foundation stock status except those identified as Registered.

Aglianico FPS 04 was derived from Aglianico de Taburno sent to FPS for the public collection by Carol Mastroberardino in 2000 from the Mastroberardino Winery in Atripalda, Italy. The original material tested positive for leafroll, fleck and Kober stem grooving. Tissue culture

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Susan Nelson-Kluk, FPS Grape Program Manager, looks over some of the imported grape selections currently in quarantine. Extensive testing in the field and laboratory is required prior to public release through the California Registration and Certification Program for Grapevines.

Photo by Bev Ferguson

Inside:

Comments from the Director

Deborah Golino
Director, Foundation Plant Services
Cooperative Extension Plant Pathology Specialist

Since the 1950s, Foundation Plant Services has worked to develop a superior collection of grape varieties and selections (often referred to as clones).

New selections of the major wine grape varieties are added to the FPS Foundation Vineyard frequently. With increasingly diverse plant materials available, growers planting new vineyards have choices of selection as well as variety. Most of the older FPS selections were collected by UC Davis scientists over the years both from superior California vineyards and by plant exploration in other countries. Newer clones have come to California by way of formal clonal evaluation programs around the world.

In this issue of the FPS Grape Newsletter, Nancy Sweet has written two articles in which she has done an extraordinary job of documenting the history of FPS Chardonnay and Zinfandel selections. She gathered information on Chardonnay and Zinfandel from diverse sources including UCD, USDA and FPS files, scientific journals, trade publications, secondary-source literature on the history of grapes and wine in particular areas, and interviews with industry leaders, vineyard owners and winemakers. They include both scientific data from formal research trials as well as observational comments by individuals who have worked closely with these clones.

Nancy joined the FPS staff in June of 2006 with the assignment of leading the work on the National Grape Registry website (*http://ngr.ucdavis.edu*). An article with further details about this website is on page 5. Phase I has been well received by researchers and industry. In Phase II, specific information about individual selections of varieties is needed. The process of compiling this information is formidable. Although some basic information is available about selections that come to FPS is routinely available, for most clones both history and performance information is scarce, and what information is available is not readily accessible.

Readers should keep in mind that clonal performance can vary widely under different vineyard practices, climatic regions, elevations and soil types. There is a tremendous need for further formal evaluation of these clones side-by-side under the diverse viticultural practices to which they may be used.

All the best,
Deborah

Upcoming Events

Syrah Vine Health Symposium will be held November 6, 2007, from 9:00 am–4:00 pm at ARC Ballroom A, UC Davis. Online registration is required at *http://groups.ucanr.org/Syrah*

Current Issues in Vineyard Health, UC Davis Extension class. November 14, 2007, 9:00 am–4:00 pm at the DaVinci building in Davis. Registration and information is provided at *www.extension.ucdavis.edu*

FPS Annual Meeting: November 29, 2007 at the Buehler Alumni and Visitors Center, UC Davis. For reservations or information, contact the FPS office by phone: (530) 752-3590 or email: *fps@ucdavis.edu*

2008 Unified Wine and Grape Symposium to be held January 29–31 at the Sacramento Convention Center, 1400 J Street, Sacramento, California. For more information, go to *http://www.unifiedsymposium.org*

59th Annual Meeting of the American Society for Enology and Viticulture will be held June 17–20, 2008 in Portland, Oregon. Details are available at *http://www.asev.org*

2nd Annual National Viticulture Research Conference will be held July 9–11, 2008 at UC Davis. Further details and online registration are posted at *http://ucanr.org/nvrc*

Foundation Plant Services

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http://fps.ucdavis.edu

Virus Status Update on FPS Source Vines and Selections

by Cheryl Covert, Plant Introduction and Distribution Manager, Foundation Plant Services, UC Davis

FPS IS ALWAYS WORKING TO MAINTAIN the highest disease testing standards for its Foundation vineyard source vines, with all candidate vines undergoing an exhaustive testing regimen prior to inclusion in the vineyard, as well as regular visual inspections and periodic retesting to detect any changes in disease status. From time to time, as evidence of the effectiveness of our retesting activities, vines are identified that test positive for disease. Upon discovery and careful confirmation of a registered vine that is infected with a disease targeted by the CDFA Registration & Certification Program for Grapevines (R&C Program), FPS notifies all recipients of propagating material from the infected vine(s) and makes any appropriate recommendations to customers based on the particular situation. At the same time, FPS notifies CDFA R&C Program officials of the finding, and CDFA normally follows up with its own notice and instructions to R&C Program participants. Vines that are confirmed to be infected with R&C Program-targeted disease are removed from the Foundation vineyard.

Following is an update on virus disease findings and confirmations in the Foundation vineyard over the past year. Questions regarding the disease status of any of the materials described below may be directed to FPS plant pathologists Dr. Deborah Golino (dagolino@ucdavis.edu; 530-754-8101) or Dr. Adib Rowhani (akrowhani@ucdavis.edu; 530-752-5401).

Syrah FPS 09 source vine NYL E16 V5 tests positive for Kober stem grooving

On May 4, 2007 FPS sent a notice to customers who have received Syrah FPS 09 propagating material from FPS source vine NYL E16 V5 informing them that this vine has been confirmed by Kober 5BB field index to be infected with Kober stem grooving. The notice indicated that the virus status of the sibling vine at NYL E16 V6 was being tested to determine whether it is also positive for Kober stem grooving.

FPS recently began using the Kober 5BB index to screen some of the new materials being planted into the Foundation vineyard in an effort to upgrade the quality of California-certified planting stock. Kober stem grooving is caused by Grapevine virus A (GVA), and symptoms include grooving on the stem of Kober 5BB. GVA is transmitted by grafting, mealybugs and scale insects. To date, only a small number of the selections in the Foundation vineyard have been tested using this field indicator.

Since Kober stem grooving is not a disease currently targeted by the California Registration & Certification Program for Grapevines, the registration status of the FPS source vines will remain unchanged. Though the only registered vine of Syrah FPS 09 (NYL E16 V5) was removed from the vineyard in March 2007, the status of plants propagated from this vine will not change for now. The sibling to this vine (NYL E16 V6) has been placed on "hold" pending the results of reindexing on Kober 5BB, and remains in the Foundation vineyard. Tissue culture will be used to eliminate the virus and create a new selection that tests negative for Kober stem grooving. When the new selection becomes available, Syrah FPS 09 will be phased out gradually and replaced by the new selection.

Customers may continue to purchase material from the remaining provisionally-registered (P) Syrah FPS 09 source vine only if they are willing to assume any potential risk associated with its use. Customers who have purchased Syrah FPS 09 materials from FPS are encouraged to share information about the Kober stem grooving infection with their customers who may be affected.

Tannat FPS 01 source vine BKN A19 V4 tests positive for Leafroll

On May 4, 2007 FPS sent a notice to customers who have received Tannat FPS 01 propagating material from Foundation vineyard source vine BKN A19 V4, informing them that this vine has been confirmed by reindexing on Cabernet franc to be infected with leafroll virus. All recipients had been previously notified in December 2004 that the health status of this source vine was suspect because its sibling vine at BKS A19 V3 had been confirmed positive for leafroll in 2004.

We do not know when the Tannat FPS 01 sources at BKN A19 V3 & 4 became infected. Predecessor Tannat FPS 01 parent vines in older FPS plantings were removed before they could be tested. Leafroll was detected in these vines as part of a long-term project funded by the California Fruit Tree, Nut Tree and Grapevine Improvement Advisory Board (IAB) to annually reindex 20 foundation source vines on the full panel of field indicators, and it had been 18 years since this selection was tested on Cabernet franc. None of the ELISA or PCR tests conducted on the two BKN source vines over the last 10 years produced any positive results, but we know that the Cabernet franc index detects leafroll more efficiently than ELISA or PCR, and is therefore the definitive test for leafroll for the R&C Program.

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Virus Status Update … *Continued from page 3*

Upon FPS' recommendation, and in accordance with CDFA R&C Program regulations, on August 6, 2007 CDFA sent a notice to all R&C Program participants canceling registration for the Tannat FPS 01 Foundation mother vines at BKN A19 V3 & 4 and for all propagations from them that are planted in registered increase blocks and certified nursery rows. Participants were directed to remove all Tannat FPS 01 vines sourced from BKN A19 V3 & 4 that are planted in registered increase blocks or certified nursery rows. Participants were also informed that any budwood and grafted plants produced from the leafroll-positive source vines would no longer be eligible to be identified as California Registered or Certified stock. Finally, because of the unknown virus status of FPS' predecessor Tannat FPS 01 source vines at FV H9 V3 & 4 and TYR MO15 V11 & 12, participants must also test any vines propagated from these older FPS source locations for leafroll, and must remove any vines that test positive.

There are currently no alternate publicly-available sources of Tannat FPS 01 in the FPS collection. Our tissue culture staff is in the process of attempting to eliminate the virus from this selection using micro-shoot tip culture, however the earliest we might have leafroll-negative material available would be in 2011. Those looking for certified Tannat material in the interim can contact Sunridge Nurseries, the R&C Program nursery participant authorized to sell the ENTAV-INRA® trademarked clones of Tannat. Questions regarding CDFA's instructions to R&C Program participants can be directed to CDFA R&C Program Supervisor Susan McCarthy by phone at 916-654-0435 Ext. 3613 or by email at *smccarthy@cdfa.ca.gov*.

Malegue 44-53 FPS 01 source vine BKS M9 V3 tests positive for Arabis mosaic virus

In September 2007 FPS sent a notice to customers who have received Malegue 44-53 FPS 01 propagating material from FPS source vine BKS M9 V3 informing them that this vine has been confirmed by ELISA and PCR testing to be infected with Arabis mosaic virus (ArMV).

Because ArMV is a quarantine pest and is excluded from the CDFA Registration & Certification (R&C) Program for Grapevines, CDFA has been notified and the ArMV-positive source vine has been removed from the Foundation vineyard. FPS is carefully monitoring the vineyard block in which ArMV has been found, and additional testing has been implemented to ensure that any possible spread of this disease is immediately detected and contained. Alternate Malegue 44-53 FPS 01 source vines remain in the FPS Foundation vineyard that have tested negative for ArMV.

FPS has recommended that CDFA cancel registration from the Malegue 44-53 FPS 01 source vine at BKS M9 V3 and from all propagations from this vine in R&C Program increase blocks and nursery rows. In addition, FPS recommends removing any registered increase block mother vines that were propagated from the Malegue 44-53 FPS 01 at BKS M9 V3. Finally, we recommend discarding budwood and grafted plants propagated from this original FPS source vine.

Pinot noir FPS 29 Confirmed Leafroll Positive... Registered, Leafroll-negative Replacement Now Available as Pinot noir FPS 106

In the *2003 FPS Grape Program Newsletter* it was noted that the leafroll status of the FPS Pinot noir FPS 29 source vines was in question. FPS has since been able to confirm the presence of leafroll virus in Pinot noir FPS 29 source vines that were located at NYL D13 V3 & 4. Fortunately, there were no distributions of material to customers from these two source vines, and they were both removed from the Foundation vineyard in March of 2006.

To review the history of this issue, the 2003 newsletter article noted that in the 1960s the Pinot noir FPS 29 originating from the Jackson vineyard (first under the name "Pinot Saint George" and later under the names "Pinot Franc" and finally "Pinot noir 29") passed the index tests required to qualify for the CDFA R&C Program without any disease elimination treatments. It was planted in the FPS collection in 1967 (FV H11 V11 & V12), though it was not registered at that time due to uncertainty about its varietal identity. Oregon State University researchers subsequently included this selection in its Pinot noir clonal trials, where it was consistently rated in the highest wine quality groups. Due to the interest generated by the OSU trials, a number of wineries ordered this selection from FPS between 1988 and 1999, even though both FPS source vines were nonregistered.

Because of continuing interest in this selection, which had not been tested on field indicators since the 1960s, as funds became available in the late 1990s to reindex important FPS grape selections on the full panel of field indicators, Pinot noir FPS 29 was included in the 1999-2000 grape field index. Because the FV block in which the Pinot noir FPS 29 vines were planted was slated for removal in 1999, propagations were made to hold in the greenhouse for possible planting in the new NYL vineyard. Both FV block vines were removed in October 1999, and the field index results, completed in the fall of 2000, were all negative. Herbaceous indexing and ELISA panels completed in 1999 and 2000 on the FV block vines all came out negative as well, so in 2001 the propagations were planted in the new NYL block at NYL D13 V3 & 4.

Subsequently, full ELISA testing panels completed in 2002 and 2003 on the new NYL source vines came out negative. Up to this point, there were no test results indicating a potential problem with leafroll in Pinot noir FPS 29.

Then, as PCR testing was incorporated into the testing regimen for some of our older Foundation vineyard source vines, and greenhouse propagations from the old FV source vines were tested by PCR in 2002, the PCR results on the old FV block vines at FV H11 V11 & 12 came up positive for Grapevine leafroll-associated viruses 4 & 5 (GLRaV 4 & 5). Since the leafroll status of the now-removed FV block source vines was now in question, the new NYL block source vines propagated from them were put on "hold" and included in the 2004-05 grape field index. Index results completed on the NYL block source vines in 2006 confirmed the presence of Leafroll disease in the Pinot noir FPS 29 source vines at NYL D13 V3 & 4. Both vines were removed from the Foundation vineyard in October 2006.

Based on the testing history outlined here, FPS has been able to confirm the presence of leafroll in the Pinot noir FPS 29 source vines at NYL D13 V3 & 4. Fortunately, our distribution database records indicate that no customers received propagating material from either of the two registered NYL block source vines. The positive PCR test results on the old nonregistered FV block source vines at FV H11 V11 & 12 mean it is also very likely that leafroll was present in the old FV block source vines as well. Though notification to recipients of disease found in nonregistered vines is not required by the R&C Program, FPS feels it is important to make this information available here for those who may have received propagating material from the old FV source vines.

Fortunately, because our original Pinot noir FPS 29 material had never been through virus elimination therapy, in 1998 material from the Pinot noir FPS 29 FV block source vines was submitted to the FPS lab for microshoot tip culture to create a cleaned up version of this selection. A tissue culture explant produced from this process was indexed on field indicators in 2001, 2002 and 2003, and all tests were negative. Complete ELISA and PCR testing panels on the new tissue-cultured selection were also negative for disease. Two source vines of the new selection, now available as **Pinot noir FPS 106**, were planted in the Foundation vineyard in 2003 and 2004. One of the vines has been confirmed true to variety by visual inspection and DNA ID testing, and is now registered in the R&C Program. The other new vine currently has provisionally-registered (P) status, and will be registered as soon as trueness to variety can be confirmed (hopefully in Fall 2007).

ON THE WEB

National Grape Registry
www.ngr.ucdavis.edu

The National Grape Registry (NGR) website continues to evolve with improvements to the existing pages and addition of new features. The site has been operational for almost one year, during which user feedback revealed issues which have been or are being addressed. The Vitis International Variety Catalogue from Europe recently replaced its former website with a new format and possibly new content. The NGR database was prepared with the former Vitis database. Any necessary changes to NGR synonym lists will be implemented over time as comparison with the new Vitis catalogue entries can be made. Several spreadsheets containing many new varieties, mostly from the USDA Clonal Germplasm Repository, are currently under review and should be added to the variety profiles within the near future. Finally, the NGR project has entered Phase II, the display of clonal selections for each variety. The programming work for that feature is almost complete, and the initial database with profiles of the FPS selections for each variety is currently being compiled.

UC Integrated Viticulture Online
http://iv.ucdavis.edu

This website has benefitted from support by the viticultural industry and experts on a wide range of topics. The website is simple to maneuver through, and the menu is broken into categories such as 'UC Researchers,' where users can find contact information for UC academics and Cooperative Extension specialists, and 'Viticultural Information,' which has an extensive list of topics to investigate further. Each topic includes descriptions and links to experts, related websites and, wherever possible, pdfs of articles or chapters from UC publications.

An expansion in the number of videotaped UC Davis Extension classes and other events posted on the IV website is planned for the coming year. This is tremendously exciting as it will make some of the best seminars offered at UC Davis available to all. Only a few topics currently include links to 'Breeze' videos, but since there is no cost or additional software needed to see and hear the speakers and their presentations, we look forward to adding to the collection.

New Releases of Fay Triplett Red Wine Varieties 'Maxine Rouge' and 'Rougett'

by L. Peter Christensen, Viticulture Specialist, Emeritus, and Matthew Fidelibus, Viticulture Specialist, Department of Viticulture and Enology, UC Davis

'Maxine Rouge' and 'Rougett' are public releases of red wine varieties bred and developed by Fay Triplett of Ceres, California. 'Triplett blanc,' a white variety, was released in 2004. These varieties had shown promise in preliminary testing at Ceres and were subsequently transferred to the UC Kearney Agricultural Center in the late 1980s and early 1990s where they were evaluated with 29 other selections. Background information on Fay Triplett's breeding program and the first variety release, 'Triplett blanc,' can be found in FPS Grape Program Newsletters, October 2002 and October 2004, at *http://fps.ucdavis.edu*.

Both selections have completed indexing at FPS and are available to growers and nurseries.

'MAXINE ROUGE'

'Maxine Rouge' is named after Fay's wife, Maxine, a devoted supporter of his 50 years of grape breeding work. It was tested as F101-3 and is a complex cross of *F1-2 [T213-13 x T42-36 (Ruby Cabernet x Barbera)] x T793-20 (Grenache x Ravat noir)*. The parentage of T213-13 is: *T61-9 (Grenache x Gros Manzenc) x T74-21 (Zinfandel x Cabernet Sauvignon)*.

The vine is of medium vigor with semi-upright shoots and a fairly open canopy. The leaves are medium, glabrous, almost entire with reduced lateral sinuses, with a V-shaped petiolar sinus and broad, rounded teeth. Clusters are small-medium, loose to well-filled, short conical, and sometimes shouldered or winged with medium peduncles. Berries are round, medium-small and dark blue-black with a whitish bloom; their skin is tough, of good anthocyanin content and very low bunch rot potential. The vines are highly fruitful, but with relatively small clusters. Fruit ripening is early (late August in Fresno County) and with superior compositional balance—high °Brix, high TA and low pH. These characteristics make the variety well suited to a warm climate district. A three-year summary of the harvest data from the UC Kearney Agricultural Center (Fresno County) is given in Table 1.

The test vines at Kearney were planted at 8- x 10-feet vine and row spacing and trained to a bilateral cordon at 54 inches and with a foliar catch wire at 65 inches. They were pruned to 22 2-node spurs per vine. Higher node numbers may be used with vigorous vines due to the small clusters. The small clusters and upright vine growth might also make the variety suitable for quadrilateral vine training. The fairly open canopy minimizes the need for canopy manipulation. Close attention to fruit maturity and harvest date is needed due to the early ripening characteristics. The berries, especially when fully exposed to sun, begin to lose turgidity beyond 22 °Brix. The early ripening may require opening up a red wine crush program at an earlier date than usual for some wineries. Table wines made from the variety have been described as medium bodied with good color and mouth feel and of excellent acidity. The flavor profile is fresh red to dark fruits, and it can have some herbaceous flavor as well. It has been described as similar to Cabernet Sauvignon or Ruby Cabernet if the fruit is fully ripe.

'Maxine Rouge' clusters. *Photo courtesy of Peter Christensen*

Table 1. 'Maxine Rouge' 3-year harvest means.

Harvest Date	Berry Analysis				Cluster Analysis			Total Yield
	Wt./berry (gms.)	Soluble Solids (°Brix)	Titratable acidity (g/100ml)	pH	Number/vine	Wt./cluster (lb.)	Number w/rot	Tons/Acre
Aug. 29	1.15	23.4	1.06	3.2	150	0.33	0	12.5

'ROUGETT'

'Rougett' is a Fay Triplett cross of *T213-13 [T61-9-A(Grenache x Gros Manzenc) x T74-21A (Zinfandel x Cabernet Sauvignon)] x T 42-36 (Ruby Cabernet x Barbera)*. It was tested as F1-13.

The vine is of medium vigor with semi-erect growth and a fairly open canopy. The leaves are medium, 5-lobed with relatively shallow inferior lateral sinuses; narrow U-shaped petiolar sinus; medium sharp teeth; pink petioles; and glabrous on upperside with sparse, tufted hairs on underside. Clusters are medium-large, conical, well-filled, and often winged and with some large wings. The peduncles are short to medium and often lignified. Berries are medium, oval, and blue-black with white bloom. Occasional reddish-purple berries may be present. Bunch rot potential is very low. Ripening tends to be staggered among berries within a cluster; they reach full ripeness in late September to mid October in Fresno County. 'Rougett' has always stood out as having clean fruit of unusually high acidity and low pH for a warm region. The averages for five years of harvest data collection are shown in Table 2. These harvests tended to be early for the variety due to scheduling needs.

Vine spacing, training and trellising of the test vines were similar to that of 'Maxine Rouge.' Pruning practice was 18 2-node spurs per vine. The variety has performed well with bilateral cordon training and spur pruning. Only minimal canopy manipulation would be required due to the variety's growth habit. 'Rougett' is a much later ripening selection than 'Maxine Rouge.' It would fit into a later crushing program in a warm climate because of its low bunch rot potential and retention of high acidity and low pH.

'Rougett' clusters. *Photo courtesy of Peter Christensen*

Harvest-time berry sampling for wine making in 2006 showed 24.0 °Brix on October 16. The final harvest sampling was on October 29 with 26.9 °Brix, 0.84 g/100 ml TA and 3.2 pH—an excellent balance for a warm region.

Wines of 'Rougett' are of lighter body than those of 'Maxine Rouge'; 'Rougett' may be most suitable for Rosè production. The color is light to medium and the tannins are low to medium. The flavor profile is typically red fruit, including strawberries and raspberries.

Table 2. 'Rougett' 5-year harvest means.

Harvest Date	Berry Analysis				Cluster Analysis			Total Yield
	Wt./berry (gms.)	Soluble Solids (°Brix)	Titratable acidity (g/100ml)	pH	Number/vine	Wt./cluster (lb.)	Number w/rot	Tons/Acre
Sept. 18	1.91	21.4	1.15	3.3	94	0.79	0.2	14.3

The Light Brown Apple Moth Invasion: Should Grape Growers Be Concerned?

by Dr. Frank G. Zalom, Department of Entomology, University of California, Davis

THE LIGHT BROWN APPLE MOTH (LBAM), *Epiphyas postvittana*, was confirmed in California by the USDA Animal and Plant Health Inspection Service (APHIS) in March, 2007, the first time this pest has been detected in the continental United States. It has since been found in Alameda, Contra Costa, Los Angeles, Marin, Monterey, Napa, San Francisco, Santa Clara, Santa Cruz, San Mateo and Solano counties. To date, there have been over 5000 confirmed detections over an affected area of at least 500,000 acres. These finds have been confined to urban landscape plants and commercial nurseries. It has not been detected in California grape vineyards.

LBAM is a native of Australia that has also become established in New Zealand, New Caledonia, Great Britain, and Hawaii. It has a broad plant host range of over 250 known species that includes landscape trees, ornamental shrubs, fruit crops (including grapes) and certain vegetable crops. LBAM is considered to have high potential to cause economic damage to agricultural commodities and, since it is an exotic species, there is particular concern for the possible loss of international and domestic markets for some crops. APHIS has already issued a Federal Domestic Quarantine order, with restrictions on interstate shipment of plant material, and the California Department of Food and Agriculture (CDFA) issued a State Interior Quarantine order restricting intrastate shipment of plant material from counties where LBAM is known to occur.

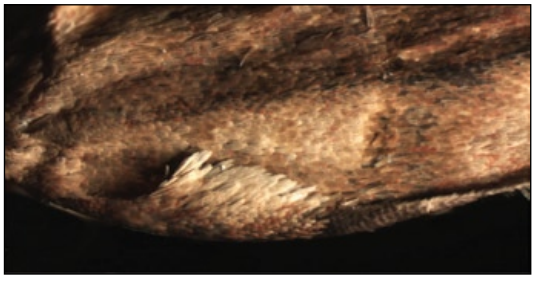
A Technical Working Group has been established to advise APHIS and CDFA on a response to the LBAM infestation. The Technical Working Group has recommended that the agencies adopt a long-term goal of eradicating LBAM, and the Federal government, through the Commodity Credit Corporation, has approved more than $15 million in funds to prevent its further spread in California and to protect other states. Eradication is slated to begin in mid-September, first in Monterey County, by using microencapsulated LBAM pheromone for mating disruption. This is the first attempt to eradicate an exotic pest using this approach.

Although LBAM is found throughout Australia, it does not survive well there at high temperatures. It is a more serious pest in cooler areas with mild summers, moderate rainfall (~ 29 inches) and moderate to high relative humidity (approximately 70%). Hot, dry conditions seem to substantially reduce populations. The adult moth typically only flies short distances, about 300 feet, to find suitable hosts. Therefore its longer-range dispersal will most likely occur by movement of infested nursery plants or green waste, and on equipment and containers. However, movement of adult moths in wind currents cannot be dimissed. It is difficult to say how quickly it may spread, if at all, beyond its current range in California, or how well it would succeed in warmer and drier areas of the state.

Identification

LBAM belongs to the Lepidoptera family Tortricidae, which includes a number of notorious pest species including the orange tortrix, *Argyrotaenia citrana*, and the omnivorous leafroller, *Platynota sultana*, which are pests of California grapes. In general, it is difficult to distinguish LBAM from these and other endemic leafrollers. The adult stage is the easiest of the developmental stages to distinguish. The adult male is about 0.3 to 0.4 inch (8 to 10mm) long and the adult female slightly larger. Their wingspread is about twice their length. The overall color of both sexes is yellowish brown, but the forewings of the male are slightly to much darker toward the distal edges, and there is a costal fold present along the edges of the forewings. The sex pheromone of LBAM is available commercially and can be used with delta traps to detect male moths. Pheromone traps have been deployed throughout California by Agricultural Commissioner's offices as part of CDFA's detection program to establish the area of LBAM infestation.

A male light brown apple moth showing distinct dark coloration on the distal half of the forewing. Wing coloration can vary considerably. *Photo used with permission from Dr. David Williams, Victoria, Australia*



Detail of the costal fold on the forewing of a male light brown apple moth.

As with other leafrollers, LBAM eggs are usually laid slightly overlapping each other as an egg mass on the upper surface of leaves, or occasionally on fruit. Eggs are pale white to light green, becoming yellowish and then dark before hatching. A typical egg mass has 20 to 50 eggs, but may be larger. Newly hatched larvae are pale yellow and undergo 5 or 6 larval molts each increasing in size. Mature larvae are light green with a light brown head, and the setae (hairs) on the body are white. Larvae have a greenish anal comb. The larvae are active, and may grow to 0.75 inch (18 mm) in length at maturity. After emerging, the larva builds a silken shelter by rolling a leaf lengthways and webbing its edges together. These webbed leafrolls are rather easy to see when they are present, and are characteristic of all leafrollers including a number of species endemic to California. Leaves may also be webbed together or joined to fruit. The larvae feed within these shelters. Larvae may also build webbed shelters within grape bunches and feed on the berries. LBAM does not have a diapause, and will most likely overwinter as larvae in leaf litter and other plant material.

Monitoring

In Australia, it is recommended that pheromone traps to detect and monitor the male moths be placed at one per 5 acres, with at least one in every vineyard no matter how small. There is a degree-day model for predicting LBAM development. The lower and upper developmental thresholds for LBAM are 45º and 88ºF, respectively. This model predicts that there will most likely be 2 generations a year on the central and north coast regions of California, but that there may be 3 to 4 generations a year in the central valley and southern California. In Australia, generations do not overlap, but they do in Great Britain and New Zealand. This likely reflects different weather conditions during the winter since there is no diapause.

Within their range, LBAM larvae are present for most of the year on host plants. Larvae are best detected by looking for the characteristic webbing of leaves. When fruit is present, larvae and webbing may be found within grape bunches and this is when they are most damaging. Larvae can persist in bunches remaining on vines after harvest, and can survive for up to 2 months in the winter without feeding.

Damage

Foliar feeding by leafrollers is generally considered minor in fruit crops; the primary concern is fruit damage. In areas of Australia, grapes can be severely damaged by leafroller larvae feeding among the berries and spreading Botrytis bunch rot, as well as by feeding along the bunch stem and directly on the berries. They may also feed on grape buds, and the injured buds may fail to develop shoots or clusters. It is considered a major grape pest in Australia. Damage to grapes by LBAM is similar to that of the orange tortrix and the omnivorous leafroller which are often seen in California vineyards.

Mature light brown apple moth larva and webbing.

Photo by Jack Kelly Clark

Control

If APHIS and CDFA decide LBAM can no longer be eradicated, management of the pest will move to a traditional IPM program. This would likely include monitoring, use of a degree-day model to target young larvae with insecticides, pheromone mating disruption, and conservation of biological control agents. The intensity of inputs would depend on crop and location. Although it is impossible to determine how severe LBAM will be for California grape growers should it become established, it might be expected that their management would be similar to that of orange tortrix and omnivorous leafroller. The UCIPM Pest Management Guidelines for Grapes (*http://www.ipm.ucdavis.edu/PMG/selectnewpest.grapes.html*) describe management strategies for these insects which should be applicable for LBAM as well, including vineyard sanitation practices (removing broadleaf weeds during the winter, and by removing and destroying cluster mummies when pruning). If monitoring suggests that insecticide treatment is necessary, there are several reduced-risk insecticides available for control of leafrollers in grapevines including *Bacillus thuringiensis*, spinosad (Entrust and Success), and methoxyfenozide (Intrepid), as well as cryolite and a number of organophosphates and carbamates, although none of these products currently list LBAM as a target pest on their California labels.

FPS RESPONDS TO LBAM QUARANTINE

Due to the confirmed find in July 2007 of Light Brown Apple Moth (LBAM) in Solano County, in which a portion of the FPS field plantings are located, FPS is now required to comply with the conditions of the state and federal LBAM quarantines when distributing propagating material from all LBAM host species, including grapevines. Solano County and USDA officials have surveyed the FPS plantings with no LBAM findings, and have established a monitored trapping program in the FPS field collections. An LBAM quarantine compliance agreement has been established that will permit FPS to continue distributing propagating material accompanied by a one-page federal certificate indicating that FPS has complied with the terms of the LBAM quarantine. Pre-shipment notifications to state plant health officials will be made for material going to 10 states, including Oregon. Questions related to FPS compliance with the LBAM quarantine can be directed to Cheryl Covert at clcovert@ucdavis.edu or by phone at 530-754-8101.

The Zinfandels of FPS

by Nancy L. Sweet, Foundation Plant Services, UC Davis, and Dr. James A. Wolpert, Department of Viticulture and Enology, UC Davis. This article was originally presented at the UC Davis Extension Symposium 'Variety Focus: Zinfandel' held on May 31, 2007.

THE STORY OF THE ZINFANDELS of Foundation Plant Services (FPS) is a complex one. Three distinct sources of clones may have developed separately in three countries for well over 100 years. The "Zinfandel" grape is grown across multiple climate regions, yielding many unique varietal wines. The grape's enigmatic path to California has never been completely resolved and possibly never will be. What is clear is that the grape known in the 19th century as "the Zinfandel" is the only important *V. vinifera* wine variety closely identified exclusively with California.

The best evidence suggests that Zinfandel came to California around 1850. Plant material was shared and exchanged freely up and down the state thereafter, especially during the wine boom of the late 19th century when many new varieties were imported from Europe and elsewhere. Along with the new varieties came grapevine virus diseases. Very little was known about the effect of plant viruses on grapevines until the 1940s. It wasn't until 1952 that the State of California formed an association to develop, maintain and distribute virus-free grape stock that was true to the variety name. (Alley and Golino 2000) The long history of propagation of the Zinfandel grape from non-certified field selections, and the uncertain origins of the grape have resulted in the existence of relatively few virus-tested clonal selections of certified origin in California. (Verdegaal and Rous 1995) In 1990, there were only five selections of Zinfandel registered in the Foundation Plant Services collection; today, forty-seven selections are 'in the pipeline' at various stages of virus testing, clean up, and inclusion in the Foundation vineyard.

Zinfandel is the fourth leading wine grape variety (behind Chardonnay, Cabernet Sauvignon, and Merlot) in total acreage in California. The California Department of Food and Agriculture reported in April 2007 that there were 52,361 acres of Zinfandel (including Primitivo) grapes planted in 2006. (California Agricultural Statistics Service 2007) Although Zinfandel has a presence in 44 counties, the areas with at least 1000 acres of Zinfandel/Primitivo standing are Amador, Fresno, Kern, Madera, Mendocino, Merced, Napa, Sacramento, San Joaquin, San Luis Obispo, Sonoma, and Tulare counties. These California counties lie in all five regions on the Winkler heat summation scale, from the coastal valley and hill areas (regions I-III) to the Central Valley counties and portions of the Sierra foothills (regions IV-V).

Drs. Edi Maletić and Ivan Pejić examine a Plavac mali vine on the island of Solta off the Dalmation Coast. These researchers, from the University of Zagreb, collaborated with Dr. Carole Meredith to unravel the DNA mysteries of Zinfandel, and spoke at the UCD symposium 'Variety Focus: Zinfandel.' *Photo courtesy of Ivan Pejić*

Zinfandel wine takes many forms, in part due to the quality of grape, the vineyard management practices applied and the location of the vineyard within California's varied topography. Zinfandel grown for red wine production can be either tannin-rich (needing aging) or light and fruity with softer tannins. (Sullivan 2003) Zinfandel grapes grown in the hotter areas of the Central Valley (regions IV-V) are frequently made into white or pink Zinfandel, a popular wine with a higher sugar and lower alcohol content. Finally, late-harvested Zinfandel with its high alcohol content is appropriate for dessert wines in the style of port. The grape is complex and versatile.

The mystery of the origin and identity of California's Zinfandel variety has been reported thoroughly in many scientific journals, in historian Charles L. Sullivan's *Zinfandel: a History of a Grape and Its Wine* (2003) and Dr. Jasenka Piljac's *Zinfandel: A Croatian-American Wine Story*

(2004). Definitive genetic analysis in 2003 ultimately made a crucial link when it proved that California's Zinfandel, Italy's Primitivo and Croatia's Crljenak/Pribidrag all share the same DNA profile. (Maletić et al. 2003, 2004)

Although the path Zinfandel took to California is still not certain, the most plausible theory of the grape's journey to the United States starts with the Austrian Imperial Nursery collection in Vienna, from which an amateur horticulturist named George Gibbs brought the grape to Long Island, New York in the 1820s. At that time, the Austrian Empire included the kingdom of Hungary, of which the territory now known as Croatia was a part. The importance of this fact will later become apparent. In the early 1800s, Zinfandel (known then as Zinfindal, Zenfendel and Black St. Peters) was used as a table grape grown in hothouses on the East Coast. The origin of the name "Zinfandel" is similarly not clear. However, an 1830 text by William Robert Prince, *A Treatise on the Vine*, mentions a "Black Zinfardel of Hungary" in a list of foreign varieties of recent introduction to the United States. (Sullivan 2003)

Zinfandel's journey to California probably occurred around the time of the Gold Rush in the early 1850s. A search of public records by Sullivan revealed that many shipments of *V. vinifera* varieties, including Zinfandel, were made from the East Coast to the West Coast by men such as Frederick Macondray and Anthony P. Smith. *Vinifera* varieties were also imported from Europe around that time. Zinfandel began to be recognized as a wine in its own right in the 1860s and then emerged as an exceptional grape variety for wine making in northern California in the 1880s. Thereafter, the Zinfandel name would be closely identified with the State of California.

At the same time, a grape variety called Primitivo developed a reputation of its own in Italy. Primitivo is grown principally in Puglia (Apulia), a long fertile region along the Adriatic Coast in southeast Italy. Puglia, like California, experiences mild wet winters and hot summers with scarce rainfall. The name "Puglia" derives from the Roman *a-pluvia* or "lack of rain." (Robinson 2006) Because of the high alcohol and intense pigmentation of the wines made with Primitivo in the area, Primitivo wines are often used in Italy to fortify red wines made in cooler regions. (Golino, personal communication)

One theory posits that the Primitivo grape was taken across the Adriatic Sea from Croatia to Puglia in the 18th century. (Maletić et al. 2004; Robinson 2006) Dr. Giovanni Martelli of the Istituto di Patologia Vegetale in Bari, Italy, stated in an e-mail that the first recorded presence of the Primitivo grape in Italy was in Gioia del Colle, a small town of Puglia located in the hills of Murgia. Gioia is situated halfway between the Adriatic and Ionian Seas and halfway between Bari and Taranto. Mr. Francesco Filippo Indellicati, a local priest who was also a learned amateur botanist and agronomist, made a note of the Primitivo grape in Gioia town records in 1799. Today, over 70% of the vineyards in Puglia are in the plains with very high daytime temperatures. Primitivo is primarily cultivated on the western side of the flat Salento peninsula in Puglia near the city of Manduria, about 100 km southeast of Bari. Puglia and the Croatian region on the Dalmatian Coast have similar climatic conditions—marine influence, humidity, cool summer nights. The Salento peninsula (Puglia), central and southern Dalmatia, and certain warmer areas in the Central Valley of California are in Winkler climate zone IV. However, the growing season is drier in California than that of the central Dalmatian Coast. (Maletić et al. 2003)

In the late 1960s, USDA-ARS Plant Pathologist Dr. Austin Goheen discovered the Italian grape. He was dining one evening in Italy with Dr. Martelli when he tasted a wine he thought was a Zinfandel. The two men then went to a vineyard located between Bari and Gioia del Colle (40 km southeast of Bari), where Goheen collected the plant material which eventually became Primitivo FPS 03. He brought some plant material back to the USDA facility in Davis, California. Once Primitivo and Zinfandel were planted side-by-side, they appeared to be the same variety. (Maletić et al. 2003; Mirošević and Meredith 2000) Subsequent genetic comparison (isozyme patterns, restriction fragment length polymorphisms, microsatellite alleles) confirmed that the two grapes share the same genetic profile. (Bowers 1998; Maletić et al. 2003)

Although the DNA profiles for Zinfandel and Primitivo appear to be identical, some clonal divergence seems to have resulted over time, most likely attributable to the lengthy period of independent development of the two grapes in California and Italy, respectively. (DNA profiles are excellent for distinguishing between grapevine varieties but cannot be used to identify clones.) Dr. Andrew Walker states (personal communication) that it is difficult to visually distinguish California Zinfandel selections from the Primitivo selections now in the FPS collection when they are growing side-by-side in the field, but there are some subtle differences in appearance. Primitivo berries are slighter smaller than Zinfandel; the size discrepancy is noted if the two grapes are simultaneously viewed together or if one measures the berries. Both Primitivo and Zinfandel have tight clusters and thin skin, which favors bunch rot with this genotype. However, Primitivo has looser clusters than Zinfandel, and consequently less rot. In some environments, Dr. Walker has also seen a slight

difference with respect to hairiness on the leaves of the two groups of grapes. In California, Primitivo leaves can have felty, dense hair on the back of the leaves, while Zinfandel leaves have a cobwebby consistency. More observation across leaves of similar age and in similar climates and locations is needed to make a conclusive finding on differences between the leaves.

In a communication to the Alcohol and Tobacco Tax and Trade Bureau (TTB) of the U.S. Treasury Department on the issue of whether or not Zinfandel and Primitivo should be treated as synonyms for purposes of wine labeling, Dr. Carole Meredith of the University of California, Davis, whose lab was the first to make a genetic comparison of the two grapes, noted that the independent propagation of the two varieties has resulted in small differences, such as berry size or fruit composition, that she believed could be significant for wine-making. Although the European Union recognizes the name Zinfandel as a synonym for the Primitivo grape, TTB continues to maintain them as separate prime grape variety names used to designate American wines. Consequently, Zinfandel and Primitivo may not be used as synonyms on wine labels for wines made in the United States.

The search for the "true origin" of the Zinfandel grape took a new path in the 1990s. Many have speculated that Zinfandel may have its origin in Hungary or other areas of Eastern Europe, practically all of which was within the Austrian Empire at the time Zinfandel was brought to the United States.

Researchers from the Faculty of Agriculture, University of Zagreb (Drs. Edi Maletić and Ivan Pejić) and local experts in Dalmatia identified a Croatian grape called Plavac mali, an autochtonous Dalmatian cultivar that looked like Zinfandel. The Croatian scientists collaborated with Dr. Meredith to test the DNA profile of Plavac mali against Zinfandel and Primitivo. (Mirošević and Meredith 2000) The profiles did not match. The similarity of the two grapes was later explained by the discovery that Zinfandel is one of the parents of Plavac mali. (Maletić et al. 2004)

In 2001, the Croatian scientists found another local vine called Crljenak kaštelanski ("the red from the town of Kašteli") in a coastal town called Kaštel Novi in central Dalmatia north of Split. The Kaštela region is an ancient wine-growing area in Eastern Europe, from the time before the Roman occupation. The climate is characterized by long and warm summers and mild winters, although the climate in Kaštela is wetter than California is during the growing season. (Maletić et al. 2004) In 2002, additional vines known locally as Pribidrag were found in the Dalmatian coastal town of Omiš.

Crljenak and Pribidrag looked morphologically identical to Zinfandel. Drs. Maletić and Pejić sent the vines to Dr. Meredith, who confirmed that the DNA profile of the two grapes was identical to Zinfandel. (Anonymous 2002) Records and herbarium specimens in Croatia indicate that this cultivar (known in Croatia by many synonyms) was once prominent in Dalmatia and either originated in Kaštela or had a lengthy association with that region. The scientists also concluded that their research results are con-

Crljenak kaštelanski vine in Croatia. The DNA profile for this Croatian variety has been shown to be identical to California Zinfandel, and vines have been brought to FPS for testing and evaluation. Croatian winemakers have also focused more attention on this variety, which previously had not been an important varietal in their winemaking industry.
Photo courtesy of Ivan Pejić

sistent with Zinfandel belonging to the broader Croatian gene pool in Dalmatia (as opposed to gene pools in Greece and Italy). The vines found to be identical to Zinfandel are rare in Croatia today. (Maletić et al. 2004) In fact, prior to its discovery in 2001, Crljenak had not been bottled as a varietal in its own right in Croatia. (M. Andrew Walker, personal communication)

One of the active parties in the effort to bring the Croatian grapevines to California is Ridge Vineyards, which imported Crljenak kaštelanski and Pribidrag plant material to the United States via FPS in 2002 and 2005, respectively. The source of the Crljenak vines was Kaštel Novi, Croatia, and the Pribidrag was from Svinisce and Marusici, Croatia. Ridge Vineyards and the Croatian scientists hope that testing under experimental conditions will show that the Croatian clone line possesses qualities that could enrich California Zinfandel wines. David Gates, Vice-President of Ridge Vineyards, stated, "The genetic variability in these selections from Croatia will hopefully add a bit more complexity and diversity to California Zinfandel. It will be fun to see in the coming years just how that genetic variability will express itself—viticulturally and in the wines made from these grapes." FPS selections of both Zinfandel and Primitivo were sent to Croatia as part of this international exchange, where they will be compared to indigenous clones for vineyard and winemaking performance.

The original Crljenak plant material suffered from virus and underwent shoot tissue culture propagation, the virus testing of which should be completed by 2008. The Pribidrag is a few years behind that. Once selections of each qualify for the California Grapevine Registration & Certification (R&C) Program, they will be released from federal quarantine, planted in the FPS Foundation vineyard, and distributed to Ridge Wines. Ridge Wines will retain an exclusive right to the plant material for two years, after which each selection will be available to the public.

Most of the Zinfandel plant material in California originated with the vines imported to the state in the mid-1800s. Trials are underway to explore the clonal diversity of 'Heritage' Zinfandel from around the state with the hope of finding superior material well adapted to our vineyard conditions. (See 'Public Heritage Zinfandel Clones') The discovery of the Croatian Zinfandel selections growing under the names Crljenak and Pribidrag could have a significant impact on the genetic diversity of the Zinfandel clonal material in California. Crljenak/Pribidrag was originally cultivated as a variety in central Europe, not in California or Italy. It would be reasonable to expect the greatest diversity of clonal variation would be in this region, perhaps with unique qualities that new clones of the grape from Croatia might offer to winemakers.

Primitivo offers another source of genetic diversity for California's Zinfandel since there may be important clonal variation in Italy. We do not know at this time whether the selections of Primitivo introduced by Dr. Goheen are typical of Italian clones.

It may be helpful to review some of the conventions at FPS for the identification of selections. Because it is difficult to tell clones apart objectively, and duplicate clones may come to the FPS collection from more that one source, each introduction receives a unique FPS selection number to preserve its identity. In addition, sub-clones that have been produced by heat treatment or tissue-culture virus-elimination therapy also receive unique numbers since their clonal performance may vary because of changes in vine health due to differing virus status or even the possibility of mutation during therapy.

REGISTERED FPS PUBLIC SELECTIONS

The registered and certified Zinfandel selections currently available to the public at FPS include Zinfandel FPS 01A, 02, 03 and 06. There are also a number of proprietary selections maintained at FPS for various owners.

Zinfandel FPS 01A and Zinfandel FPS 02 came to FPS in 1961 from a vineyard in Lodi owned by Leon Handel. The climate in the Lodi-Woodbridge area is amenable to growing good quality Zinfandel grapes due to the marine influences permeating the San Joaquin Delta region of the Central Valley. San Joaquin County has led the state in total Zinfandel acreage since the middle of the last century. (Sullivan 2003) Statistics reported by CDFA in the 2006 Grape Acreage report show that the San Joaquin Valley now has ~20,200 acres of Zinfandel (including Primitivo) of the ~50,000 acres of Zinfandel grapes planted in California.

The original plant material from Lodi tested negative for virus. Zinfandel FPS 1A and 02 were registered in the California Grapevine R&C Program in 1962 without any kind of virus elimination treatment. Both selections are still available from FPS as California Foundation stock.

Zinfandel FPS 06 was propagated from Zinfandel FPS 01A in 1966. The difference is that Zinfandel FPS 06 underwent heat treatment for 117 days. It first appeared on the registered selection list in 1967 and has consistently tested negative for all viruses.

Zinfandel FPS 03 came to FPS in 1964 from a vineyard (Reutz #1) near Livermore, California. Zinfandel has a long tradition in the Livermore Valley and was an important wine grape variety planted there as far back as 1885. (Sullivan 2003) According to Phil Wente of Wente Vineyards, the Reutz vineyard was a 40-acre farm owned

and farmed by Reinhardt Reutz on Vineyard Avenue just southeast of Pleasanton, California. The vineyard had been planted during Prohibition and, over the years, the grapes were sold to Ruby Hill Winery, Cresta Blanca Winery, Almaden, and Wente Bros. Winery. Mr. Wente explained, "When UC Davis began the process of collecting vines for the Foundation vineyard, my grandfather, Ernest Wente, told Harold Olmo that the best Zinfandel in the Livermore Valley was grown in the Reutz Vineyard. A number of other premier varieties were selected from the Livermore Valley as representative of their overall quality, and it was only natural that Zinfandel from this region would be considered as well, based on the quality wines produced over the years from the Reutz Vineyard." The Reutz vineyard was pulled out in the late 1970s when Mr. Reutz was unable to continue farming it.

Zinfandel FPS 03 did not receive heat treatment, and first appeared on the list of registered selections for public distribution in 1965. It is still available from FPS as California Foundation stock.

Primitivo FPS 03, 05 and **06** were imported from Italy. Primitivo FPS 03 was obtained in 1968 by Dr. Austin Goheen through the Istituto di Patologia Vegetale in Bari, Italy, the capital city of the Puglia region. The material that became Primitivo FPS 03 underwent heat treatment for 59 days before coming to the United States as USDA plant introduction (PI)325796-A-1. For a while, even after planting in the Foundation vineyard in 1971, the selection was known as Primitivo de Gioia, a synonym for Primitivo in the Vitis International Variety Catalogue. Some time prior to planting in the Brooks South vineyard in 1984, the name of this selection was changed to simply "Primitivo." Dr. Martelli explained that the name "Primitivo di Gioia" is the "older" denomination of the variety and now cannot be used any longer, even in Italy, because the European Union has determined that the names of grape cultivars grown in the EC cannot contain links to geographical locations. The TTB has imposed the same rule in the United States.

After arrival in Davis, the original mother plants of Primitivo FPS 03 tested negative for virus. Mother plants were established in the FPS Foundation block in 1971 but not professionally identified. Primitivo FPS 03 was first registered and distributed to the public in 1984 and it still available from FPS as California Foundation stock.

Primitivo FPS 05 and **06** are two of four selections that were sent from Italy to FPS in 1987 by Dr. Antonio Calò, of the Istituto Sperimentale Viticoltura in the Veneto region of northeast Italy. The Istituto is an experimental viticultural station established in 1923 in Conegliano and houses an ampelographic collection of more than 2000 grape varieties. (Robinson 2006) Selections 1 and 2 sent by Dr. Calò are now Primitivo FPS 05 and 06, respectively. These Primitivo selections were provided to FPS at the request of Dr. Goheen, who desired more Primitivo selections to compare to Zinfandel. Both selections tested negative for viruses and became registered in the R&C Program in September of 1994.

STUDIES ON PRIMITIVO AND ZINFANDEL

The publicly-available FPS Primitivo and Zinfandel selections underwent a series of comparisons by several research grups in California between 1990 and 2003.

The studies were conducted at three different sites, using varied experimental protocols for vine management. The results demonstrated that, although both varieties share the same DNA structure, there can be meaningful differences between the Primitivo and Zinfandel selections in terms of performance in the field and in the character of the wine produced.

The four publicly-available FPS Zinfandel selections (Zinfandel FPS 01A, 02, 03 and 06) and Primitivo FPS 03 were compared in a vineyard near Arbuckle, in the Sacramento Valley. The vines were planted in 1988, and data was taken for years 1990-1994. Harmony was used as rootstock, and the vines were trained to a T-trellis with a bilateral cordon formation on the lower wire. Vines were drip irrigated and spur pruned. (Wolpert 1996)

The researchers at Arbuckle found few differences in growth and yield parameters among Zinfandel clones. Zinfandel FPS 06 (the heat treated selection from Zinfandel FPS 01A) had been included in the trial to test whether heat treatment *per se* had any viticultural significance. Zinfandel FPS 06 did show some differences from Zinfandel FPS 01A in pruning (+ 0.2 kg) and berry (+ 0.15 g) weights. However, none of the Zinfandel selections demonstrated the looser clusters and smaller berries exhibited by Primitivo FPS 03.

Zinfandel selections FPS 01A, 02, 03, and 06 and Primitivo FPS 03 were included in another trial in the years 1991-1997 in the San Joaquin Valley near Lodi, California. The 1991-1993 vines were grown for White Zinfandel production and the remaining years for red Zinfandel. Vines were grown on Freedom rootstock, trained to a bilateral cordon and spur pruned. A low volume drip system provided irrigation. The production data was very similar over the years of the experiment in terms of trends and significant differences; the 1994 data was used to report the findings. (Verdegaal and Rous1995)

In the Lodi trial, there was little or no significant difference among the Zinfandel clones in terms of performance

in the field. The primary finding in this trial was a significant difference between Primitivo FPS 03 and the FPS Zinfandel clones. The Zinfandel group had higher yields and fewer clusters per vine, higher cluster and berry weights, and later maturity dates than Primitivo FPS 03. Using the 1994 data (for red wine production), they found that the Zinfandel group had lower soluble solids (°Brix) and later maturity dates than Primitivo FPS 03.

The most recent evaluation of the performance of FPS Zinfandel and Primitivo registered selections is an ongoing research study of grapevines planted in 1997 in a vineyard at the UC Kearney Agricultural Center in the southern San Joaquin Valley. The vines were grown on their own roots, common in Fresno County. They were trained in a bilateral cordon formation on a single wire mounted on a trellis. Vines were irrigated by furrow and spur pruned. Data reported in this study was taken in 2000, 2001, 2002 and 2003. (Fidelibus et al. 2005)

> ***"My take on the feasibility of comparing Zinfandel clones across districts [appellations] is you will see differences (terroir) but in many cases they will be very subtle and affected by management, especially irrigation. The one "clone" that always seems to stand alone is Primitivo compared to any Zinfandel."***
>
> **— Paul Verdegaal, UC Cooperative Extension, San Joaquin County**

There were few differences observed between the Zinfandel selections tested in the Kearney trial. However, in the southern San Joaquin Valley (unlike in Arbuckle and Lodi), the Zinfandel selections yielded similar or lower weights (kg per vine) than the Primitivo selections. Zinfandel selections had fewer clusters per vine, a slightly higher berry weight overall, and lower soluble solids at harvest than Primitivo selections. It was posited that the differing yield findings of Primitivo and Zinfandel in Arbuckle/Lodi versus Kearney could be from a rootstock-scion interaction and/or regional data for making recommendations on planting (e.g., rootstock vs. own roots).

Paul Verdegaal, farm advisor in San Joaquin County, stated in an e-mail: "My take on the feasibility of comparing Zinfandel clones across districts [appellations] is you will see differences (terroir) but in many cases they will be very subtle and affected by management, especially irrigation. The one "clone" that always seems to stand alone is Primitivo compared to any Zinfandel."

Primitivo FPS 03 was the only registered FPS Primitivo selection included in all three clonal evaluations. In Arbuckle and Lodi, where the vines were grown on rootstock, Primitivo FPS 03 simultaneously produced more clusters per vine and a lower yield than the Zinfandels, explained by Primitivo 03 having had fewer and smaller berries. In Kearney, the vines were grown on their own roots. Primitivo FPS 03 had a 15% higher yield than the remaining selections in the Kearney trial, despite the fact that (unlike Arbuckle and Lodi) average cluster weight and berries per cluster were similar for all selections. The higher yield for Primitivo 03 was attributed to a statistically significant higher number of clusters per vine for that selection versus all the others.

More importantly, the Primitivo selections in Kearney suffered substantially less sour rot than did the Zinfandel selections, evidencing a lower susceptibility to bunch rot. "One of the major impediments to producing Zinfandel fruit of acceptable quality in the central San Joaquin Valley is Zinfandel's high susceptibility to sour rot." (Fidelibus et al. 2005) Within the Primitivo selections themselves, Primitivo FPS 03 was second to Primitivo FPS 06 in the % clusters affected by rot (40% versus 34%). The Lodi study also assessed the vines for bunch rot and, when rot was measurable during the trial, observed the least amount on Primitivo FPS 03. The Lodi researchers attributed that finding to Primitivo's looser clusters, smaller berry size and earlier maturity date.

Soluble solids were measured in all three trials as °Brix. The Primitivo selection(s) had higher soluble solids at harvest than any of the Zinfandel selections in Kearney, Lodi, Arbuckle. That result is not surprising given the early fruit maturation of the Primitivo variety in general. For example, Primitivo FPS 03 ripened (on average) 7 to 10 days ahead of the Zinfandels in Lodi. However, Primitivo FPS 03 was singled out for special recognition by the Kearney researchers for its combined high yields of fruit (significantly higher than the other Primitivo and Zinfandel selections) plus high soluble solids. A significant addition to those positive findings is the relative low incidence of sour rot experienced by Primitivo FPS 03.

Primitivo FPS 05 and 06 were formally evaluated only at Kearney. The notable findings for those selections were: Primitivo FPS 05 (along with Primitivo FPS 03) had significantly smaller berries than the other selections; Primitivo FPS 06 had the lowest incidence (34%) of clusters affected by sour rot of all the selections; the fruit of Primitivo FPS 06 matured quite early and had a higher juice pH than the others; and Primitivo FPS 06 and Primitivo FPS 03 were characterized as the best performers in the trial in terms of fruit maturity, yield and bunch rot susceptibility.

The only reported wine tasting trials involving the FPS registered selections were done in conjunction with the

trial in Lodi, California. The red wine tasting panels were done in 1994–1997, with wine lots made by Woodbridge Winery. In 1994, the wines were divided by the tasters into two groups. Zinfandel FPS 03, Primitivo FPS 03 and Zinfandel FPS 06 (in order of preference) were in the top group, with more dense color, better hue, and more black cherry and berry flavors. (Verdegaal and Rous 1995) It was considered surprising that two of the heavier yielding clones——Zinfandel FPS 03 and 06—were in the top group. In an e-mail from Paul Verdegaal, the farm advisor stated that in 1995 the same plots were not thinned enough but there were differences in the wines. The tasters preferred Zinfandel FPS 03, 06 and 02 to an overcropped Primitivo FPS 03 and Zinfandel FPS 01A. Verdegaal further stated that, in 1996, the plots were thinned and preferences split into three groups: (1) Primitivo FPS 03; (2) Zinfandel FPS 03, 06, and 02; and (3) Zinfandel FPS 01A.

The evidence from the three Central Valley trials showed that the Primitivo and Zinfandel "clones" performed in a substantially different fashion in Arbuckle, Lodi and Kearney. In all sites, the Primitivo fruit matured earlier than did the Zinfandel grapes. Not surprisingly, the name of the Primitivo variety comes from the Latin *primus*, which means 'first.' The Primitivo grape variety is "early at all stages of its physiologic development compared to other vine varieties." (Calò et al. 2001) One significant finding differentiating the two sources of "clones" (Zinfandel and Primitivo) in all three locations is that Primitivo clusters continue to be structured differently (looser, less compact) than those of Zinfandel.

Finally, a study to compare 63 Zinfandel clones and field selections was initiated in 1995 on vines grown in the Zinfandel Heritage Vineyard located at the University of California's Oakville Experimental Vineyard in Napa County, California. Phase I of the study included Zinfandel selections FPS 01A, 02 and 03, as well as Primitivo FPS 03, 05, and 06. The remaining vines consisted of Zinfandel Heritage clones from various counties throughout California. Traditional management techniques were used in maintaining the vines, which were budded in 1995-96 (Phase I). St. George rootstock was used. The vines were head-trained (supported by split redwood stakes) and spur pruned. A subsurface drip irrigation system was employed. (Anderson et al. 1999) The project had not yet reached the replicated trial stage but certain preliminary observations were made from data collected at the 1998 harvest, including the facts that Primitivo matured (°Brix) sooner than Zinfandel and had lighter mean berry weights and cluster weights than Zinfandel. Primitivo clusters continue to be structured differently (looser, less compact) even when grown in the climate and topography of a county like Napa. The vines for the study were pulled out and the project was terminated in 2006.

Zinfandel (left) and Primitivo in a comparative field trial in Lodi, California. *Photos by Paul Verdegaal*

FPS PROPRIETARY SELECTIONS

Zinfandel FPS 08 is a proprietary selection that was brought to FPS in 1996 by Bob Dempel of Dempel Farming Co. in Santa Rosa, California. The source of the plant material was 100-year-old Zinfandel vines planted on Bisordi Lane in Fulton, Sonoma County. Some of the original material submitted to FPS tested negative for virus and qualified to be planted into the Foundation block, where it was identified as Zinfandel FPS 08. This selection first appeared on the FPS Registered list in 1998. Zinfandel FPS 08 was removed from the Foundation block in 2006; however, mother vines in private increase blocks remain registered sources of California Certified Stock.

Dempel states that Zinfandel FPS 08 is known for its small clusters and berry size. Wine produced from Zinfandel FPS 08 berries by Paradise Ridge Winery (Santa Rosa) in 2003 exhibited deep color, a rich texture and brambly berry, spice and pepper flavors. (Vierra 2005) Mr. Dempel sells California certified Zinfandel FPS 08 vines propagated from his registered increase block at Dempel Ranch Vineyards in Hopland, California. Zinfandel FPS 08 is also available from Dempel's licensee, Sunridge Nurseries.

Zinfandel FPS 29 is a sub-clone of Zinfandel FPS 08, and was propagated by shoot tip tissue culture techniques from Zinfandel FPS 08. Zinfandel FPS 29 is a proprietary selection owned by Bob Dempel, who named it the Baldocchi Zinfandel clone in honor of his friend Dewey Baldocchi, a winemaker and pioneer in the Sonoma County grape industry. (Howie 1999) Zinfandel FPS 29 plant material has tested negative for virus and is expected to be added to the FPS Registered list within three years.

Zinfandel FPS 13 is a proprietary FPS selection owned by NovaVine Grapevine Nursery in Santa Rosa, California. The original plant material came to FPS in 1999 from an old vine Zinfandel vineyard owned by Milton and Ellen Heath. The vines of the NovaVine Zinfandel clone are grown in sandy loam soil on the Kelseyville benches (1300-2000 feet) at the base of Mount Konocti in Lake County. Jim Smith, manager of the source vineyard observed, "The vines [of this clone] yield a versatile grape that is very 'fruit forward' with a nose that 'jumps out of the glass.' Spiciness can be dictated by an open canopy (very fruity) or an extra-shaded canopy (heavy peppery characteristics)." Five wineries—Wild Hog, X Winery, DeLoach, Hall Crest, and Jelly Jar—have produced unique and very different wines composed almost solely of this clone's fruit.

All tests on Zinfandel FPS 13 at FPS were negative for viruses, and it was placed on the Registered selection list in 2006. Plant material for Zinfandel FPS 13 can be obtained through NovaVine Grapevine Nursery, Inc.

Zinfandel FPS 16 is an old-vine Zinfandel that is a proprietary selection owned by Kendall-Jackson for its Hartford Court label. The original plant material came to FPS in 1997 from a vineyard located on Wood Road in Forestville, Sonoma County, approximately 15 miles from the Pacific Coast. The vineyard was originally planted in the early 1900s, and the vines are head-trained on St. George rootstock. Don Hartford, owner of the Wood Road vineyard, noted: "This clone seems to do well in the cool Russian River Valley climate. It gets fully ripe while maintaining a great acid balance that promotes a bright fruit character as well as good weight and texture." Kendall-Jackson maintains another planting of this same Hartford clone on shallow gravelly (Huichica) clay loam soil atop a hill overlooking the Santa Rosa plain at Windsor, Sonoma County. Under cool, sometimes humid conditions, and shallow clay loam soil on a hillside, this Zinfandel clone is reported to ripen in a timely manner and produce concentrated flavors.

Zinfandel FPS 16 plant material was produced by shoot tip tissue culture propagation of the original Wood Lane plant material and became a Registered selection in 2006. Plant material may be obtained from Kendall-Jackson Nurseries, Santa Rosa, California.

PUBLIC HERITAGE ZINFANDEL CLONES

Several heritage ("old vine") clones may become publicly available through FPS in the future after more testing. Old-vine sources for Zinfandel plant material are sought after by wine makers. The theory is that grapes from very old vines maintained in the traditional head-trained style for vine balance produce more concentrated flavors. (Sullivan 2003) The concentrated flavors are believed to be the result of lower crop yields under those parameters. In 2002, two groups of heritage Zinfandel grapevines were donated to FPS for the benefit of the public.

Gary Morisoli donated nine varieties from the Napa Morisoli Heritage Vineyard, which is thought to have been originally planted in the late 1800s. The vineyard was predominately Zinfandel but, as is common in older California vineyards, there were other varieties present, including both wine and table grapes. Morisoli's grandfather (born 1902) said that as a teenager, he began to replace some of the old vines in the vineyard as they died. Morisoli suspects that some of the original plantings remained in the vineyard. (Anonymous 2002) In 2001, ampelographer Jean-Michel Boursiquot, the soon-to-be Director of ENTAV in France, author Jim Wolpert, and FPS Director Deborah Golino visited the vineyard to examine the vines. About one-and-a-quarter acres of the vineyard remained. Boursiquot was able to identify nine varieties of interest to FPS and the public heritage clone program, and the vines were marked with the correct variety names. In December of that year, Dr. Golino collected dormant wood from those mature vines for testing and treatment at FPS.

The original plant material donated to FPS tested positive for several viruses and must undergo shoot tip tissue culture propagation prior to certification for the Foundation block. It is possible that plant material for this old Zinfandel selection will be available to the public by 2012.

A second source of old vine Zinfandel arrived at FPS at the same time as the Morisoli selection. The source of this second group was the Gate Vineyard (Niebaum-Coppola Estate) in Rutherford, California. That original plant material tested positive for virus and must undergo shoot tip tissue culture propagation. This source of heritage Zinfandel could be available to the public as early as 2012.

CALIFORNIA HERITAGE ZINFANDEL PROJECT

Another group of old-vine Zinfandel clones being collected and preserved for the benefit of the public are from the former Heritage Vineyard for California Zinfandel, created at the UC Oakville Experiment Station in 1995. This effort has been directed by Dr. James Wolpert of the University of California, Davis, Department of Viticulture and Enology, and funded by UCD and Zinfandel Advocates and Producers (ZAP). ZAP is a trade association organized in 1991 and composed of producers and consumers devoted to Zinfandel wine produced primarily in the coastal valleys, Sierra foothills and the Lodi area of California.

In 1995, Dr. Wolpert and his colleagues began collecting budwood from certain well-known California Zinfandel vines which were more than sixty years old. Budwood

from twenty of those vines was sent to FPS under code names to commence the registration and certification process. The heritage clone Oakville trials were designed for both field performance and wine tasting comparisons; however, they were interrupted this year when the original heritage selections were removed from the Oakville vineyard due to concerns about the spread of leafroll virus from these vines. These twenty selections are currently not available to the public, but testing and virus indexing continue. It is hoped that a subset of the collection (selections testing negative for virus, freed from infection by therapy, and receiving positive recommendations from ZAP wine tasting trials) will be available in the future for public distribution.

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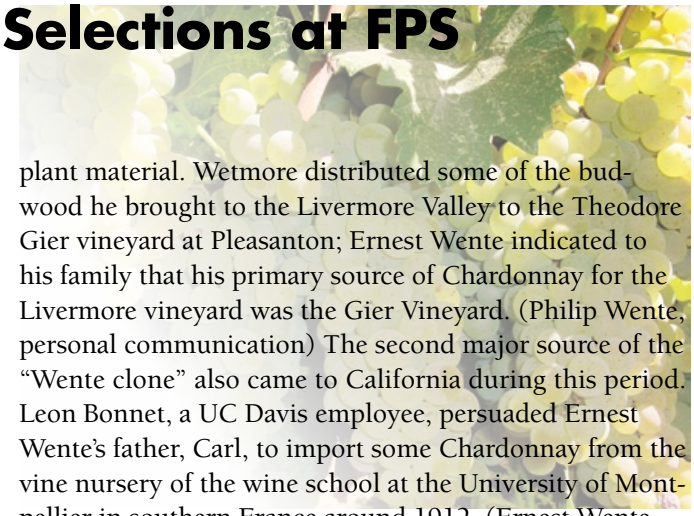
Summary of FPS Zinfandel and Primitivo selections; their sources, status and where they are available.

Variety	FPS sel #	Reported source	Reg. status	Available from	Disease test status	Treatment
Zinfandel	01A	Leon Handel Vineyard, Lodi, CA, in 1961	Registered 1962	FPS	All tests negative	None
Zinfandel	02	Leon Handel Vineyard, Lodi, CA, in 1961	Registered 1962	FPS	All tests negative	None
Zinfandel	03	Reutz Vineyard, Livermore, CA in 1964	Registered 1965	FPS	All tests negative	None
Zinfandel	06	Zinfandel 01A in 1966	Registered 1967	FPS	All tests negative	Heat treated 117 days
Zinfandel	08	Vineyard in Fulton, Sonoma County, in 1996	Registered 1998	Dempel Ranch Vineyards	All tests negative	None
Zinfandel	13	Vineyard in Kelseyville, Lake County, in 1999	Registered 2006	NovaVine, Inc.	All tests negative	None
Zinfandel	16	Wood Road in Forestville, Sonoma County, in 1997	Registered 2006	Kendall-Jackson Nurseries	All tests negative	Shoot tip culture
Zinfandel	29	Zinfandel 08	Provisional	Dempel Ranch Vineyards	All tests negative	Shoot tip culture
Primitivo	03	Dr. Austin Goheen brought from Bari, Italy, in 1968	Registered 1984	FPS	RSP+	Heat treated 59 days
Primitivo	05	Dr. Antonio Calò, Conegliano, Italy, in 1987	Registered 1994	FPS	All tests negative	None
Primitivo	06	Dr. Antonio Calò, Conegliano, Italy, in 1987	Registered 1994	FPS	RSP+	None

Chardonnay History and Selections at FPS



by Nancy L. Sweet, Foundation Plant Services, UC Davis

The noble Chardonnay grape of Burgundy and Champagne has long been a member of the wine aristocracy. The classic white wine grape, whose name means "a place of thistles" in Latin, traces its heritage to the Middle Ages and a small village of the same name in the Maĉon region of France. (Olmo 1971) Chardonnay has maintained its place at the top of the white wine hierarchy for centuries, within the precise French wine-making tradition. The esteem with which it has been held in France is reflected by a comment from Alexandre Dumas, the French novelist, who was quoted as saying that one high quality French Chardonnay named Montrachet should be sipped only while kneeling and with head bowed. (Taber 2005)

Chardonnay found its way to the New World in the late 19th century when California was awakening to the possibilities of its own wine industry. Uncertainty relative to the precise time of its arrival was caused by a combination of lack of knowledge about the variety and mislabelling of newly-introduced Chardonnay grapes. Notwithstanding morphological and physiological differences, the Chardonnay variety has long been confused with the true Pinot blanc variety and, on occasion, with Melon. (Galet 1998; Christensen et al. 2003). Additionally, the identity confusion in California was aggravated by the use of alternate spellings and erroneous names for the variety, including Chardenai, Chardonay, Pinot Chardonnay, Pinot blanc Chardonnay, and White Pinot. (Olmo 1971)

Some sources indicate that Chardonnay was present in California by the 1880s. In 1882, Charles Wetmore, the President of the California State Viticultural Commission, imported Chardonnay budwood from Meursault in Burgundy and distributed it in the Livermore Valley, the site of Wetmore's own winery, La Cresta Blanca. (Asher 1990) Chardonnay appeared in the catalogue of the Barren Hills Nurseries of Felix Gillet in Nevada City in 1888-89. University of California (UC) records from 1896 show that university researchers E.W. Hilgard and F.T. Bioletti had tested Chardonnay grapes (under the name "Pinot blanc Chardonnay") and Pinot blanc grapes sent to them from around the state. (Amerine 1990) Additional documents show that Chardonnay was grown in the University or substation vineyards in the late 19th century. (Olmo 1971)

Many of the important current sources of Chardonnay budwood at Foundation Plant Services (FPS) have their genesis in imports by California growers around the turn of the 20th century. The Wetmore budwood provided an integral component of the well-known "Wente clone" plant material. Wetmore distributed some of the budwood he brought to the Livermore Valley to the Theodore Gier vineyard at Pleasanton; Ernest Wente indicated to his family that his primary source of Chardonnay for the Livermore vineyard was the Gier Vineyard. (Philip Wente, personal communication) The second major source of the "Wente clone" also came to California during this period. Leon Bonnet, a UC Davis employee, persuaded Ernest Wente's father, Carl, to import some Chardonnay from the vine nursery of the wine school at the University of Montpellier in southern France around 1912. (Ernest Wente, oral history 1969; Asher 1990) The third major source of California Chardonnay was imported from Burgundy by Paul Masson for his La Cresta Vineyard in the Santa Cruz Mountains in 1896. (Asher 1990)

Notwithstanding the importations by California growers, UC researchers did not recommend that growers plant Chardonnay for wine making in the early 20th century. (Amerine 1990) Much of the state's existing Chardonnay was destroyed during Prohibition because the delicate thin-skinned fruit could not withstand shipment to the East Coast for home winemakers. (Olmo 1971) The result was that Chardonnay had a very limited presence in California vineyards at the end of Prohibition in 1933. The only Chardonnay acreage with commercial potential in California at that time were the Wente and Masson vineyards.

Around the time of WWII, the University of California did recommend Chardonnay as a desirable variety for producing quality table wine in the cooler regions of the state, namely, Winkler climate regions I and II (e.g. the Central or North Coast regions of California) and tentatively III (e.g. the Livermore Valley). (Amerine 1990) One of the strengths of Chardonnay is its malleability—it adapts and thrives in diverse climates and in a wide range of soil types. Vine yields vary considerably (2 to 8 tons per acre) by climatic region, clonal variation and viticultural practices. (Christensen et al. 2003)

Chardonnay thrives in cool districts such as Winkler Region 1, where it produces lighter, crisper, more neutral wines with higher acidity which are frequently used in sparkling wines. However, Chardonnay vines leaf out and bud early and are susceptible to damage from early spring frosts, which can be a disadvantage in the cooler areas. (Olmo 1971) Chardonnay also excels in warmer areas where the fruit ripens more fully in the longer growing season and produces more highly-flavored wines than in the cooler zones.

Despite the UC recommendation, there was still a hesitancy to produce much Chardonnay wine in the 1950s. The variety demonstrated low fruit yields and frequently suffered from viruses in California. Moreover, the wines produced were usually mislabeled as Pinot chardonnay. (Amerine 1990) By 1960 it was estimated that only about 150 acres of Chardonnay existed in California, mainly in Alameda and Napa counties. (Christensen et al. 2003) An indication that Chardonnay remained a minor player is the fact that, prior to 1968, Chardonnay acreage was reported by the California Department of Food and Agriculture (CDFA) as part of the "Miscellaneous" category in its statistical reports. (Amerine 1990)

The grape and wine industry showed an increased willingness to experiment with the Chardonnay variety in the 1960s. Davis experts, led by University of California viticulturalist Dr. Harold P. Olmo and USDA-ARS plant pathologist Dr. Austin Goheen, selected and tested promising California clonal material and subjected it to heat treatment to eliminate the viruses that impeded yields. The result was higher-yielding, virus-tested clonal material that produced effectively in various climate zones, including the warmer interior valleys in California. An increase in Chardonnay acreage in this period was also attributed to improved production efficiency and improved wine quality. The reported Chardonnay acreage in California in 1968 was 986 bearing acres. By the mid-1970s, the acreage had steadily increased to a total of more than 7000 bearing and nonbearing acres, including all five California climate regions. (Amerine 1990)

California's very young Chardonnay industry was about to be an unwitting participant in a controversy which would publicly challenge the esteemed French wine makers. In 1976, the unassuming siblings of the ancient French Chardonnay grape caused a shock wave in the wine world when a California Chardonnay, Chateau Montelena 1973, bested some of France's most prestigious whites in a low key blind tasting in a Paris hotel. New York Times reporter George M. Taber chronicled the event in his book, "*Judgment of Paris: California vs. France and the Historic 1976 Paris Tasting that Revolutionized Wine*." Leading French wine experts awarded California Chardonnays four of the six top places in that tasting. All nine judges gave their highest scores for white wine to a California Chardonnay, either Chateau Montelena or Chalone. (Asher 2002)

Following the Judgment of Paris in 1976, California Chardonnay plantings increased exponentially. Chardonnay acreage quadrupled from 2700 to 11,000+ acres between 1970 and 1980, and then quadrupled again to 45,000 acres by 1988 to overtake France's total Chardonnay acreage. (Wolpert et al. 1994; Robinson 2006) The familiar "California style" Chardonnay wine—ripe, buttery, and oakey—was developed with riper grapes, acid-lowering malolactic fermentation and aging in oak barrels. The mania continued with a huge increase in planting of Chardonnay grapes in California, peaking in the mid-1990s. By the turn of the 21st century, Chardonnay was the state's most widely planted wine grape variety, with total acreage exceeding 100,000 acres. (Christensen et al. 2003)

The overproduction of Chardonnay and widespread success of the California-style wine made it fashionable for some wine drinkers to begin to complain about "flabby" or "fat" Chardonnays and to "boycott" (Anything But Chardonnay) the variety as passé. Chardonnay producers responded to the criticisms with the increased popularity of a crisp new style involving fermentation in steel barrels and high acidity, offered as an alternative to the full, rich, oaky version. The discussion continues today among wine makers and wine drinkers as to which style shows the grape to its best advantage. Chardonnay continues to successfully survive its critics.

In 1991, DNA fingerprinting performed on Chardonnay revealed that one of the noble grape's ancestors was a viticultural "commoner." Microsatellite analysis showed that the parents of Chardonnay were the Pinot grape and nearly-extinct Gouais blanc, both of which were widespread in northeast France in the Middle Ages. (Bowers et al. 1999b) The Pinot parental line offers a possible explanation for the longtime misidentification of Chardonnay as the "white Pinot." It is theorized that Gouais blanc vines were given in the 3rd century to what was at the time Gaul by Probus, a Roman Emperor from Dalmatia. Gouais blanc is the same variety as 'Heunisch weiss' which was previously grown in Eastern Europe as 'Belina Drobna.' The lack of respect the French had for the Gouais grape is illustrated by the fact that the name was "derived from an old French adjective '*gou*'—a term of derision." The Gouais grape was grown by peasants on land not considered acceptable for a Pinot or another noble grape. Gouais blanc is no longer planted in France. Famous siblings from the same fertile Pinot x Gouais blanc cross include Aligoté, Melon, and Gamay noir. (Bowers et al. 1999b)

The noble Chardonnay has persisted atop the white wine hierarchy amid the challenges and surprises. The variety is succeessful in multiple climates, soils, and wine-making styles because of its adaptability. Chardonnay continues to have the greatest acreage of the wine grapes planted in California. Statistics reported by the Wine Institute (California) and WineBusiness.com for 2006 wine sales show that Chardonnay is still the top-selling variety in the United States. It remains the most important premium white table wine variety in the world.

CLONAL DEVELOPMENT IN CALIFORNIA

FPS maintains a large collection of Chardonnay selections, most of which are available to the public. The FPS selections embody two main styles of the Chardonnay grape. Traditional Chardonnay grape clusters are small to medium size and cylindrical. The berries are small and round and have thin skins. Chardonnay often suffers from *millerandage*, whereby clusters contain both normal- and small-sized berries, known as "hens and chicks" or "pumpkins and peas." (Christensen et al. 2003; Robinson 2006) The second style of Chardonnay differs from the traditional form in flavor profile. Clones known as Chardonnay *musqué* are an aromatic subvariety of Chardonnay that has a slight muscat flavor, probably caused by an accumulation of monoterpenes during fruit maturation. (Reynolds et al. 2007) There is a third Chardonnay form, a rare pink mutant called Chardonnay rosé, which is not available in the FPS collection.

California Chardonnay plant material in the post-WWII period, when the wine industry was initially developing the grape as a wine varietal, had two primary sources—the Wente vineyard in Livermore and the Paul Masson Vineyard in the Santa Cruz Mountains. As noted previously, there were two separate French sources of Chardonnay grapes for the vines in the Wente vineyard. Distinct clonal lines emerged from the Chardonnay developed from these sources. Distinctions between clones are manifested by subtle morphological and biochemical differences. Researchers have proved that clonal diversity within ancient winegrape cultivars such as Chardonnay has a genetic basis accounted for "by the differential accumulation of somatic mutations in different somatic lineages." (Riaz et al. 2002) Chardonnay is very adaptable to many climates and soils; clonal variation results over time when plant material from the same source is dispersed to various climate and topographical regions throughout the state. Several researchers have observed differences in Chardonnay clonal selections, manifested in yield, vigor, fruit intensity and composition, and flavor profiles. (Christensen et al. 2003; Bettiga 2003)

Formal grape clonal selection programs in the United States have not received the financial support that has allowed European programs to progress. Despite this limitation, Dr. Olmo was able to make a great contribution to Chardonnay clonal selection in the late 1950s. He had observed that the Chardonnay plant material available in California at that time produced low yields with shot berries and suffered from viruses. Dr. Olmo attributed those qualities to the lack of interest in the variety by the California grape and wine industry. (Olmo, undated) He conducted Chardonnay trials at Louis Martini's Carneros

A few undersized berries interspersed among normal-sized grapes, also known as 'hens and chicks' can be seen on this cluster of Chardonnay FPS 72. This condition can have varying amounts of small berries in proportion to the number of larger ones.
photo by Jarue Manning

vineyard and at the University's Oakville vineyard in the 1950s and 1960s and identified several selections for virus elimination treatment in Dr. Austin Goheen's program at Foundation Plant Services. These eventually became the most widely planted Chardonnay selections in California. The Olmo Chardonnay program increased the yield of Chardonnay vines substantially, raising the average yield from ½ ton per acre in the 1950s to over 5 tons per acre. (Christensen et al. 2003)

The term "Wente clone" is pervasive in the Chardonnay story because many growers, as well as Dr. Olmo, obtained budwood either directly or indirectly from the Wente vineyard in Livermore. Philip Wente stated in an e-mail: "The primary interest in obtaining wood from [the Wente] vineyard was that it had been continually selected by Ernest Wente for vines showing desirable traits and replicated in different new vineyard selections over 30 to 40 years. That wood was non-existent in the few other Chardonnay vineyards in the state at the time. CDFA records indicate around 230 acres of Chardonnay in California in 1960, so there were most likely only a few growers … our records showed Wente with about 70 acres at that time." The term "Wente clone" can be confusing in that it has been used both for an older selection with small clusters that sometimes contain a high percent of shot berries and for the more productive selections at FPS that can be traced back to the Wente Vineyard. (Christensen et al. 2003) The "old Wente" clone is notable for its frequent "hens and chicks" berry morphology and clonal variation in flavor and aroma. (Asher 1990) The heat-treated UC selections developed from the Wente grapes do not exhibit the *millenderage* ("hens and chicks") tendency. Some of the clonal variants derived from the Wente material are known by names such as Robert Young, Stony Hill, and Curtis clone(s). Chardonnay-*musqué* style Wente variants include Spring Mountain, See's, Sterling and Rued.

A fact of historical interest is that FPS at one time possessed plant material which originated directly from the

Wente Livermore Vineyard. **Chardonnay FPS 03** came to FPS around 1963 with a source designation of "Wente 6 v18" and "Wente 10 v27," and was not heat treated. This selection was planted in the Foundation Vineyard in 1964 and first appeared on the Registered list that year as Chardonnay FPS 03. In 1965, the name was changed to **Chardonnay FPS 03A**. It disappeared from the Registered list in 1966 but was still distributed by FPS as late as 1968. Austin Goheen wrote in 1986: "Chardonnay 3A was a selection from a commercial planting in Livermore Valley. It was abandoned in 1968 because it did not set normal fruit [it had shot berries]." (Goheen paper 1986)

Two of the first to propagate vineyards directly from the Wente's vineyard were Fred and Eleanor McCrea, who harvested wood from the Livermore vineyard in 1948 for their new vineyard at Stony Hill above Napa Valley (Asher 1990; Letter from Virginia Cole 1992) With the permission of Herman Wente, they took cuttings "at random" from a great number of Chardonnay vines throughout the Wente vineyard. The McCreas then planted the wood at their Stony Hill vineyard in St. Helena. They were early pioneers in Chardonnay planting in California at a time when there were less than 200 acres of Chardonnay planted. Later, others such as Louis Martini and Hanzell took Wente clone wood from the McCreas' Stony Hill vineyard.

Louis Martini, Jr. took wood, which he referred to as the "Wente clone," from Stony Hill Chardonnay vines for planting at the Martini family Stanly Lane Vineyard in Carneros in 1951 or 1952. (Olmo undated) The name "Stanly Lane" is derived from the historic ranch of Judge John Stanly. In 1942, Martini purchased 200 acres of the Stanly Ranch and years later began clonal experimentation with several varieties including Chardonnay. (Olmo undated; Winter 2007) Martini selected 30 individual vines at Stony Hill and budded 20 grafts from each of the 30 vines onto St. George rootstock. He later allowed UC Davis to use these 600 vines for trials. (Olmo undated)

Dr. Olmo began clonal selection of Chardonnay for the UC Davis collection in the early 1950s. His goals were to improve yield, eliminate the shot berry quality of many Chardonnays, and select against vines that appeared to be infected with virus. After measuring vine yields and making small wine lots in glass from the vines in the Martini vineyard for a number of years, Dr. Olmo made selections for the University's clonal propagation program from the Stanly Lane vines beginning in 1955. The wood for what was later to become **Chardonnay FPS selections 04–08** and **14** (the "Martini selections") was taken from the Stanly Lane vineyard in Carneros. (Olmo undated)

Dr. Olmo then advanced three of the Martini selections (Olmo #68, #70, and #72) to field and wine trials at the UC Oakville Experimental Vineyard from 1960 to 1966. He compared them to one clone obtained in Meursault, France (former FPS Chardonnay 02 and Olmo number 812) and two clones from Alsace, France (Olmo numbers 430 and 439). In the Oakville experiment, the Martini selections yielded as much as 5 tons, which was 2 to 3 tons per acre more than the French selections, which were abandoned long ago by FPS. (Wolpert et al. 1994; Olmo undated; Goheen paper 1986)

In 1964, the initial group of Martini selections, which were then identified by numbers given to them by Dr. Olmo (for example, Olmo #66 (FPS 04), #68 (FPS 06 and 08) and #69 (FPS 05)), were taken to FPS for heat treatment to rid them of any virus. The issue of whether or not heat treatment eliminated virus was not well-settled at that time. USDA-ARS Plant Pathologist Dr. Austin Goheen explained in a 1985 letter: "Chardonnay became one of the first cultivars to test out the possibility of thermotherapy. We took the best appearing vines and heat treated them. From the explants that we obtained we indexed several lines. One line, which indexed disease-free and which was easily recognizable as a good Chardonnay, was registered in the California Clean Stock program." (Goheen 1985)

Vines produced from single buds that were heat-treated were given unique selection numbers even if the buds were taken from the same original parent plant. For example, FPS selections 06 and 08 were both propagated from the same source vine, designated Olmo #68, at the Stanly Lane property. Each of these so-called Martini selections was heat-treated for a different period of time. The heat-treated Martini Chardonnay selections released to the public through the California Registration & Certification (R&C) Program for Grapevines are also sometimes referred to as "heat treated Wente clones."

CALIFORNIA AND WASHINGTON CLONES

Chardonnay FPS 04 (formerly Olmo #66) and **FPS 05** (formerly Olmo #69) were two of the selections brought to FPS by Dr. Olmo from the Martini Carneros vineyards. Both selections underwent heat treatment for 90 days and were first registered in the California R&C Program for Grapevines in 1969.

In the 1960s (prior to the time FPS selections 04 and 05 were released as Registered plant material) Curtis Alley, a UC Davis viticulture specialist, combined the two selections into what he called "clone 108"—most likely due to the fact that despite originating from separate mother vines, the two selections had undergone heat treatment for the same length of time. "Clone 108" was also variously called the "Davis clone" or the "Wente clone," and was distributed throughout the 1960s when it was used to

Clusters of Chardonnay FPS 04 hang in the foundation vineyard at FPS. One of the FPS selections constituting 'clone 108,' it was widely planted and included in most field trials. *Photo by Bev Ferguson*

plant most of Washington State's and half of Napa's Chardonnay. (Asher 1990; Goheen letter 1986)

Wente Brothers was one of the early recipients of the heat-treated derivative of the old Wente clone for their new property in Monterey County. Philip Wente confirms that Wente Vineyards records show that in 1963 Wente received wood from FPS from location "G9 v5-6," which at the time was known as clone 108 but was later identified as FPS 04. Wente planted clone 108 in new increase block 36 at Arroyo Seco. Clone 108 was separated into FPS selections 04 and 05 in 1969 due to the fact that the selections had originated with different vine sources.

Chardonnay FPS 06 and **08** (both formerly Olmo #68) were taken from the same vine at the Martini vineyards. FPS 06 and FPS 08 received individual FPS selection numbers as they underwent heat treatment for different lengths of time; 164-2 days and 114-3 days, respectively. FPS 06 yielded over four tons per acre in the field trials conducted by Dr. Olmo in the late 1950s, making it the highest yielding selection of the Stanly Lane vines. Chardonnay FPS 06 and FPS 08 first appeared on the FPS Registered list in 1973.

Chardonnay FPS 09, 10, 11, 12 and **13** were all propagated from FPS 08 in the late 1960s. FPS 09 and 10 underwent heat treatment for 102 days; FPS 11 and FPS 12 for 116 days; and FPS 13 for 144 days. They all first appeared on the FPS Registered list in 1973.

Chardonnay FPS 14 (formerly Olmo #65) came to FPS from the Martini Stanly Lane vineyard via UC Davis' West Armstrong tract in the late 1960s. It was subjected to heat treatment for 111 days and first appeared on the Registered list in 1974.

Although widely planted on the West Coast, the "Davis clones" have been criticized by some winemakers who feel that a healthy yield capacity is at odds with production of high quality wine. Others believe that the Davis plant material such as "clone 108" is desirable if a crop is controlled by holding yields to a certain maximum amount such as three or four tons per acre). (Asher, 1990) The following statement appeared in the journal *Wine & Spirits* in April 1994:

> "The Chardonnay clones selected and developed for the industry in the 1970s by Dr. Harold Olmo and his colleagues at UC Davis, particularly the dependable, high-yield clone #108, accomplished the goal of making Chardonnay commercially viable in California. By raising the basic level of quality, Dr. Olmo's work conferred the freedom to pursue a more elusive aesthetic ideal. For years, that pursuit was conducted furtively with suitcase clones smuggled in from France and propagated on the sly, unfortunately with their viral diseases and other problems intact." (Smith 1994)

In contrast, Bill Knuttel, Chalk Hill winemaker, was quoted in *Trellis Talk* in June 2000 about Chardonnay 04:

> "Growers should not forego any of the clones that have been in use, especially FPMS 4 … [which] is more subject to vintage variation than some other clones, especially because of yield, but with the right site and vintage conditions, it normally produces healthy yields and good wine. Many of the great Chardonnays of 1994 and 1995 had clone 4 as a base."

The FPS "Martini" selections (Chardonnay FPS 04, 05, 06, 08, 14) and their propagative offspring (Chardonnay FPS 09-13) have undergone several field trials to assess their performance in various California climate zones. FPS 04 and 05 have been the Chardonnay workhorses in the state since they were initially distributed together as "clone 108." Either FPS 04 or 05 is invariably included in every California study of Chardonnay selections.

UC Davis researchers conducted field trials at Jaeger Vineyards and Beringer Vineyards in the Napa Valley between 1989–1991. The purpose was to evaluate clonal differences among six certified virus-tested FPS selections (Chardonnay FPS 04, 05, 06, 14, 15, 16). Only clones testing free of virus were used to ensure that observed differences were genetic and not due to virus status. Both FPS 04 and 05 had characteristic high yields with large numbers of heavy clusters and high numbers of moderately heavy berries per cluster. FPS 06 yielded more but lighter clusters, with fewer berries per cluster than FPS 04 and 05. FPS 06 and 15 (discussed below) exhibited the greatest pruning weights at both sites. (Wolpert et al. 1994)

Field performance of the same six FPS Chardonnays plus Chardonnay FPS 09 was assessed in the Salinas Valley in 1994–1996, with similar results to the Napa trials. FPS 06 and 09 originated from the same plant material in the Martini Stanly Lane vineyard (Olmo #68) but underwent heat treatment for different periods of time. (Bettiga 2003)

Chardonnay FPS 04 and 05 again showed the highest yields, attributable to higher cluster weights, large berry size and weights, and higher numbers of berries per cluster. Titratable acidity was highest and pH lowest for selections 04 and 05; the later maturity of these selections had also been observed in prior experiments. This tendency to later maturity has ripening implications for cool climate areas with shorter growing seasons. (Bettiga, 2003)

Pruning weights were highest for selections Chardonnay FPS 06, 09 and 15, which was similar to the Napa trials, and those three selections were in a group with intermediate yields, fewer berries and clusters and lower berry weights than selections FPS 04 and 05. FPS 06 and 09 showed modest yields with a higher number of smaller clusters per vine. However, no significant differences in yield, growth or other experimental parameter were detected for FPS 06 and 09, leading the researchers to conclude that the different heat treatment periods imposed on the two selections from the same source vine did not influence vine performance. (Bettiga 2003)

The heavy clusters driving the high yields exhibited by Chardonnay FPS 04 and 05 in the cool-climate trials could be problematic in the warmer climate regions of California on the theory that large tight clusters could suffer more sour rot than smaller or lighter clusters. Approximately 7% of the state's Chardonnay is grown in the San Joaquin Valley. (Fidelibus et al. 2006)

Researchers in Fresno County evaluated the performance of Chardonnay FPS 04, 06, and 15, along with two Italian clones and one French clone (discussed below) for performance in a warm climate. Data from 2000–2003 revealed a "strikingly significant," more so than Napa and Salinas, year x clone interaction for yield and yield components for FPS 04 and 15. For three of four years, FPS 04 showed the fewest and heaviest clusters; this was attributed to having more berries per cluster. The researchers rated the Chardonnay FPS 04 fruit as having the most desirable fruit composition of the clones tested, with higher Brix, lower pH and higher titratable acids. The longer growing season of the warm climate region favors the fruit in this late-maturing selection. However, FPS 04 and two others (FPS 20 and 37) had the highest incidence of susceptibility to sour rot. That trait is a major disadvantage for FPS 04 when grown in the warm climate area of the California Central Valley. The researchers ultimately recommended that growers in that region consider Chardonnay FPS 15 rather than Chardonnay FPS 04 due to its low bunch rot potential. (Fidelibus et al. 2006)

Chardonnay FPS 15 was sent to UC Davis in 1969 by "the father of Washington Wine," Dr. Walter Clore, of the Irrigated Agriculture Research and Extension Station (IARES) in Prosser, Washington. Dr. Walter Clore was a horticulturalist associated with Washington State University's Prosser Experiment Station for 40 years. He presided over field and wine trials for 250 grape varieties, including Chardonnay, and was primarily responsible for convincing Washington growers that premium wines could be made from *vinifera* grapes grown in Eastern Washington. Clore planted variety blocks at Prosser beginning in the late 1930s using *vinifera* material that he and his mentor, Sunnyside farmer and winery owner W.B. Bridgman, imported from Europe and from California growers. (Clore et al. 1976; Irvine et al. 1997)

Chardonnay FPS 15 has been known in the state of Washington as "the Prosser clone." Other than a location designation "Prosser LR 2v6", the origin of Chardonnay FPS 15 is not clear. The Clore variety blocks at Prosser were split into "High" and "Low" sections. FPS 15 was from row 2 vine 6 of the Low section variety block. The selection underwent heat treatment at Davis for 173 days and has since tested negative for viruses. Chardonnay FPS 15 was registered in the California R&C Program for Grapevines in 1974 and has been one of the most requested Chardonnay selections in the past five years.

A 1-½ acre variety trial was established at the IAREC vineyard in 1965 using premium wine grapes including Chardonnay; the analysis of the experiment does not report a source for the Chardonnay plants used in the trial but does indicate that the material in the trial was known to be infected with virus. Data on yields and fruit composition were reported for 1967-1970. The Chardonnay in the trial was one of the lowest yielding varieties, with 3.78-5.59 tons per acre, and had loose clusters and an excessive amount of shot berries. It was infected with leafroll virus. Grape maturity and fruit analysis figures for the four-year period of the trials varied from: °Brix 21.3 to 23.1, which was within the range of FPS 15 in Fresno 22.8 and Salinas 23.2; 0.76 to 1.03 percent titratable acid, which was higher than Fresno 0.58 and Salinas 0.65; and pH 3.20 to 3.43, which was lower than Fresno and Salinas 3.70 and 3.61. (Clore et al. 1972) The grape morphology, timing of the Washington IAREC trial, and the fact that the Chardonnay in the trial was virus-infected suggest that this Chardonnay was the clone that eventually became FPS 15.

Chardonnay FPS 15 has been evaluated in numerous California field and wine trials. In addition to the trials mentioned above, UC Cooperative Extension Specialist Larry Bettiga began a second trial in Monterey County in 1995 near the city of Greenfield. Chardonnay FPS 05 and 15 were used as standards to compare with some French and Italian clones. (Bettiga 2002, unpublished) Chardonnay FPS 15 was also included in the Chalk Hill trial at Healdsburg, Sonoma County, begun in 1989. FPS 15 produced relatively low to moderate yields in all the trials.

Yields for the trials in the cooler growing areas were:

County	Vineyard	kg/vine	Researcher(s)
Napa	Jaeger/Beringer	9.3	Wolpert et al. 1994
Sonoma	Chalk Hill	4.94-8.12	Heald and Heald 1999
Monterey	Salinas/Zabala	3.83	Bettiga 2003
Monterey	Salinas/Pacific	6.79	Bettiga 2002

In the Fresno County trial, Chardonnay FPS 15 yielded an average of 19.9 kg/vine for the four-year period, which was the lowest of the six selections tested. FPS 15 experienced erratic fruit yield over the years as indicated by significant year x clone interaction in some of the trials. The lower yields were also attributed to lower cluster weights due to smaller and fewer berries per cluster. A large number of shot berries was reported in all the trials except for Fresno. In summary, although FPS 15 demonstrated high vine vigor in the trials, it produced lower yields due to higher numbers of smaller, loose clusters.

The Fresno and Sonoma/Chalk Hill researchers found FPS 15 to be "sour-rot resistant" and "rot resistant," respectively. The Fresno researchers found 70-90% fewer clusters with sour rot in FPS 15 than with the other selections tested. The cluster morphology and sour-rot resistance led them to recommend Chardonnay FPS 15 for the warmer growing areas of the Central Valley. (Fidelibus et al. 2006)

Chardonnay FPS 15 has received good marks for fruit composition in some of the trials. The Fresno researchers concluded that FPS 15 had acceptable fruit quality due to fewer soluble solids and high titratable acidity. In trials at Simi in the early 1990s, it was concluded that FPS 15 had a great "intensity" of fruity flavor, which could be excellent for blends. (Letter from Viriginia Cole 1992) The Chalk Hill researchers found FPS 15 to be one of the five most preferred clones in the wine tasting category of the trials due to consistently high quality wine produced over the years; FPS 15 was advanced to further trials at Chalk Hill. (Heald and Heald 1999; Trellis Talk 2000) The researchers concluded: "[FPS 15] is projected to be ideal for cool climates and Reserve Chardonnay programs." (Heald and Heald 1999)

One of the other popular FPS Chardonnay selections is **Chardonnay FPS 17**, from the Robert Young Vineyard in Alexander Valley. Its original source vines have often been referred to as "the Robert Young clone" which was planted with budwood brought from the Wente vineyard in Livermore in the 1960s. (Asher 1990) FPS 17, a proprietary selection held for Robert Young Vineyards, underwent heat treatment upon its arrival in Davis in 1982 and first appeared on the FPS Registered list in 1987.

FPS 17 was included in the Chalk Hill trials in Sonoma County. The 1996 harvest showed that FPS 17 had a moderate yield amounting to 6.5 tons per acre—higher yielding and with larger clusters than FPS 15. Chardonnay FPS 17 had many small shot berries and showed some rot resistance. The researchers concluded that it might be suitable for cool climate areas and rot-prone sites. Data taken over a four-year period showed the following ranges for FPS 17: Brix 22.4-23.3, pH 3.30-3.44, and low titratable acid levels 5.7-7.9. FPS 17 was considered one of the most promising selections in the trial because it consistently produced high quality wines over the years. (Heald and Heald 1999; Trellis Talk 2000)

Chardonnay FPS 72 was generously donated to the FPS public collection by the Wente family from a production block in the Arroyo Seco appellation that has provided a rich source of Chardonnay plant material to many California growers. That plant material was once known in California as Chardonnay FPS 02A.

The story of **Chardonnay FPS 2A** began in the 1930s at UC Davis. FPS Chardonnay-1 was planted in 1956 in one of the first Foundation vineyards in Davis, described in the 1956 Registered List as "vineyard at the intersection of S.P. R.R. and U.S. 40 in the old Agronomy field." The source listed for Chardonnay-1 on the old registered lists and FPS records, "I 57-12, UCD." I 57-12, UCD, is a field location for a Chardonnay vine shown in very old Olmo maps of the Department of Viticulture and Enology's Armstrong Vineyard Block "I," and its history can be traced in the old maps back to a source called D3: 19-21, which was a block location in the Armstrong Vineyard in 1930. There the trail goes cold. There was no further evidence in available UC Davis records as to the source of I 57 v12 / D3: 19-21. The oral tradition passed down through three generations of the Wente family indicates that Chardonnay 02A originated as a result of vineyard selection efforts by the Wentes. (Philip Wente, personal communication)

Old FPS distribution records show that the plant material described as Chardonnay-1 in the 1956 Registered list was distributed to FPS customers until 1961 (FPS Distribution Records, 1956-1961). When a new Foundation vineyard

was created around 1961, plant material was taken from the old Chardonnay-1 in order to do a heat treatment on it and release it under a different selection number. Chardonnay-1 itself disappeared from the Registered list in 1963 and was removed from the Foundation vineyard in 1967.

The plant material taken from Chardonnay-1 underwent 102 days of heat treatment in 1961-1962. The new selection was renumbered Chardonnay FPS 02A and planted in the new Foundation vineyard (¼ mile south of Straloch Road and ¼ mile west of Hopkins Road) in 1964. (FPS Indexing Records). Chardonnay FPS 02A was first distributed by FPS to customers in 1966. In fact, records from both FPS and Wente Vineyards show that 19 budsticks of Chardonnay FPS 02A were sent to Wente Vineyards in 1966 (FPS Distribution Records 1966; Philip Wente, personal communication) The Wente records show that the wood from those budsticks was planted in a production block near Greenfield in Monterey County. Wente Vineyards distributed wood from that production block to many growers throughout the state of California. (Asher 1990) FPS distributed Chardonnay FPS 02A to individual customers, wineries and nurseries until 1967; in 1968 it was removed from the list of Registered vines, and pulled out of the Foundation vineyard because of leafroll positive status in 1969.

Chardonnay FPS 02A resembles the "Wente clone" that was described above as the "older clone" with small clusters and shot berries. Dr. Jim Wolpert of the Department of Viticulture and Enology at UC Davis describes the vines as clean (no obvious virus symptoms on the leaves), with uniform production and small clusters with frequent "hens and chicks" morphology (*millenderage*). (Jim Wolpert, personal communication) Ralph Riva, Wente vineyard viticulturalist, indicates that this grape material produces four main flavor components—apple, muscat, pineapple and fruit cocktail—which results in a very good Chardonnay. (Ralph Riva, personal communication)

Despite the fact that Chardonnay FPS 02A had become a popular and widely-used "clone" in the state, FPS no longer had any plant material of that selection growing in the Foundation block after 1969. Around 1991, Dr. Wolpert and Ralph Riva collaborated in the effort to return Chardonnay FPS 02A plant material to FPS. Mr. Riva brought a large amount of FPS 02A wood from a single vine to FPS. That plant material underwent shoot tip tissue culture treatment for virus elimination and first appeared on the FPS Registered list in 2002 as Chardonnay FPS 72.

Robert Mondavi Vineyards has made two of its Chardonnay selections available through FPS. Mondavi's version of the Wente clone, **Chardonnay FPS 67**, arrived at FPS in 1995 as a proprietary selection. It underwent tissue culture treatment for virus elimination and first appeared on the FPS Registered list in 2002. **Chardonnay FPS 106** came to FPS in 1998 as a proprietary selection from Mondavi's Byron Vineyards in Santa Barbara County. It underwent tissue culture treatment and first appeared on the FPS Registered list in 2005. Both Mondavi selections were released to the FPS public collection in 2006.

Chardonnay FPS 79 and 80 came to FPS in 1996 from Sterling Vineyards, which farms approximately 1200 acres of vineyards throughout the Napa Valley. FPS Director Deborah Golino collected the plant material from one of Sterling's vineyards. The selections, described as Heritage Sterling muscat clones 1 and 3, consist of two Chardonnay *musqué*-type clones that were favored by both the winemaker and viticulturalist and believed to possess unique qualities. Both selections tested positive for virus and underwent shoot tip tissue culture treatment. They first appeared on the FPS Registered list in 2002.

Chardonnay FPS 97 is a proprietary Chardonnay selection held at FPS for Chalk Hill Estate Vineyards & Winery in Healdsburg, California. The selection originated from a vineyard planted in 1974 and exhibits cluster morphology similar to an "old Wente" field selection with loose clusters with many small shot berries. For that reason, Chalk Hill refers to it as the "Shot Berry clone." (Heald and Heald 1999) Chalk Hill's viticulturalist Mark Lingenfelder added, "Chalk Hill Winery still farms 13 acres of that original block planted in 1974 and it continues to be one of our best blocks in terms of wine quality." (Mark Lingenfelder, personal communication) Chardonnay FPS 97 came to FPS with virus in 1996 and subsequently underwent shoot tissue culture treatment. It first appeared on the FPS Registered list in 2003. Chalk Hill has recently incorporated FPS 97 into its ongoing clonal trials begun in 1996 and plans to begin making a separate wine from the vines in 2007 in order to compare selection FPS 97 wine attributes to the other 16 clones in the trial.

Chardonnay FPS 102 was donated to the FPS public collection in 1997 by Kendall-Jackson Vineyards, who refers to this selection as the "Z clone." The selection originated in Sonoma County and was described as an aromatic (muscat-type) Chardonnay in the nature of the Rued or Spring Mountain clones. Chardonnay FPS 102 underwent shoot tip tissue culture procedures for virus elimination and first appeared on the FPS Registered list in 2003.

A group of Chardonnay clones donated to the FPS public collection in 2002 promises additional clonal variety with aromatic overtones in Wente clone material. Larry Hyde, a well-respected Napa grape grower who has developed a variety of Chardonnay clones over the years, made six clones available to the public through FPS and the Cali-

fornia R&C Program for Grapevines. The 130-acre Hyde vineyard in the Carneros region supplies grapes from these and other clones to more than a dozen wineries, frequently resulting in high quality wines. The six selections are currently undergoing virus elimination treatment at FPS and may be available for release to the public as soon as 2012.

One of these six Chardonnay selections is the "Hyde clone" (FPS group number 7244)[1] and comes from a 20-year-old block at Carneros. The Hyde clone suffers from corky bark virus, which Hyde now accomodates by growing it on St. George rootstock. The clone is productive with high acidity. Larry Hyde explained that the grapes yield an unusual and unique complex flavor profile, characterized by "nutmeg as young wine, followed by a peach-like fruit flavor in one or two months." (Larry Hyde, personal communication)

The additional clones donated by Hyde to FPS are Wente-like Chardonnays which he believes are each unique in terms of flavor profile. Hyde obtained two of the selections (FPS groups 7245 and 7246) from the former Linda Vista Nursery and characterizes them as "clean and heat-treated" Wente selections. One of the Linda Vista selections (7245) has small clusters and poor set, and the other (7246) has been a favorite of some winemakers due to its small clusters of flavorful small berries. The fourth selection (group number 7247) in this additional group originated from the Wente Livermore vineyard. The fifth selection (group number 7008) is labelled as the Calera clone.

Finally, the sixth selection in the Hyde group (FPS group number 7248) is an aromatic (muscat) grape obtained by Hyde from the Long Vineyards in Napa. Zelma Long indicates that the Long Vineyard was planted above Lake Hennessey in the Napa Valley in 1966 and 1967, using a massal selection that the budder, Rudi Rossi, said was collected from the Martini Vineyards. Larry Hyde took cuttings from the Long vineyard for the material currently at FPS. Ms. Long, who has made wine for Simi Winery from Hyde's Long Vineyard selection, and made wine at Long Vineyard itself, indicates that the two groups of wines show different character. A grape sensory analysis she conducted at Long Vineyards showed five different flavor expressions in those grapes—yellow apple, citrus, spicy apple (nutmeg and ripe apple), white fruit (pear) and muscat (with citrus overlay)—each occurring in a different percentage in the vineyard, with the yellow apple and the citrus being the most common. (Zelma Long, personal communication)

[1] Selection numbers are only assigned when a selection has tested negative for virus and has been placed in the R&C Program.

CALIFORNIA MT. EDEN CLONES

Chardonnay FPS 27, 28 and **66** are field selections that originated from a Chardonnay line not derived from the Wente Vineyard.

Paul Masson immigrated to the San Jose, California, area in 1878, and he established a vineyard and winery, La Cresta, in the Santa Cruz Mountains. Wine grapes have been grown in that mountain appellation region since the 1860s, and Chardonnay's value as a base for sparkling wines was recognized by Masson and others at the turn of the century. (Olmo 1971) Masson imported Chardonnay plant material from Burgundy around 1896. A grower named Martin Ray took Chardonnay cuttings from the Paul Masson property and planted them in 1943 in a new vineyard property on a nearby 2000-foot peak called Mt. Eden in the Santa Cruz Mountains. The Chardonnay from that vineyard is called the "Mt. Eden clone." It has been described as "a low-yielding, virus-infected selection with small berries and tight clusters." (Christensen et al. 2003) Two of the wineries that have had success with this clone are Matanzas Creek Winery and Simi Winery.

Chardonnay FPS 27 and **28** were donated to the FPS public collection by Matanzas Creek Winery in 1984. Merry Edwards was the winemaker at both Mt. Eden Vineyards (1974–1977) and Matanzas Creek (1977–84) and took Mt. Eden plant material to Matanzas Creek. (Smith 1994) The selections donated by Matanzas Creek to FPS were "Matanzas Creek Mt. Eden Vineyard clones 1 and 2." Both selections underwent 61 days of heat treatment at Davis. Selection 27 first appeared on the FPS Registered list in 1992, and selection 28 appeared in 1994.

Chardonnay FPS 66 was collected in 1994 by FPS Director Deborah Golino from a Chardonnay block that had been planted by Simi Vineyards around 1990, in a newly developed Chardonnay vineyard on Piner Road in the Russian River Valley. The source of the Mt. Eden clone plant material was grower Larry Hyde's vineyard in Carneros. Simi had previously made wine from the Hyde grapes and appreciated the wine for its intensity and depth of feel. (Diane Kenworthy, personal communication) Ms. Long indicates that the vines from the Hyde vineyard were productive and of excellent quality and describes the wine from the Hyde grapes as having "depth and power and texture." (Zelma Long, personal communication) Dr. Golino, Ms. Kenworthy and Simi winemaker Zelma Long selected four vines from the Mt. Eden clone block at Simi. One of those four vines evolved into Chardonnay FPS 66. Upon its arrival at FPS, selection 66 tested positive for virus and underwent shoot tip tissue culture treatment for virus elimination. It first appeared on the FPS Registered list in 1999.

Chardonnay FPS 66 at the Foundation vineyard at FPS. A 'Mt. Eden' clone, the plant material originated in Larry Hyde's vineyard. *Photo by Bev Ferguson*

FRENCH CLONES

Recent imports from Europe have increased the clonal diversity of Chardonnay plant material available in California. Chardonnay is the leading white wine grape variety in France, where it is grown in Burgundy, Champagne, the Languedoc and a few other areas. In the French system, clonal material is subjected to extensive testing and certification; there are now 28 Chardonnay clones officially certified by the French Department of Agriculture. (Laurent Audeguin, personal communication). Some of the more popular of those French clones are **ENTAV-INRA® nos. 96** (most frequently propagated), **76, 95, 277 and 548**. **Clones 77** and **809** are popular French clones of the *musqué* type.

In the mid-1980s the Oregon Winegrowers' Association and Oregon State University (OSU) collaborated on a project related to a mutual interest in European clonal material. The California Chardonnay clones (in particular, "selection 108," also known as Chardonnay FPS 04 and 05) did not ripen in a timely manner in their more northern climate. David Adelsheim of Adelsheim Vineyard in Oregon and Ron Cameron at OSU worked together and successfully established relationships with Professor Raymond Bernard, viticulturalist and regional director at the Office National Interprofessionnel des Vins (ONIVINS) in Dijon, France, and Alex Schaeffer at the Station de Reserches Viticoles et Oenologiques, INRA, Colmar, France. The OSU program (no longer in existence) was able to import eight French Chardonnay clones selected by Bernard from Burgundian 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 in 1987–88 to make some of the French Chardonnay clones (the "Dijon clones") available for the public collection at FPS.

The French clones sent to FPS from OSU are public and considered "generic." The source for generic French clones is indicated on the FPS database using the following language: "reported to be French clone xx". This language is used to distinguish the generic clonal material from trademarked clones that are authorized by the Etablissement National Technique pour l'Amelioration de la Viticulture (ENTAV) and sent from the official ENTAV 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 clones.

The generic clones that came to FPS from Dijon via OSU are included in the official French catalogue of certified clones. The reported French source and corresponding selection numbers used to identify these materials at FPS are French 76 (FPS 69), French 77 (FPS 44 and 45), French 78 (FPS 39), French 96 (FPS 70), French 352 (FPS 41) and French 277 (FPS 42, 49 and 51). French 352 was from l'Espiguette and the other clones were from Dijon.

At the time the plant material arrived at FPS (1987-88), the California R&C Program regulations provided that RSP+ (tested positive for Rupestris Stem Pitting virus) plants could not come out of quarantine, so the RSP+ OSU Chardonnays all underwent shoot tip tissue culture treatment. The selections mentioned above appeared on the FPS Registered list gradually over a period of time between 1997 and 2002.

The Etablissement National Technique pour l'Amelioration de la Viticulture (ENTAV) was the first foreign entity to contract with FPS for Chardonnay importation services. ENTAV is an official agency certified by the French Ministry of Agriculture and responsible for the management and coordination of the French national clonal selection program. ENTAV maintains the French national repository of accredited clones and has created an ENTAV-INRA® Authorized clone trademark to identify its official clonal materials internationally. This trademark is a good indication that the clonal identity of a vine is correct. Trademarked importations come directly from official French source vines. ENTAV 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 ENTAV (as of this writing: California Grapevine Nursery, Herrick Grapevines, and Sunridge Nurseries).

The selection numbers used to identify ENTAV-INRA® authorized clones in the FPS collection equate to the same numbers used by the official trademarked clones; i.e., the three trademarked Chardonnay clones sent to FPS in 1997 are labeled authorized Chardonnay ENTAV-INRA® 76, 96 and 548 as well as Chardonnay FPS 76, 96, and 548, respectively. The three selections became registered in the California R&C Program for Grapevines in 2000.

Laurent Audeguin of ENTAV summarized the performance of these three FPS registered selections. ENTAV-INRA® 76 is a regular clone in terms of production and quality; the wines obtained are representative of the variety: aromatic, fine, typical and well-balanced. ENTAV-INRA® 96 demonstrates good vigor and a high level of production; the wines obtained are aromatic, elegant and sharp. ENTAV-INRA® 548 has lower-than-average production due to small and loose clusters with high sugar potential; the wines are aromatic, complex and concentrated with good length. All three selections have good aging potential if yield is controlled. (Laurent Audeguin, personal communication).

Chardonnay is key to many fine sparkling wines. Domaine Mumm contracted with FPS to import five Chardonnay clones from Champagne Perrier-Jouet, France in 1988 for the Domaine Mumm vineyards and the FPS public collection. None of the importations were duplicates of other registered FPS selections. This contract was entered into prior to the time of the ENTAV-INRA® trademark program, so the clones are generic clones and contain the reference "reported to be French xx." The imported clones with the FPS selection number in parentheses behind the reported French clone number are **French 75 (FPS 43** and **46), French 95 (FPS 37 and 38), French 116 (FPS 83), French 117 (FPS 81)** and **French 125 (FPS 40)**. All of the selections underwent shoot tip tissue culture treatment for virus elimination and first appeared on the FPS Registered list in 1997 (FPS 37, 38 and 46), 1998 (FPS 43), 1999 (FPS 40) and 2002 (FPS 81 and 83).

Some of the French clonal material available in the OSU, ENTAV and Domaine groups has been included in research trials in California. Farm advisor Larry Bettiga evaluated French clones 75, 76, 78, 95 and 96 in his Pacific Vineyard trial in Monterey County. French clones 76, 95 and 96 were in the moderate-to-high yield group with Chardonnay FPS 05, but were more consistent in performance over the years. Clones 95 and 96 had a high number of moderate to large berries per cluster. He found that "under cooler bloom conditions berry set and development has observed to be more uniform." Vine vigor and °Brix were higher than FPS 04 and 05. Clones 76 and 78 had a greater number of smaller weight clusters with fewer berries than 95 and 96. Clone 75 showed medium cluster weights with above-average numbers of small berries per cluster. Vine vigor was weak to moderate. (Bettiga 2002, unpublished)

Matthew Fidelibus, a UC Cooperative Extension viticulture specialist, included French clone 95 (Chardonnay FPS 37) in his Fresno County trial. The average yield for the four-year period was 23.2 kg/vine, which was not significantly different than FPS 04 and 06. Clone 95 was in the group with the highest average number of clusters per vine but produced an average cluster weight (0.24 kg) between those of FPS 04 (0.29 kg) and FPS 15 (0.20). Although berry weight for all three selections did not differ significantly, the number of berries per cluster for clone 95 was lower than FPS 04 and higher than FPS 15. Clone 95 had similar °Brix and pH levels as FPS 15, with lower titratable acid than both FPS 04 and 15. Clone 95, like FPS 04, often exhibited a high incidence of sour rot in the warmer climate. (Fidelibus et al. 2006)

The Chalk Hill trials in Sonoma included some French clones. In 1996, Clone 75 produced a low yield of 5.4 tons per acre, but the wine was highly rated as rich and concentrated. Clone 95 had the highest yield (6.4 tons per acre) of the four French clones and produced a "rich, well balanced wine." Clone 95 was one of the five most preferred clones from 1996. Clone 96 was the least-preferred of the four clones. Clones 78 and 352 produced moderate to high yields and good quality wines. (Heald and Heald 1999) The French clones have been included in the ongoing Chalk Hill trials.

Gloria Ferrer vineyard manager Mike Crumly and winemaker Bob Iantosca travelled to Champage in 1987 and met with the man in charge of clonal research for the Comité Interprofessional des Vins de Champagne (CIVC). The CIVC offered them cuttings from the plant material of their choice. Gloria Ferrer arranged for the Saanichton Plant Quarantine Station in British Columbia to import six Chardonnay clones from CIVC in Epernay, France, in 1989. (FPS importation services were very limited then, while new quarantine facilities were under construction in Davis). Saanichton was able to ship these clones to Gloria Ferrer in Sonoma in 1993 after completing all the tests to qualify them for certification in Canada.

In 1996, Gloria Ferrer generously donated cuttings from the six clones to the FPS public collection. FPS performed shoot tip tissue culture virus elimination procedures on all the clones and qualified them for the R&C Program between 2002 and 2004. The reported French clone sources and their corresponding FPS selection numbers are: **French 118 (FPS 104), French 121 (FPS 99), French**

124 (FPS 84 and **98), French 130 (FPS 82), French 131 (FPS 100),** and **French 132 (FPS 85)**.

The final group of French clonal material was imported to Davis by Dr. Austin Goheen for Far Niente Winery in 1981. The material is reported to be French clonal material from a grower named Fetzmann in the Cote d'Or, France. Four separate plants are represented by this group, which are now part of the FPS public collection. **Chardonnay FPS 48** and **50** are from the same clonal material that was labeled "clone 2" by the importer; the plant material underwent both heat treatment (109 days) and shoot tip tissue culture treatment, and first appeared on the FPS Registered list in 1997. **FPS 54** (designated "clone 4" in the shipment) underwent heat treatment (60 days) and tissue culture procedures and became Registered in 1999. **FPS 71** was created using tissue culture (after heat treatment) from the original Burgundian clone and appeared on the FPS Registered list in 2001. Finally, **FPS 73** ("clone 3" in the shipment) underwent both heat treatment (78 days) and tissue culture procedures, and became Registered in the program in 2002.

ITALIAN CLONES

Chardonnay migrated to Italy some time during the Middle Ages or Renaissance periods. The first documented evidence of the variety in Italy occurred in the 1700s in connection with the Medici family, who facilitated importation of French wine varieties including a "Pineau from Bourgogne." (Calò and Costacurta 1990) The first "official" cultivations of Chardonnay began in the last half of the 19th century primarily on the subalpine slopes in northern Italy in order to improve the quality of Italian wines. (Calò and Costacurta 1990; Robinson 2006)

Pinot bianco (Weissburgunder) and Chardonnay (Gelber Weissburgunder) were cultivated together and treated alike in Italy for a time. Field trials conducted between the two world wars at the Istituto Sperimentale Viticoltura in the Veneto region of northeast Italy (Conegliano) raised Chardonnay's profile in northern Italy. The two varieties were clearly separated in 1978 in the National Catalogue of Wine Varieties. (Calò et al. 2001)

Four Chardonnay selections were received by FPS from Conegliano, Italy, in 1984. The selections were labeled Congeliano 6, 7, 10, and 11 and became **Chardonnay FPS 20, 21, 22,** and **23**, respectively. All four tested negative for virus and were not treated. They first appeared on the FPS Registered list in 1990.

The FPS Conegliano clones were used in several clonal trials in California. Larry Bettiga put FPS 20, 22, and 23 in the Pacific Vineyard trial in Greenfield. FPS 22 and 23 had lower yields, attributed to erratic fruit set resulting in lower berry weights and numbers of berries per cluster, plus had shot berries. FPS 20 had larger berries, moderate yields, and lower °Brix than the other selections. (Bettiga 2002) FPS 20 performed in the same relative fashion in the Fresno trial. (Fidelibus et al. 2006) FPS 22 showed high vigor but scored in tier 1 in the wine portion of the Chalk Hill trial in Sonoma. (Heald and Heald 1999)

Chardonnay FPS 74, which is known in Italy as SMA 127, came to FPS from Dr. Antonio Calò of the Istituto Sperimentale at Conegliano in 1988. It tested RSP+ and underwent shoot tip tissue culture treatment before appearing on the registered list in 1998. Literature from Italy describes SMA 127 as a grape with excellent production, having clusters of average size. The acidity and sugar content of the must are reportedly high. SMA 127 is suitable as a base for sparkling wine. (Calò and Costacurta 1990)

Another group of Italian Chardonnay selections came from one of the first international entities to contract with FPS for grape importation services, Vivai Cooperativi Rauscedo (VCR) in Italy. VCR is a private nursery cooperative that was formed 70 years ago and currently has an annual production capacity of over 60 million vines. More than 30 years ago, VCR started its own clonal selection program which includes micro vinification for evaluating winegrape clones. In 1997, VCR formed a joint venture with NovaVine Grapevine Nursery in Santa Rosa, California, making NovaVine the exclusive U.S. producer and distributor of the private VCR clones. There are currently three privately controlled VCR Chardonnay clones at FPS: designated **SMA 108 (FPS 86), VCR 10 (FPS 103)** and **VCR 4 (FPS 105)**, all of which were first registered in 2004. Tom Nemcik of NovaVine explains that "the VCR 4 clone is characterized as a *Musqué* because of its delicate perfume and taste of muscat." (Tom Nemcik, personal communication)

Chardonnay FPS 18 came to FPS in 1983 with the designation 'Rauscedo 8' and is now in the public collection. That selection did not undergo any treatment and first appeared on the FPS Registered list in 1987. FPS 18 was included in some of the clonal trials in California. In Monterey County it produced moderate yields on clusters of moderate weight. (Bettiga 2002) In Fresno, FPS 18 was in the higher yielding group (22.6 kg/vine) but in the intermediate group for clusters per vine, cluster weight, berries per cluster, and berry weight. It exhibited a high incidence of sour rot. (Fidelibus et al. 2006) In Sonoma County, FPS 18 produced high yield and early sugar accumulation but did not score highly in the still wine tasting category. (Heald and Heald 1999) This clone is used successfully in Italy as a base for sparkling wine.

OTHER FOREIGN CLONES

Chardonnay FPS 16 was imported from Australia's Rutherglen variety collection in 1970 and was given USDA Plant Identification (P.I.) number 364283. The selection tested negative for virus at FPS, but underwent heat treatment for 60 days. FPS 16 appeared on the FPS Registered list in 1980.

In 1990, ampelographer Dr. Jean-Michel Boursiquot examined FPS 16 and opined that it looked different than the characteristic Chardonnay vine and was possibly a tetraploid. In the 1996 FPS Grape Program Newsletter it was announced that, effective November 1996, FPS 16 would be placed "on hold" due to its off-type appearance. "Hold status" indicates that FPS no longer supplies propagation wood of a selection to customers unless the customer specifically requests it, after being informed of potential issues related to the selection. Chardonnay FPS 16 retained its Registered status while it was on "hold" status.

Chardonnay FPS 16 was one of a group of Chardonnays subjected to DNA testing (microsatellite marker comparison analysis) in 2002. The results showed that Chardonnay FPS 16 did not differ in a significant way from the microsatellite marker profiles of the other Chardonnays in the analysis. (Riaz et al. 2002) Dr. Andrew Walker, professor in the Department of Viticulture and Enology at UC Davis, states that Chardonnay FPS 16 resembles traditional Chardonnay morphology enough to identify it as a Chardonnay, but suggests that FPS 16 exhibits clonal variation (leaves with sharper teeth; noticeably larger berries). (Andrew Walker, e-mail to Rhonda Smith)

Finally, there is a proprietary Chardonnay selection from Germany at FPS. Geisenheim has been a viticultural research institute in Germany since 1872. **Chardonnay FPS 25** arrived at FPS from the Geisenheim research institute in 1984 with the designation "Geisenheim selection #1-12". The selection tested negative for virus and first appeared on the FPS Registered list in 1990.

The Chardonnay selections maintained in the FPS collection reflect a large and diverse pool from which growers and winemakers can choose for varietal wines or blending materials. California has created its own selections from the Chardonnay clones imported from France in the 19th and 20th centuries. Clonal variation has been captured in selections collected from different climate and topographical regions within the state. Additional Chardonnay selections now in the pipeline show promise. Foreign sources of Chardonnay imported from Europe and Australia have increased the clonal diversity available to California growers and winemakers. Chardonnay has earned its reputation for adaptability and resilience by its performance in California.

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Summary of FPS Chardonnay selections; their sources, status and where they are available.

FPS #	Reported Source	Reg Status	Available from	Disease test status	Treatment
04	Martini vineyard in 1964; once known as #108 along with sel. 05	registered in 1969	FPS	all tests negative	heat treated 90 days
05	Martini vineyard in 1964; once known as #108 along with sel. 04	registered in 1969	FPS	all tests negative	heat treated 90 days
06	Martini vineyard in 1964	registered in 1973	FPS	all tests negative	heat treated 164-2 days
08	Martini vineyard in 1964	registered in 1973	FPS	all tests negative	heat treated 114-3 days
09	Chardonnay FPS 08	registered in 1973	FPS	all tests negative	heat treated 102 days
10	Chardonnay FPS 08	registered in 1973	FPS	all tests negative	heat treated 102 days
11	Chardonnay FPS 08	registered in 1973	FPS	all tests negative	heat treated 116 days
12	Chardonnay FPS 08	registered in 1973	FPS	all tests negative	heat treated 116-2 days

FPS #	Reported Source	Reg Status	Available from	Disease test status	Treatment
13	Chardonnay FPS 08	registered in 1973	FPS	all tests negative	heat treated 144 days
14	Martini vineyard/WA K3 v62 in late 1960s	registered in 1974	FPS	all tests negative	heat treated 111 days
15	Prosser, Washington in 1969	registered in 1974	FPS	all tests negative	heat treated 173 days
16	Rutherglen, Australia in 1970	registered in 1980-HOLD	FPS	all tests negative	heat treated 60 days
17	Proprietary selection from Robert Young vineyard in 1982	registered in 1987	Contact Robert Young Vineyard	all tests negative	heat treated 62 days
18	Italy, Rauscedo 8 in 1983	registered in 1987	FPS	all tests negative	none
20	Italy, Conegliano 6 in 1984	registered in 1990	FPS	all tests negative	none
21	Italy, Conegliano 7 in 1984	registered in 1990	FPS	all tests negative	none
22	Italy, Conegliano 10 in 1984	registered in 1990	FPS	all tests negative	none
23	Italy, Conegliano 11 in 1984	registered in 1990	FPS	all tests negative	none
25	Germany, Proprietary selection from Geisenheim in 1984	registered in 1990	Contact VinoUltima, VA	all tests negative	none
27	Matanzas Creek (Mt. Eden clone) in 1984	registered in 1992	FPS	all tests negative	heat treated 61-2 days
28	Matanzas Creek (Mt. Eden clone) in 1984	registered in 1994	FPS	all tests negative	heat treated 61-1 days
37	Champagne Perrier-Jouet, France, in 1988. Reported to be French clone #95	registered in 1997	FPS	all tests negative	shoot tip culture
38	Champagne Perrier-Jouet, France, in 1988. Reported to be French clone #95	registered in 1997	FPS	all tests negative	shoot tip culture
39	Dijon, France, via OSU in 1987-8. Reported to be French clone # 78.	registered in 1998	FPS	all tests negative	shoot tip culture
40	Champagne Perrier-Jouet, France, in 1988. Reported to be French clone #125.	registered in 1999	FPS	all tests negative	shoot tip culture
41	l'Espiguette, France, via OSU, in 1987. Reported to be French clone #352.	registered in 1997	FPS	all tests negative	shoot tip culture
42	Dijon, France, via OSU in 1987-8. Reported to be French clone #277.	registered in 1997	FPS	all tests negative	shoot tip culture
43	Champagne Perrier-Jouet, France in 1988. Reported to be French clone # 75.	registered in 1998	FPS	all tests negative	shoot tip culture
44	Dijon, France, via OSU in 1987-8. Reported to be French clone #77.	registered in 1998	FPS	all tests negative	shoot tip culture
45	Dijon, France, via OSU in 1987-8. Reported to be French clone #77.	registered in 1997	FPS	all tests negative	shoot tip culture
46	Champagne Perrier-Jouet, France, in 1988. Reported to be French clone #75.	registered in 1997	FPS	all tests negative	shoot tip culture

FPS #	Reported Source	Reg Status	Available from	Disease test status	Treatment
48	Cote d'Or, France, in 1981.	registered in 1997	FPS	all tests negative	shoot tip culture
49	Dijon, France, via OSU in 1987-8. Reported to be French clone #277.	registered in 1997	FPS	all tests negative	shoot tip culture
50	Cote d'Or, France, in 1981.	registered in 1997	FPS	all tests negative	shoot tip culture
51	Dijon, France, via OSU in 1987-8. Reported to be French clone #277.	registered in 1999	FPS	all tests negative	shoot tip culture
54	Cote d'Or, France, in 1981.	registered in 1999	FPS	all tests negative	shoot tip culture and HT 60-1 days
66	Russian River Valley, CA, in 1994. Simi/Mt. Eden clone.	registered in 1999	FPS	all tests negative	shoot tip culture
67	Wente clone from Robert Mondavi Vineyards, Napa, California in 1995.	registered in 2002	FPS	all tests negative	shoot tip culture
69	Dijon, France, via OSU in 1987-8. Reported to be French clone #76.	registered in 2002	FPS	all tests negative	shoot tip culture
70	Dijon, France, via OSU in 1987-8. Reported to be French clone #96.	registered in 2001	FPS	RSP+	shoot tip culture
71	Cote d'Or, France, in 1981.	registered in 2001	FPS	all tests negative	shoot tip culture and HT 60-1 days
72	Wente clone from production block in Monterey County, CA, in 1991.	registered in 2002	FPS	all tests negative	shoot tip culture
73	Cote d'Or, France, in 1981.	registered in 2002	FPS	all tests negative	shoot tip culture and HT 78 days
74	SMA 127 from Conegliano, Italy, in 1988.	registered in 1998	FPS	all tests negative	shoot tip culture
76	French ENTAV-INRA® 76 authorized clone, France, in 1997	registered in 2000	Contact Sunridge Nurseries or Herrick Grapevines	all tests to qualify for Foundation stock negative	none
79	Sterling Vineyards, CA, in 1996	registered in 2002	FPS	all tests negative	shoot tip culture
80	Sterling Vineyards, CA, in 1996	registered in 2002	FPS	all tests negative	shoot tip culture
81	Champagne Perrier-Jouet, France in 1988. Reported to be French clone # 117.	registered in 2002	FPS	all tests negative	shoot tip culture
82	Epernay, France, via Saanichton, Canada,and CA vineyard in 1996. Reported to be French clone #130.	registered in 2002	FPS	all tests negative	shoot tip culture
83	Champagne Perrier-Jouet, France, in 1988. Reported to be French clone #116.	registered in 2002	FPS	all tests negative	shoot tip culture

FPS #	Reported Source	Reg Status	Available from	Disease test status	Treatment
84	Epernay, France, via Saanichton, Canada,and CA vineyard in 1996. Reported to be French clone #124.	registered in 2002	FPS	RSP+	shoot tip culture
85	Epernay, France, via Saanichton, Canada, and CA vineyard in 1996. Reported to be French clone #132.	registered in 2002	FPS	all tests negative	shoot tip culture
86	SMA 108, from Rauscedo, Italy, in 1999.	registered in 2004	Contact NovaVine Grapevine Nursery	RSP+	none
96	French ENTAV-INRA® 96 authorized clone, France, in 1997	registered in 2000	Contact Sunridge Nurseries or Herrick Grapevines	all tests to qualify for Foundation stock negative	none
97	Chalk Hill Winery, CA, in 1996	registered in 2003	Contact Chalk Hill Vineyards	all tests negative	shoot tip culture
98	Epernay, France, via Saanichton, Canada, and CA vineyard in 1996. Reported to be French clone #124.	registered in 2003	FPS	all tests negative	shoot tip culture
99	Epernay, France, via Saanichton, Canada, and CA vineyard in 1996. Reported to be French clone #121.	registered in 2003	FPS	all tests negative	shoot tip culture
100	Epernay, France, via Saanichton, Canada, and CA vineyard, in 1996. Reported to be French clone #131.	registered in 2003	FPS	all tests negative	shoot tip culture
102	Kendall-Jackson, CA, in 1997	registered in 2003	FPS	all tests negative	shoot tip culture
103	VCR 10, from Rauscedo, Italy, in 1998.	registered in 2004	Contact NovaVine Grapevine Nursery	RSP+	none
104	Epernay, France, via Saanichton, Canada and CA vineyard, in 1996. Reported to be French clone # 118.	registered in 2004	FPS	all tests negative	shoot tip culture
105	VCR 4, from Rauscedo, Italy, in 1998	registered in 2004	Contact NovaVine Grapevine Nursery	all tests negative	shoot tip culture
106	Robert Mondavi's Byron Vineyards in Santa Barbara, California, in 1998	registered in 2005	FPS	all tests negative	shoot tip culture
548	French ENTAV-INRA® 548 authorized clone, France, in 1997	registered in 2000	Contact Sunridge Nurseries or Herrick Grapevines	all tests to qualify for Foundation stock negative	none

New Draft of Regulations for the California Registration and Certification Program for Grapevines is Ready for Review

by Susan Nelson-Kluk, FPS Grape Program Manager, UC Davis

A NEW DRAFT OF PROPOSED REGULATIONS for the California Registration and Certification Program for Grapevines has been produced. It is the result of a long process that was started in the mid 1990s to revise the current regulations that were adopted in 1984. A proposed revision dated August 14, 1997 was discussed extensively, but it was not carried through the seven-month review and adoption process. The second effort was started in the fall of 2005 and consisted of a series of meetings (held January 13, 2006, February 22, 2006, April 26, 2006 and February 28, 2007) that included program participants, grape industry members, California Department of Food and Agriculture (CDFA) officials and staff of Foundation Plant Services (FPS). In addition, a Grapevine Virus Disease Workshop was held June 20, 2006 at which the latest technical information related to grape viruses was presented. Audio and visual recordings of the workshop talks are available on the Web at *http://fps.ucdavis.edu/Grape/UnexGCPW.html*.

The 2007 draft regulations include many new provisions that were agreed upon by participants at the February 28, 2007 meeting. One of the most important is the creation of two levels of increase blocks—"primary" and "secondary." Propagation materials from primary increase blocks will qualify to use to plant secondary increase blocks, but no top-working or block expansion with materials from within the block will be allowed at the secondary increase level. Only scion varieties (no rootstocks) will be produced in secondary blocks. Two levels of increase blocks will make it more affordable to produce greater quantities of high-quality certified planting stock because nurseries will be able to register vineyards owned by their customers as secondary increase blocks. The ultimate goal is to increase the percentage of certified grape nursery stock produced by nurseries.

Many of the new provisions are aimed at improving the quality of California Certified planting stock by phasing out old increase blocks and requiring regular testing of active increase blocks. Specifically, increase blocks that were planted before 1993 will not qualify for "primary" increase block status, and increase blocks planted between 1993 and January 1, 2002 must be tested for fanleaf, tomato ring spot and leafroll-associated viruses in 2007 or later to qualify for primary increase block status. In addition, primary and secondary increase blocks must be tested for fanleaf, tomato ring spot and leafroll-associated viruses every five years to stay in the program. Participants will also be required to maintain records tracing the origin of all new vines planted in primary and secondary increase blocks back to their original FPS Foundation block single vine source.

Increase blocks planted before 1993 may qualify for secondary increase block status if tests conducted in 2007 or later show no virus is present. Top-worked vines and rootstocks will be allowed in pre-1993 blocks that become secondary increase blocks.

Selections added to the program at the Foundation block level after the new regulations take effect will be screened for leafroll-associated viruses 1, 2, 3, 4, 5, 6, 7, 9 and 2-RG; Grapevine virus A (GVA, which causes Kober stem grooving disease); and Grapevine virus B (GVB, which causes corky bark disease) using lab-based tests. These screenings are in addition to the tests used to qualify new materials for the existing program. Two more herbaceous indicator tests (cucumber and tobacco) will also be added to the existing Chenopodium test to screen for Grape Decline and Grapevine Degeneration when the new regulations take effect.

The new draft regulations are posted on the Web at *http://ucanr.org/r&c07draftgrapevine*. Comments may be e-mailed to Susan Nelson-Kluk at *sanelsonkluk@ucdavis.edu* or phoned: 530-752-0538. Nurserymen, growers, scientists, regulators, and other interested people are encouraged to review this draft carefully and submit comments. A summary of comments submitted will be presented at the FPS annual meeting on November 29, 2007, and a final draft will be prepared to send to the State of California Office of Administrative Law. There will be at least another 45-day comment period offered by the Office of Administrative Law and possibly public hearings.

New Grape Selections … *Continued from front page*

was used to eliminate virus from the original material and create Aglianico FPS 04. Jancis Robinson calls Aglianico "a dark skinned top quality southern Italian [wine] grape variety…" (1)

Arinto FPS 02 was derived from original material sent from the AGRO Ideia Nursery in Potugal. The nursery collected it from the Quinta da Cortezia vineyard in the city of Aldeia Gavinha, Portugal. It was among 13 selections Jim Duarte arranged to have sent to FPS from the AGRO Ideia Nursery for the FPS public collection in 2000. The original material of this selection tested positive for leafroll, fleck and Kober stem grooving. Tissue culture was used to eliminate the virus and create Arinto FPS 02. Arinto FPS 01 (released in 2005) and Arinto FPS 02 were created from two different source vines of the same Portuguese Arinto clone. Arinto is a high acid white wine variety. (1)

Cabernet Sauvignon FPS 47 is the long-awaited clean version of the generic French material reported to be clone 337. The original material was imported directly from France in 1989 and tested positive for leafroll and fleck viruses. It took a long time to clean it up with tissue culture because of a propagation error made in the 1990s. DNA analysis was performed in the fall of 2007 to confirm that this selection is indeed Cabernet Sauvignon.

Cornifesto FPS 01 was imported from Portugal by the late Dr. Harold Olmo in 1984. The original material tested positive only for Rupestris Stem Pitting (RSP), so no virus elimination work was necessary. RSP was dropped from the viruses of concern for the R&C Program on January 1, 2000. (2) Cornifesto is described by Jancis Robinson as a minor dark grape grown in the Douro region of Portugal. (1)

Melon FPS 08 and Melon FPS 09. Melon FPS 03 and FPS 04 were imported from Pont de la Maye, France in 1968. Both selections were removed from the registered list in 1981 because they tested positive for RSP. Tissue culture was used in the late 1990s to create Melon FPS 08 and 09 from Melon 03 and 04, respectively.

Millardet et de Grasset 106-8 FPS 01 was first supplied to FPS in 2003 from the UC Davis Viticulture and Enology (VEN) Department Vineyard. It is the result of a cross made by Millardet in 1882 between *Riparia* x (*Cordifolia* x *Rupestris*). According to Pongracz, 106-8 is highly resistant to phylloxera but very sensitive to lime-induced chlorosis. It is easy to graft and root and it is recommended for non-calcareous siliceous-clay soils whose surface hardens and dries out quickly after heavy rains. (3) Virus testing was completed in 2004 and FPS mother vines were professionally identified in 2007, so Millardet et de Grasset 106-8 (FPS 01) now has Registered Foundation Stock status.

Nebbiolo FPS 12 came from an introduction labeled Nebbiolo Michet and imported from the Istituto di Coltivazioni Aboree, Della Universita di Torino, Torino, Italy in 1973. The name was changed from Nebbiolo Michet to Nebbiolo in 2004 because Nebbiolo is the only name approved for this variety by the Federal Alcohol and Tobacco Tax and Trade Bureau (TTB). In addition, DNA analysis conducted at FPS showed that Nebbiolo Fino, Nebbiolo Lampia, and Nebbiolo Michet matched each other and several other Nebbiolo references from Italy. Robinson says that "…Michet is Lampia afflicted with a virus which causes the vine's canes to fork." (1) The original Nebbiolo Michet material tested positive for leafroll (but not fanleaf) even after it was heat treated in the 1980s. Fanleaf is the virus that causes forked canes. Tissue culture was used in 2001 to successfully eliminate the leafroll from this source and create Nebbiolo FPS 12. All tests for fanleaf are negative for FPS 12.

Parellada FPS 01 was made using tissue culture from a selection imported from Bodegas Torres, Spain in 1988. Parellada is a white variety used to produce Spanish sparkling wines in combination with Macabeo and Xarello. (1) The FPS mother vines were professionally identified in 2007, so Parellada FPS 01 now has Registered Foundation Stock status.

Pinot noir FPS 108 Tissue culture was used to make Pinot noir FPS 108 from the Hanzel Vineyard clone which was evaluated in the Carneros Creek clonal trial. The story of the Carneros Creek trial, including this selection, was published in the 2002 FPS Grape Newsletter. (4) This selection was identified as "selection E" in that trial. The FPS mother vines were professionally identified in 2007, so Pinot noir FPS 108 now has Registered Foundation Stock status.

Pinot noir FPS 120 was derived from material imported from Roederer, Chouilly, France in 1984. The original material was reported to be the French clone 292. It qualified for release from quarantine without any treatment in 1993 because it was only infected with RSP, and was distributed as non-registered Pinot noir FPS 35. At the time, RSP was not a disease of concern for federal or California state quarantine, but RSP-positive selections did not qualify for the California Grapevine R&C Program. In 2001, tissue culture was used to eliminate the RSP and create Pinot noir FPS 120. In France, clone 292 is a high-yielding clone that produces wines of good quality when production is controlled. (5)

Pinot noir FPS 119 and 121 came from selections reported to be the French clones 123 and 156, respectively. They were imported from Dijon, France by Oregon State University (OSU) and sent to FPS in 1987. Tests conducted at FPS showed clone 123 was infected with leafroll and clone 156 was infected with RSP. The RSP-positive selection of 156 was released from quarantine in 1993 and distributed as non-registered Pinot noir FPS 43. Tissue culture was used to eliminate the RSP from FPS 43 and create Pinot noir FPS 121. Tissue culture was also used to eliminate leafroll from 123 and create Pinot noir FPS 119. The 1997 *Catalogue of Selected Wine Grape Varieties and Clones Cultivated in France* does not include Pinot noir 123 and 156, so these clones may have been dropped from the French certification program. (5)

Pinot noir FPS 122 was derived from material donated to the FPS public collection in 1999 by a private grape grower in Lompoc, California. The original source is reported to be Vosne Romanee, France. Tissue culture was used to eliminate leafroll, fleck and RSP from the original material and create Pinot noir FPS 122.

Riesling FPS 23 is another selection that came to FPS from OSU in 1987. OSU received the original material, from Geisenheim, Germany labeled "Riesling 239-25GM." Tests at FPS in the late 1980s detected RSP, so the selection was distributed in the 1990s as non-registered RSP+ Riesling FPS 02. Tissue culture was used to eliminate the RSP and create Riesling FPS 23.

Saint George FPS 20 was made from the RSP+ Saint George FPS 15 using tissue culture. The original source of FPS 15 came to UC Davis from Rutherglen, Australia sometime before 1971. Saint George FPS 20 tested negative for RSP and all of the viruses targeted by the R&C Program. The FPS mother vines were professionally identified in 2007, so Saint George FPS 20 has Registered Foundation Stock status.

Semillon FPS 15 is from a Semillon selection imported from New South Wales, Australia in 1982. It was first released from quarantine in 1993 and distributed from FPS as non-registered RSP+ Semillon FPS 10. Tissue culture was used in 2001 to eliminate the RSP and create Semillon FPS 15.

Syrah FPS 12 came to FPS from Ontario, Canada in 1999. The original material tested negative for virus, so it qualified for quarantine release without any virus elimination treatments. The source was reported to be French Syrah 99, which is a very productive clone in France exhibiting large clusters that produce weakly-structured wines. (5) The FPS mother vines were professionally identified in 2007, so Syrah FPS 12 has Registered Foundation Stock status.

Syrah FPS 16 was donated to the FPS public collection by Larry Hyde. He called the source materials the 'Phelps clone' in the Hyde Vineyards. The only virus detected in the original material was RSP, so it qualified to be planted into the foundation block without any virus elimination treatment.

Teroldego FPS 03 and **FPS 04** came from source vines located in the Sutter Home Delta Ranch in Courtland, California and were donated to FPS in 2003 by the Sutter Home Winery. Sutter Home identified them as "Trinchero selection 1 and 2," respectively. The original material tested positive only for RSP, so it qualified for planting in the Foundation block without any virus elimination treatments. Teroldego is a red wine variety grown in northeast Italy, where it is used to make a wine called Teroldego Rotaliano. (1)

Trousseau Gris FPS 07 was originally identified as Gray Riesling 07 at FPS. The name was changed in 2003 because the French ampelographer Jean-Michel Boursiquot indicated that the correct name is Trousseau Gris. In addition, DNA tests conducted at FPS showed this selection matched references for Trousseau, but not for Riesling. Dr. Austin Goheen, retired USDA/ARS scientist, collected this selection from the Jackson vineyard in Amador County sometime before 1965. The history of the Jackson Vineyard was published in the 2006 FPS Grape Newsletter. (6) No virus elimination therapy was necessary to clean up this selection.

White Riesling FPS 24 was derived from material labeled "Rhein Riesling Klon 110" and imported from the research institute at Geisenheim, Germany in 1952. It was first distributed by FPS as "White Riesling FPS 03;" however, FPS 03 was dropped from the R&C Program in the early 1980s because it tested positive for RSP. In 2003 the name was changed from White Riesling to Riesling, which is a name that is recognized by the TTB and better recognized internationally. Tissue culture was used to eliminate RSP and create Riesling FPS 24.

Shiraz FPS 08 and **09** were donated to the FPS public collection by Wayne Farquhar from the South Australian Vine Improvement Incorporated, where they are identified as Shiraz clones SAVII 17 and SAVII 19, respectively. In a 2005 email communication regarding these clones Farquhar said "…I can honestly say that you have perhaps the best two Shiraz clones out of Australia." In 2007, both imports qualified for release from quarantine and Provisional status in the R&C Program without any virus elimination treatment.

Cabernet Dorsa FPS 01 is a new red-wine cultivar sent to FPS in 2005 by Dr. Berns H.E. Hill from the National

Institute for Education and Research in Weinsberg, Germany exclusively for Sunridge Nurseries. According to a private email communication from Sunridge Nurseries, Cabernet Dorsa is a cross between Dornfelder and Cabernet Sauvignon. The variety was officially registered in Germany in 1998. In Germany the fruit ripens medium to late season. The grape clusters are loose and yields are medium high. The vines are medium high with upright growth and low to medium sucker growth. The wines are of high quality with intense color, a great deal of body, cherry aromas and fine aging abilities. This variety will be available to the public exclusively from Sunridge Nurseries.

Fiano FPS 03 was imported from the Vivai Cooperativi Rauscedo (VCR) Nursery in Italy in 2000 (labeled clone VCR 3) for NovaVine Nursery. Fiano FPS 03 underwent tissue culture procedures due to inconclusive disease testing. A VCR Nursery clone description designates Avellino, Italy (in the province of Campania) as the source of clone VCR 3 and reports it is recommended for its body and for the delicacy and character of its bouquet. Robinson says Fiano is used to make Campania's Fiano di Avillino wine (1). Fiano FPS 03 (VCR 3) is available to the public exclusively from NovaVine Nursery.

References:

(1) Robinson, Jancis, 2006. *The Oxford Companion to Wine*, Third Edition

(2) Nelson-Kluk, S, 2001. California Grapevine Registration and Certification Program Update. Foundation Plant Services Grape Program Newsletter, October 2001:5.

(3) Pongracz, D. P., 1983. *Rootstocks for Grape-vines*

(4) Nelson-Kluk, S, 2002. Carneros Creek Clonal Trial. Foundation Plant Services Grape Program Newsletter, October 2002:10-11.

(5) Ministry of Agriculture, Fisheries and Food CTPS. 1997. *Catalogue of Selected Wine Grape Varieties and Clones Cultivated in France*. Etablissement National Technique pour l'Amelioration de la Viticulture (ENTAV), France.

(6) Nelson-Kluk, S, 2006. Jackson Vineyard Story. Foundation Plant Services Grape Program Newsletter, November 2006:24-26.

Nestled at the outskirts of the University of California, Davis, Foundation Plant Services enjoys a rural setting with the benefits of being just minutes from campus. Isolation of the Foundation vineyards from commercial fields is a requirement for maintaining Foundation status in the California Registration and Certification Program for Grapevines. *Photo by Bev Ferguson*