Foundation Plant Services
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FPS GRAPE PROGRAM NEWSLETTER

fps.ucdavis.edu

October 2010

Russell Ranch Foundation Vineyard is Under Way

by Mike Cunningham, Production Manager, Foundation Plant Services, UC Davis

An important decision reached by the National Grape Clean Plant Network in February, 2009, was to set the future national standard for grapevine foundation material in the United States at a rigorous new level. Compliance with the new NCPN standard will ultimately be required as a prerequisite to NCPN certification for foundation vineyard collections. Participants in the California Grapevine Registration and Certification Program are also keenly aware of the need for updated and improved health and disease standards for the propagation of grapevine clean stock. Foundation Plant Services (FPS), the recognized leader in management of pathogen-tested grapevine foundation plant material, is the headquarters for the NCPN Grape Network and is the sole source of foundation level grapevine propagation material in California.

To meet the new NCPN standard, FPS is well under way in establishing a new foundation vineyard on a portion of a 1600-acre parcel of farmland, known as Russell Ranch, near the UCD campus. In 1990 UC Davis acquired Russell Ranch to serve large-scale agricultural and environmental research, the study of sustainable agricultural practices and other land-based programs.

The Russell Ranch is located about 4 miles west of the main Davis campus. Thirteen acres of the Russell Ranch site consists in large part of the Hamm House, which was built in the late-1860s and inhabited until 2002 by the Russell family, important to the early development of the city of Davis. As said of the Hamm House property in the Russell Ranch Use Strategy Work Group Recommendations from July 2009, "the potential of this property to accommodate campus and non-campus events is unparalleled on the campus and in the community of Davis… the 13-acre ranch could be a gateway to showcase the campus' research and be highly visible for use in outreach to the regional community."

Approximately 1000 acres of Russell Ranch farmland, contiguous with the Hamm House property, is currently leased to a tenant farmer whose primary crops are alfalfa, tomatoes, sunflowers, wheat, corn and watermelon. Russell Ranch falls within the area that the 2003 UC Davis Long Range Development Plan recognizes as prime farmland for campus use.

As per the Farm Bill of 2008, funding of $20 million over four years, beginning in FY 2009, was authorized to establish the National Clean Plant Network for specialty crops. Initially including only grapevines and fruit and nut trees, the main goal is to provide reliable sources of propagative material that are free of propagative-borne pathogens.

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Inside:

DORMANT ORDER DEADLINE: November 15

2010-11 Season Orders

FPS is now accepting orders for the 2010-11 season. To request unrooted, ungrafted dormant cuttings for delivery in January-March 2011 or green mist-propagated plants (MPPs) for 2011 delivery, submit your order by November 15, 2010. This will help ensure that you receive a share of any varieties/selections that are in short supply. Orders received after November 15 will be filled on a first-come, first-served basis after orders received by the deadline are filled. **To place an order**, sign and submit an FPS Order Form/Grower Agreement, available at *fps.ucdavis.edu/WebSitePDFs/Forms/FPSOrderForm.pdf*.

Updated lists of registered grape selections, new grape selections, prices and order forms are available on the FPS Web site at *fps.ucdavis.edu/grape.html*.

Additional details about FPS selections, including source and status information, and whether a selection has been through tissue culture, may be accessed on the National Grape Registry at *ngr.ucdavis.edu*.

Anyone with questions on navigating this Web site to find information may contact site manager Nancy Sweet (*nlsweet@ucdavis.edu*; 530-752-8646) or the FPS introduction and distribution office (*fps@ucdavis.edu*; 530-752-2022). Non-internet users are welcome to call Nancy or the FPS office for assistance in obtaining information on FPS selections.

Submit signed forms or service agreements to FPS by one of the following methods:

FAX to (530) 752-2132

E-mail as a PDF attachment to *trpinkelton@ucdavis.edu*

U.S. Postal Mail:
Foundation Plant Services
University of California
One Shields Avenue
Davis, CA 95616-8600

Express courier (FedEx, UPS, etc.) Note this is different from the postal mailing address:
Foundation Plant Services
University of California
455 Hopkins Road
Davis, CA 95616

Upcoming Events

FPS Annual Meeting: December 9, 2010 at the Buehler Alumni and Visitors Center, UC Davis. Advance registration required; online form and details posted at *ucanr.org/sites/FPSevent* or contact Jeanette Martin, phone: (530) 752-6000.

Current Issues in Vineyard Health, UC Davis Extension class. November 30, 2010, 9:00 am–4:00 pm at the DaVinci building in Davis. Registration and information is provided at *www.extension.ucdavis.edu*

2011 Unified Wine and Grape Symposium to be held January 25–27 at the Sacramento Convention Center, 1400 J Street, Sacramento, California. For more information, go to *www.unifiedsymposium.org*

Wine and Wine Grape Research 2011 will be held February 28, 2011, from 9:00 am–4:00 pm at Freeborn Hall, UC Davis. $49. UC Davis Extension at *www.extension.ucdavis.edu/winemaking*

62nd Annual Meeting of the American Society for Enology and Viticulture June 20–24, 2011 in Monterey, CA. Details are available at *www.asev.org*

17th Meeting of the ICVG Will be held in October 2012 at UC Davis. Anyone interested is encouraged to complete the survey at *ucanr.org/sites/ICVG* to help select the dates.

Foundation Plant Services

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From the Director's Desk

Deborah Golino

By all measures, it has been an unusually busy and successful year for Foundation Plant Services.

In November 2009, FPS was the recipient of a generous gift of $1 million from Trinchero Family Estates, a family-owned wine company in the Napa Valley. This gift will help fund a new facility at FPS which will be named the Trinchero Family Estates building. For those who don't know them, the Trinchero family came to Napa Valley in 1947, and bought an abandoned winery named Sutter Home. Following the success of Bob Trinchero's 'white zinfandel' in the 70's, they have since expanded their portfolio to include 23 different wine labels, including Sutter Home, Trinchero Napa Valley, Napa Cellars, Terra d'Oro, Montevina, Trinity Oaks, Folie à Deux, Ménage à Trois, and the alcohol-removed wine, Fre. We greatly appreciate the Trinchero family's support of viticultural research and of FPS.

It was 1994 when we moved into the university's National Grapevine Importation and Clean Stock Facility located west of the Davis campus. Since then, our programs have more than tripled, necessitating expansion for new staff and information technology needs. The Trinchero Family Estates gift will support construction of a planned $3.8 million, 5,600-square-foot new building adjacent to the current facility. The project aims to achieve LEED silver certification with sustainable design features for water and energy. It will include a meeting room for hosting classes and stakeholder gatherings, and will replace an aging trailer of offices for our laboratory scientists. At this writing, 95% plans are being circulated for final campus approval.

One of the most notable developments in the last three years for FPS has been the availability of federal funding from the newly created USDA National Clean Plant Network (NCPN). As FPS Director, I have long advocated the availability of federal funds to support service programs such as FPS and sister programs at UC Riverside, Cornell, Washington State University at Prosser, Clemson, and USDA-ARS Corvallis. FPS was represented at the first NCPN meeting hosted by USDA in Maryland in May 2007, where I presented a national overview of the scope and importance of these key agricultural programs. As one of the NCPN lead centers, FPS participates in the National Grape, Tree, and Berry Networks, hosts the NCPN Stakeholder Website, and I serve as Chair of the National Grape Network.

The 2008 USDA Farm Bill contained $20 million to create a new National Clean Plant Network (NCPN), administered under a Memorandum of Understanding between USDA's three participating agencies: APHIS, ARS, and NIFA. This funding was allocated to be spent over 4 years by a competitive grants process overseen by USDA-APHIS.

FPS received a $350,000 grant from USDA-APHIS in 2008 to provide a jump-start for NCPN activities of our grape quarantine and therapy program. In FY 2009, FPS responded to the first NCPN Request for Applications (RFA) and was awarded $1,034,959 in funding. We reapplied in the 2010 RFA cycle, and in August received notification that we were approved for $1,608,624—a significant award for a USDA NCPN center. These funds included about $1,326,704 for grapevines and about $270,920 for fruit trees. We have modernized our laboratory equipment; refurbished growth chambers and greenhouses; considerably expanded our grape importation, quarantine and therapy programs; increased pathogen testing for tree and grape collections; organized and hosted NCPN stakeholder meetings; and initiated work on a new grape Foundation standard.

The 100-acre parcel at Russell Ranch is an ideal location for a Foundation vineyard in compliance with NCPN standards (see front page). The property is remote and isolated from current UCD vineyards, and there is adequate acreage to accommodate the numerous FPS varieties and clones. The infusion of NCPN funding will promote expansion of the FPS collection and acquisition of new clones from foreign and domestic sources. Our campus has granted permission to begin this planting. The idea was enthusiastically greeted by the National Clean Plant Network Governing Board as well as the Grape Clean Plant Network members. We received the initial funding needed to begin developing this property. A well is being dug, land is being fumigated, and trellising will be installed to allow planting in Spring 2011.

And finally, in July 2010, new regulations for the California Department of Food and Agriculture' Grapevine Registration and Certification Program went into effect; a process spanning nearly 15 years. I do not think this would have been possible without the earnest and active participation of our industry leadership, FPS and CDFA's biologists. This has been an extremely complex and important process—a long time coming—but I think we now have regulations that will serve us well. Text of the new regulations is posted on the FPS website.

We will work diligently to see that these precious federal funds are spent ensuring the most secure and useful future for our programs. To do that, I value the time we spend with all our stakeholders, learning about their work and how FPS can help them deliver a better product.

FPS Offers New Grape Selections for 2010-2011

by Nancy Sweet, Foundation Plant Services

ALL FPS' NEWLY AVAILABLE PROVISIONAL SELECTIONS are included in the list *New Grape Selections Available from FPS*. The list represents all selections that have acquired Provisional status in the California Grapevine Registration & Certification Program within the past four years but have not yet attained Registered status.

A selection obtains Provisional status in the R&C Program by completing all disease testing with negative test results. All that remains for these selections to attain Registered status is professional identification.

The new public and proprietary grape selections for 2010-2011 successfully completed testing during the past year, and were released and planted in the FPS Foundation Vineyard in 2009 and 2010. Mist propagated plants (MPPs) may be ordered for Summer 2011 delivery (actual dates subject to change depending on demand). Dormant cuttings may also be ordered, but normally take approximately two years for newly-planted vines to produce adequate wood. Contact FPS to discuss the readiness of a particular selection for dormant cuttings. *New Grape Selections Available from FPS*, order forms and a price list are available on the FPS website at *fps.ucdavis.edu* under 'Grapes.'

NEW DOMESTIC PUBLIC SELECTIONS

Cortese FPS 03 This Italian white wine variety primarily associated with the Piemonte region of Italy came to FPS in 2004 from a vineyard in Southern California. The original material tested positive for virus and underwent microshoot tip tissue culture disease elimination therapy at FPS.

Fay Rouge FPS 01 Fay Rouge is the most recent release in a group of varieties developed by the late Fay Triplett, a private breeder from Ceres, California. This selection was formerly known at FPS as Triplett F101-4. Since the death of Mr. Triplett, the collection has been in the custody of the UC Cooperative Extension at Parlier, California. Pete Christensen, UCCE Viticulture Specialist-Emeritus, recently professionally identified Fay Rouge FPS 01, so it will soon attain Registered status in the R&C Program. For a complete description of Fay Rouge, please see the article on page 8 *Release of 'Fay Rouge'—a Fay Triplett Red Wine Variety.*

Vignoles FPS 01 Vignoles (also known as Ravat 51) is a French hybrid white wine grape grown in the cooler regions of the United States. (Robinson, Jancis. 2006. *Oxford Companion to Wine*, 3rd ed.) Vignoles FPS 01 came to FPS in 2006 from the Missouri State Fruit Experiment Station, Missouri State University. The original plant material tested negative for virus and was not required to undergo disease elimination therapy.

NEW IMPORTED PUBLIC SELECTIONS

Alfrocheiro FPS 03 Alfrocheiro is a red wine grape planted primarily in the Alentejo and Dão regions of Portugal. This selection was donated to the FPS public collection in 2005 by Jorge Boehm of Viveiros Plansel S.A., in Portugal. The selection has successfully undergone microshoot tip tissue culture disease elimination therapy.

Bon noir FPS 01 Bon noir is a French cultivar that was developed from a cross between Millardet et de Grasset 101-14 and Knipperlé by a private breeder named Eugène Kuhlman. Knipperlé is a white wine grape that was introduced into Alsace in 1756 and has the same pedigree as Chardonnay (Pinot x Gouais blanc). Bon noir is reportedly a cold hardy wine variety with moderate disease resistance. Bon noir FPS 01 came to FPS in 2006 from France via Dr. Bruce Reisch of Cornell University (New York State ARS Agricultural Experiment Station) at Geneva, New York. This selection was not required to undergo disease elimination therapy but has tested positive for Rupestris stem pitting (RSP) virus.

Couderc 241-123 FPS 01 This hybrid black wine grape variety was initially imported in 1998 for the Cornell Research Evaluation Quarantine Program in Geneva, New York, from the Institute for Grapevine Breeding in Geilweilerhof, Siebeldingen, Germany. Couderc 241-123 is a French interspecific cross of *Vitis rupestris* x *Vitis vinifera*. Cornell chose the variety, which is reportedly a teinturier grape, because it appeared to show promise for disease resistance. The material was transferred to FPS in 2008 for testing and, if necessary, disease elimination therapy. Although the selection tests positive for RSP virus, it was not required to undergo disease elimination therapy at FPS. The selection is awaiting professional identification at FPS.

Ehrenfelser FPS 01 This German white wine grape was developed at Geisenheim, Germany, beginning in 1929 from a cross of Riesling x Knipperlé. It was speculated that the second parent was Silvaner, but recent DNA analysis at Montpellier, France, revealed that the second parent is Knipperlé, a sister grape to Chardonnay. Ehrenfelser FPS 02 was simultaneously imported to both FPS and Cornell in 1974 from Dr. Helmut Becker of Geisenheim, Germany. The original plant material underwent heat treatment for 115 days at FPS. It tests negative for all viruses except for RSP. The selection has not undergone further disease elimination therapy.

Juan García FPS 02 This Spanish red wine variety was imported for the FPS public collection in 2008 as part of an ongoing exchange agreement with the Instituto Tecnológico Agrario de Castilla y León (ITACyL) in Valladolid, Spain.

Juan García FPS 02 is the CL (Castilla León)-52 clone. This selection passed all the required tests for the R&C Program and was not required to undergo disease elimination therapy. It tests positive for RSP virus.

Kyoho FPS 02 Kyoho is a black table grape that was created from a cross made in 1935 at the Oinoue Institute for Agronomical and Biological Science, Nakaizu, Shizouka, Japan, from Ishiharawase x Centennial. This tetraploid variety has large, purple berries with a foxy flavor. (Brooks and Olmo.1997. *Register of Fruit & Nut Varieties, 3rd ed.*) Kyoho FPS 02 came to FPS in 1982 from the Zhengzhou Fruit Tree Institute, in Henan, China. At the time of the importation, the variety was reportedly grown widely in the cold regions of China. Kyoho FPS 02 underwent heat treatment for 62 days after its arrival at FPS. It tests positive for the RSP virus.

Mencía FPS 02 Mencía is a red wine grape from the northwest region of Spain. Contrary to prior speculation, DNA profiling has revealed that Mencía is most likely not related to Cabernet Franc. (Ibáñez et al. 2003. *Genetic Study of Key Spanish Grapevine Varieties Using Microsatellite Analysis*, Am.J.Enol.Vitic. 54:1) The variety is known as Jaen in Portugal. Spain's grape named Jaén is a different variety entirely. Mencía FPS 02 was imported for the FPS public collection in 2008 as part of the ongoing exchange program with ITACyL. This selection is the CL (Castilla León)-94 clone. The original plant material tested negative for all viruses except for RSP and did not undergo disease elimination therapy.

Pedro Ximénez FPS 03 Pedro Ximénez is a white wine grape variety traditionally associated with Andalucía in southern Spain, southern Cataluña and the Canary Islands. (Robinson, 2006). This selection was originally planted in 1889 at location E10 vine 5 at the former University of California Foothill Experiment Station in Jackson, California. Dr. Austin Goheen retrieved the original plant material for this selection from the abandoned station in 1965. The material was tested at FPS and was first registered as Pedro Ximénez FPS 02, which began to show signs of leafroll virus around 2000. After reindexing the selection, it became apparent that FPS 02 suffered from leafroll virus. The selection underwent microshoot tip tissue culture disease elimination therapy and was re-released in 2010 as Pedro Ximénez FPS 03.

Pinot noir FPS 126 This selection came to FPS in 1987 from France via Oregon State University as part of the Winegrowers' Project, which aimed to acquire unique European clones for United States growers. The plant material originated from Colmar, France, and is reportedly French clone 538. This selection is considered a 'generic' clone rather than an authorized French clone because it preceded the implementation of the official French trademark program that authorizes all French clones under the trademark ENTAV-INRA®. The clonal identity of generic clones cannot be guaranteed. The original material tested negative at FPS for all pathogens except RSP virus and did not require disease elimination therapy.

Pinot noir FPS 127 This selection came to FPS in 1979 from Geisenheim, Germany, via the former quarantine program at Oregon State University. It was previously known at FPS under the German synonym name, Blauer Spätburgunder FPS 01; the name was changed to the preferred prime name Pinot noir in 2010. This selection tested negative for all viruses except for RSP virus and was not required to undergo disease elimination therapy.

Prieto Picudo FPS 02 Prieto Picudo is grown primarily in north central Spain, producing distinctive red wines. (Robinson, 2006). Prieto Picudo FPS 02 is one of the grape varieties imported in 2008 as part of the ongoing exchange program with ITACyL in Valladolid, Spain. This selection is the CL (Castilla León)-31 clone. Prieto Picudo FPS 02 tests negative for all but RSP virus and did not require disease elimination therapy. Also currently in progress at FPS are progeny from the original untreated material that were produced by microshoot tip tissue culture disease elimination therapy. Those plants are currently undergoing index and other testing. If all test results are negative, the treated plant material should be available in spring 2013.

Räuschling FPS 01 This white wine grape variety was cultivated in Germany during the Middle Ages and is now most commonly planted in Switzerland. (Robinson, 2006). Räuschling FPS 01 came to FPS in 1977 from the Geilweilerhof Institute for Grape Breeding in Siebeldingen, Germany. Plant material for this selection was collected in Germany. The original material underwent heat treatment for 61 days at FPS. It was subsequently tested and found to contain RSP virus, but no further disease elimination therapy was required.

Riesling FPS 29 Riesling FPS 29 is one of the European clones that came to FPS in 1987 via Oregon State University as part of the Winegrowers' Project. The plant material originated from Colmar, France, and is reportedly French clone 813. This selection preceded the implementation of the official French trademark program (ENTAV-INRA®) and is considered a generic clone whose clonal identity cannot be guaranteed. The original material tested negative at FPS for all pathogens except RSP virus and, therefore, did not require disease elimination therapy. For the history of the Riesling clones at FPS, see the FPS 2009 Grape Program Newsletter at *fps.ucdavis.edu* under 'Publications.'

Sultana moschata FPS 02 The white table grape whose prime name is Sultana moscata was produced by Alberto Pirovano in Rome, Italy, from a cross of Zibibbo (Muscat of Alexandria) x Sultanina. This selection came to FPS in 1978 from A.J. Antcliff at the Commonwealth Scientific Industry Research Organization (CSIRO) in

Merbein, Australia. It underwent heat treatment for 61 days and ultimately tested negative for all viruses except for RSP. FPS assigned this selection the synonym name Sultana moschata FPS 02.

Taminga FPS 01 Taminga is a white table and wine grape that was developed in Australia to thrive in conditions at that location. The cross was Merbein 29-56 (Planta fina x Sultanina) x Traminer rot, made by A.J. Antcliff at CSIRO in Merbein, Australia. Taminga FPS 01 was imported to FPS in 1983 from CSIRO. It tested negative for all viruses except RSP and has not undergone disease elimination therapy.

Tempranillo FPS 23 This Spanish Tempranillo clone was imported in 2008 from Valladolid, Spain, as part of the exchange program with ITACyL. The selection is the CL (Castilla León)-311 clone, which is a Tinto de Toro-type Tempranillo. Tempranillo FPS 23 tested negative for all viruses except for RSP and did not undergo disease elimination therapy.

Tulillah II FPS 01 Tulillah is a white wine variety created by A.J. Antcliff at CSIRO in Australia from a cross between Macabeo x Sultana. This variety was imported to FPS from CSIRO on two occasions – 1976 (Tulillah I) and 1985 (Tulillah II). Tulillah II FPS 01 tests negative for all viruses except RSP and has not undergone disease elimination therapy.

Ugni blanc FPS 01 Ugni blanc is the French synonym for the Italian white wine grape Trebbiano. The variety is planted extensively in France. (Robinson, 2006). Ugni blanc FPS 01 was imported to FPS in 1986 from the Rauscedo Nursery in Italy. It tested negative for all viruses except RSP and has not undergone disease elimination therapy.

Verdelho FPS 08 The name Verdelho has historically been used for two distinct white wine grape varieties in Portugal. One variety originated in Crete and dates back to the 15th century is planted on Madeira and in the Azores (but not continental Portugal), and also Australia. The second grape referred to as Verdelho is grown in continental Portugal, and is now known officially as Gouveio. (Jorge Boehm. 2005. *Portugal Vitícola, O Grande Livro das Castas.)* Verdelho FPS 08 is the Verdelho grape grown on Madeira, the Azores and Australia. It came to FPS in 2003 from the South Australia Vine Improvement Inc. (SAVII), Nuriootpa, South Australia. Verdelho FPS 08 was required to undergo microshoot tip tissue culture disease elimination therapy after it tested positive for leafroll virus at FPS.

Xarel.lo FPS 04 This Spanish white wine grape variety is native to Cataluña and is used with Parellada and Macabeo in cava blends in Penedès. (Robinson, 2006). This selection (JPB clone 563) was donated to the FPS public collection in 2004 by Jorge Boehm, Viveiros Plansel S.A., Portugal. Xarel.lo FPS 04 underwent microshoot tip tissue culture disease elimination therapy after it tested positive for virus at FPS.

NEW IMPORTED PROPRIETARY SELECTIONS

The Cabernet Sauvignon Vincent series

The Cabernet Sauvignon clonal collection known as the 'Vincent series' was donated to the FPS collection in 2004 and 2005 by a well-respected producer of French wine near Bordeaux, France. The donor, who wishes to remain anonymous, named the series after his vineyard manager in France as well as the patron saint of wine growers, St. Vincent of Saragossa. The Vincent series is composed of thirteen selections, taken from separate vines on the estate in France. The stipulation on the donation was that the plant material would remain proprietary for two years after return to the donor, after which the selections would become available as part of the FPS public collection.

Six of the Vincent series selections have already attained Registered status in the R&C Program and are now available to the public (Cabernet Sauvignon FPS 44, 45, 46, 48, 49, 50). Seven new Vincent selections were released in 2010 and now have Provisional status in the R&C Program: Cabernet Sauvignon FPS 52 (Vincent #1), FPS 53 (Vincent #3), FPS 55 (Vincent #4), FPS 56 (Vincent #9), FPS 57 (Vincent #11), FPS 58 (Vincent #12) and FPS 59 (Vincent #13). Cabernet Sauvignon FPS 52 did not undergo disease elimination treatment at FPS; however, all the remaining new Provisional Vincent selections tested positive for virus and underwent microshoot tip tissue culture disease elimination therapy. FPS 52 and 53 are expected to be available to the public in September 2011. FPS 55, 56, 57, 58 and 59 are expected to be available to the public in Fall 2012.

For a complete history of the Cabernet Sauvignon selections in the FPS collection, please see 'Cabernet Sauvignon at FPS' in the 2008 FPS Grape Program Newsletter at *fps.ucdavis.edu* under 'Publications.'

Official French clones

The official French clones are authorized by the French Ministry of Agriculture & Fisheries under the ENTAV-INRA® trademark. Clones bearing that label are guaranteed by ENTAV-INRA to be the appropriately numbered French clonal material. Six proprietary official French clones achieved Provisional status in the R&C Program in Spring 2010.

All six of the French clones tested negative for all viruses and did not undergo disease elimination therapy. The proprietary ENTAV-INRA clones are distributed in the United States through licensees.

Cinsaut ENTAV-INRA® 92 The plant material for this clone originated in Gard in southern France and was evaluated in the Languedoc region. This selection came to FPS in 2006.

Fer ENTAV-INRA® 557 Fer (also known as Fer Servadou) is a black wine grape variety cultivated in

southwest France but probably native to the Gironde area. (ENTAV-INRA *Catalogue*, 1995.) The plant material for this clone originated in Aveyron in the Midi-Pyrénées. It was imported to FPS in 2008.

Gewürztraminer ENTAV-INRA® 643 This French clone originated in the Alsace region of France. It came to FPS in 2006.

Mourvèdre ENTAV-INRA® 1069 This variety is native to Spain, where the plant material for this clone originated. The clone was evaluated in Provence. It came to FPS in 2007.

Savagnin blanc ENTAV-INRA® 612 This white wine variety is most likely native to Italian Tyrol but is grown in France in the Jura, where the plant material for this clone was collected. This variety is the only one that produces the French wine *vin jaune*. (Robinson, 2006.) The clone came to FPS in 2008.

Syrah ENTAV-INRA® 747 The plant material for this clone originated in Tarn-et-Garonne in the Midi-Pyrénées region of France. The clone came to FPS in 2007.

Châteauneuf-du-Pape Varieties from Tablas Creek Vineyard

Several lesser-known Rhône varieties became part of the FPS grapevine collection in 2004 as a result of a cooperative effort between FPS, UC Davis, the General Partners of Tablas Creek Vineyards in Paso Robles, Robert Haas and the Perrin family in France. Cuttings from those varieties – Vaccarèse, Terret noir, Muscardin, Cinsault, Picardan, Piquepoul blanc, Clairette blanche, and Bourboulenc – were taken by sélection massale from the best performing vines at Château de Beaucastel (the Perrin estate) in Châteauneuf-du-Pape in southern France. The plant material was imported to FPS. Once the selections become Provisional in the R&C Program, they will be proprietary to Novavine Nursery for a period of three years, after which they will become available in the FPS public collection.

Four of the Château de Beaucastel selections attained Provisional status in 2009 and 2010:

Clairette blanche FPS 04 Clairette blanche is a white wine grape native to Provence. Robert Haas of Tablas Creek Vineyards believes that this variety may have some possibilities for making sweet wines or good fresh, dry wines in very cool growing areas. (Robert Haas, 2005. *Less-known Varieties of Châteauneuf-du-Pape are Being Indexed by FPS*, 2005 FPS Grape Program Newsletter), online at *fps.ucdavis.edu* under 'Publications.' Clairette blanche FPS 04 tested positive for virus after it came to FPS in 2004 and underwent microshoot tip tissue culture disease elimination therapy. The selection became Provisional in Summer 2009. It is currently available through Novavine Nursery and will become available in the FPS public collection in Spring 2012.

Picardan FPS 01 Picardan is a white grape variety native to southern France and is an ingredient in Châteauneuf-du-Pape wine. Robert Haas opined that Picardan might be used as a source for floral character, freshness and acid to blend with other Rhône varieties that tend toward high sugars. (Haas, 2005.) Picardan FPS 01 tested positive for virus after it arrived at FPS in 2004 and underwent microshoot tip tissue culture disease elimination therapy. It is currently available through Novavine Nursery and will become available in the FPS public collection in Spring 2013.

Picpoul blanc FPS 01 This white wine grape is associated with the Languedoc region of France. Picpoul blanc FPS 01tested positive for virus at FPS and underwent microshoot tip tissue culture disease elimination therapy. It is currently available through Novavine Nursery and will become available in the FPS public collection in Spring 2013.

Terret noir FPS 01 Terret noir is one of the oldest varieties in the Languedoc. Robert Haas indicates that this variety may be a possible source of floral character, freshness and acid to blend with wines that have high alcohol levels. (Haas, 2005.) Terret noir FPS 01 underwent microshoot tip tissue culture disease elimination therapy after testing positive for virus at FPS. It is currently available at Novavine Nursery and will become available as part of the FPS public collection in Spring 2012.

Jorge Boehm clones from Portugal

Jorge Boehm is an author, viticulturalist and owner of Viveiros Plansel S.A., in Portugal. He markets his grape clones under the PLANSEL® trademark.

Fernão Pires PLANSEL® 12 This white wine grape from Portugal was imported to FPS in 2005 from Jorge Boehm in Portugal. The original plant material tested positive for virus at FPS and underwent microshoot tip tissue culture disease elimination therapy. The selection is available through Plansel licensee Sunridge Nurseries.

Graciano FPS 03 Graciano is a black wine grape variety native to Spain. Graciano FPS 03 is a proprietary selection to Sunridge Nurseries. The selection (JPB subclone 573) came to FPS in 2007 from Jorge Boehm in Portugal. The material tested negative for all viruses in the R&C Program and did not undergo disease elimination therapy.

Pepinieres Guillaume Selections

Four new releases that are proprietary to Pepinieres Guillaume in Charcenne, France, attained Provisional status in Spring, 2010. None of the four selections required disease elimination treatment. The selections are: **Cabernet Sauvignon FPS 61**, **Gros Manseng FPS 01**, **Petit Verdot FPS 03**, and **Sauvignon blanc FPS 32**. Pepinieres Guillaume proprietary material is distributed through Guillaume Grapevine Nursery in Knights Landing, California.

Release of 'Fay Rouge'—a Fay Triplett Red Wine Variety

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

'Fay Rouge' is named after Fay Triplett, a wine grape grower from Ceres, California who conducted a private wine grape breeding program over a period of 25 years. 'Fay Rouge' has completed indexing and is in 'Provisional Status' at FPS. 'Triplett blanc,' a white variety, was released in 2004; two red wine varieties, 'Maxine Rouge' and 'Rougett,' were released in 2007. These varieties had shown promise in preliminary testing by Fay 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 Triplett 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 *fps.ucdavis.edu*; an article describing 'Maxine Rouge' and 'Rougett' is in the October 2007 newsletter.

'Fay Rouge' was tested as F101-4 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)*. It is of the same parentage and a sister variety to 'Maxine Rouge.'

The shoots are of medium diameter, semi-erect and trailing. Shoot tips are glabrous and medium green. Leaves are cordiform in shape, small to medium in size, dark green on upper surface and medium green on lower surface. They are slightly bullate and wavy at the margins, with a narrow U-shaped petiolar sinus; the superior lateral sinus is of medium depth and the inferior lateral sinus is absent to shallow. They are glabrous on the upper and lower surfaces and with sparse cobwebby hairs on the lower surface veins; the teeth are of medium size with slightly convex sides.

The clusters are of medium size, conical, slightly shouldered, loose to well-filled, and with a medium-length peduncle. There was no occurrence of bunch rot during the trial. The berries are short oval, small-medium in size, of dark purple-black color, and with a gray bloom. The skin is tough and of good anthocyanin content. The canopy is moderately open due to relatively small leaves.

photo by L. Peter Christensen

The vines are very fruitful. The fruit ripens in mid season (mid September in Fresno County) and with good compositional balance, making 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-ft. 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. The fairly open canopy minimizes the need for canopy manipulation.

Table wines made from the variety have been described as medium bodied with good color and mouth feel and of good 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.

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

	Berry Analysis				Cluster Analysis			Total Yield
	Wt./berry gms.	Soluble Solids °Brix	Titratable Acidity g/100ml	pH	No./vine	Wt./cluster lb.	No. with rot	Lbs./vine
Sept 16	1.82	23.1	0.79	3.69	114	0.47	0	53.6

New Features on the National Grape Registry *ngr.ucdavis.edu*

Two new features will significantly enhance the National Grape Registry website *ngr.ucdavis.edu* in the coming months. The new additions are: photographs of typical clusters, shoots and leaves for FPS foundation vineyard selections ('clones'); and descriptive profiles of approximately 375 selections currently in the pipeline at FPS.

FPS was awarded a grant from the Oregon Wine Board this year to develop photographic illustrations of the FPS foundation vineyard selections. Deborah Lamoreux, a professional photographer based in Winters, California, has collaborated with FPS staff and Dr. Andrew Walker of the UC Davis Department of Viticulture & Enology on appropriate images for clusters, shoots and leaves for each selection (clone). There will be multiple photos of each cluster, shoot and leaf—one with the plant part standing alone and another with the plant part next to a ruler to reference size. It is expected that the photos will be useful to both ampelographers and grape growers seeking to locate a particular clone. The photographs will require a number of years to complete, beginning with the most economically important selections.

Carignane FPS 10
photographed for NGR by
Deborah Lamoreux

The second new feature on the NGR website is a module called 'Vines in Progress' that features plant material in the 'pipeline' at FPS and other clean plant centers in the United States. 'Vines in Progress' includes descriptive profiles of grape clones currently being processed at the clean plant centers. These may include selections undergoing USDA-APHIS quarantine procedures for imported materials, or disease testing and/or disease elimination therapy for domestic material destined for state certification programs. This feature was added to inform viticulturalists, researchers, grape growers and wine makers of the existence of unique or interesting varieties and clones that will become available. Others considering importing material will benefit by being able to avoid duplicating efforts on materials that are already in a pipeline. This feature should be largely incorporated by Fall 2010.

Initial 'Vines in Progress' on NGR consists of 375 grapevine selections at FPS that are either in quarantine, undergoing disease testing and/or microshoot tip tissue culture therapy, or are available in the quarantine vineyard as unique but unused germplasm imported to Davis years ago by plant explorers such as Dr. Harold Olmo. Most of the vines in progress at FPS are destined for the public foundation collection, although some may have a brief waiting period after release to the owner prior to becoming available to the public. An example of the latter is the large collection of French clones donated to FPS by Mr. Robert Haas of Tablas Creek Vineyards in Paso Robles, California. Other large groups of vines in progress were retrieved from the Middle East and Turkmenistan by Dr. Mali Aradhya of the National Clonal Germplasm Repository in Davis.

FPS Director Deborah Golino commented, "We are pleased that the National Grape Registry has been enthusiastically embraced by the grape and wine industry. We believe that the new features will make the site more informative and useful for locating unique and interesting grape clones."

Grapevine Disease Testing Protocol 2010

by Dr. Adib Rowhani and Dr. Deborah Golino, Foundation Plant Services and Department of Plant Pathology, University of California, Davis

Freedom from viruses and other pathogens in grapevine stocks is important because all plants for plantings are produced by vegetative propagation. If present, disease agents will be readily perpetuated in the progeny. Once diseased plants are established in commercial vineyards, they are not amenable to any curative or therapeutic control measures. The most effective disease control option in most instances is removal of infected plant or plants. Further, several disease agents are spread secondarily by natural vector species, i.e. mealybugs and nematodes.

The principal method proven most efficient in controlling virus and virus-like diseases in grapevines involves applying pathogen exclusion protocols in advance of wholesale plant propagations. These protocols are often performed in the framework of clean stock/certification programs. Certification schemes worldwide share a common objective: to identify healthy sources for propagation through the application of time-tested indexing procedures as well as more recently developed molecular assays. Even so, the actual procedures and protocols can vary widely depending on the specific pathogens being targeted, the endemic disease agents in a production region, the availability of techniques and financial resources, and the expectations of industries served. The first step is the establishment of foundation or nuclear source plants; these plants test free from all known harmful viruses and are professionally identified for true-to-type phenotypes.

At Foundation Plant Services (FPS), we produce and maintain grapevine certified nuclear stock materials that become available to nurseries and growers in California, the United States, and foreign countries. The California Department of Food and Agriculture (CDFA) administers the statewide California Registration and Certification (R&C) Program for Grapevines. By the establishment of National Clean Plant Network (NCPN) in 2008, further support was provided through the Federal Government 2008 Farm Bill for specialty crops including grapevines nationwide. "The purpose of NCPN is to ensure the availability of high quality asexually propagated plant material that is free of targeted plant pathogens and pests that cause disease and resulting economic loss, to protect the environment, and ensure for the global competitiveness of specialty crop producers. The NCPN promotes disease and pest free specialty crops, rapid and safe introduction of new varieties from foreign sources, hygienic products for export, and a wholesome and abundant food supply. It attains these objectives by supplying pathogen and pest tested plant material for production of plants for planting. NCPN conducts research to improve its diagnostic and therapeutic service."

However, an important decision reached by the Grape Clean Plant Network (CPN), in conjunction with members of the Core Working Group, at the Grape CPN meeting in February 2009 was to set the future national standard for grapevine foundation material in the United States at a rigorous new level. Compliance with the new NCPN standard will ultimately be required as a prerequisite to NCPN certification for a foundation vineyard on the 100-acre Russell Ranch parcel on the UC Davis campus. All grapevines in the new vineyard will be propagated by microshoot tip tissue culture techniques (used for the elimination of viruses and crown gall). To qualify the grapevine cultivars and selections for planting at Russell Ranch, they should pass a panel of qPCR and/or PCR tests listed in Table 1 (Columns D and E) **in addition to** the biological indexes that qualify the materials for the CDFA Certification program (Table 1, columns F and G). This testing scheme is designated as "**PROTOCOL 2010**." Many nepoviruses exclusively reported in Europe and other parts of the world have been added to the list to ensure the freedom of our foundation material from these exotic and harmful viruses too. Work is underway to develop more sensitive qPCR for all the pathogens listed in Table 1.

To guarantee the success of PCR and qPCR assays for the detection of pathogens listed in Table 1, the FPS laboratory received support from NCPN in 2010 to upgrade the sample processing and testing equipment. This equipment was needed in order to increase the efficiency and accuracy of the tests and included: 1) Genogrinder 2010, that could process and homogenize 96 samples at a time in a matter of 3 minutes; 2) MagMax Epress that could process the samples prepared by Genogrinder and extract total nucleic acid for amplification and disease detection. This machine has the capacity to process 96 samples at a time in approximately 20 minutes and produce high quality of total RNA; 3) 7900HT Fast Real-Time PCR system that is used for the amplification of target RNA or DNA in the sample and has the capacity of running 96 samples at a time in approximately 1:15-2:15 hours depending on the test plate block used. The machine also has the capacity for low density PCR array (LDA) which could be used to test 384 samples at a time.

Table 1: LIST OF AVAILABLE TESTS FOR PROTOCOL 2010

A	B	C	D	E	F	G
Group	**Pathogen**	**Symbols**	**qPCR**	**PCR**	**Herb. Index**	**Woody Index**
Nepoviruses	Grapevine fanleaf virus	GFLV	√	√	√	St. George
	Tomato ringspot virus	ToRSV	√	√	√	
	Tobacco ringspot virus	TRSV		√	√	
	Arabis mosaic virus	ArMV		√	√	
	Strawberry latent ringspot virus	SLRSV		√	√	
	Peach rosette mosaic virus	PRMV		√	√	
	Blueberry leaf mottle virus	BLMV		√	√	
	Grapevine Bulgarian latent virus	GBLV		√	√	
	Grapevine chrome mosaic virus	GCMV		√	√	
	Grapevine Tunisian ringspot virus	GTRV			√	
	Raspberry ringspot virus	RpRSV		√	√	
	Tomato black ring virus	TBRV		√	√	
	Grapevine Anatolian ringspot virus	GARSV		√	√	
	Grapevine deformation virus	GDefV		√	√	
	Artichoke Italian latent virus	AILV		√	√	
Closteroviruses	Grapevine leafroll associated virus 1	GLRaV-1	√	√		Cab. Franc
	Grapevine leafroll associated virus 2	GLRaV-2	√	√		Cab. Franc
	Grapevine leafroll associated virus 2RG	GLRaV-2RG	√	√		
	Grapevine leafroll associated virus 3	GLRaV-3	√	√		Cab. Franc
	Grapevine leafroll associated virus 4	GLRaV-4	√	√		Cab. Franc
	Grapevine leafroll associated virus 5	GLRaV-5	√	√		Cab. Franc
	Grapevine leafroll associated virus 6	GLRaV-6	√	√		Cab. Franc
	Grapevine leafroll associated virus 7	GLRaV-7	√	√		Cab. Franc
	Grapevine leafroll associated virus 9	GLRaV-9	√	√		Cab. Franc
	Grapevine leafroll associated virus 10	GLRaV-10		√		Cab. Franc
	Grapevine leafroll associated virus 11	GLRaV-11		√		Cab. Franc
	Grapevine leafroll associated virus Car.	GLRaV-Car	√	√		Cab. Franc
Vitiviruses	Grapevine virus A	GVA	√	√		Kober 5BB
	Grapevine virus B	GVB	√	√		LN33
	Grapevine virus D	GVD	√	√		
	Grapevine virus E	GVE		√		
Foveavirus	Grapevine rupestris stempitting associated virus (all strains)	GRSPaV	√	√		St. George
Maculavirus	Grapevine fleck virus	GFkV	√	√		St. George
	Grapevine redglobe virus	GRGV		√		
Marafiviruses	Grapevine syrah virus-1	GSyV-1	√	√		
	Grapevine vein feathering virus	GVFV		√		
	Grapevine asteroid mosaic virus	GAMV		√		St. George ?
Trichovirus	Grapevine berry inner necrosis virus	GINV		√		
Phytoplasma	Phytoplasma	Phyto		√		
Pierce's Disease	*Xylella fastidiosa*	PD	√	√		

Note: √= test is available; qPCR= quantitative PCR= real time RT-PCR with TaqMan probe; PCR= will include RT-PCR for RNA viruses; Cab. Franc= Cabernet Franc; St. George= St. George rootstock. Herb. Index.= herbaceous host indicators which will include a panel of: *Chenopodium quinoa*, *C. amaranticolor*, cucumber and tobacco plants.

Micro- vs. Macroshoot Tip Tissue Culture Therapy for Disease Elimination in Grapevines

by Susan T. Sim and Deborah Golino, Foundation Plant Services

Various techniques have been developed to eliminate plant diseases from grapevines. In the past, heat treatment in growth chambers was the most common method for eliminating virus disease from grapes. More recently, tissue culture therapy has replaced heat treatment and is used to eliminate viral, fungal, and bacterial diseases of grapes. Tissue culture is a plant propagation or disease elimination technique whereby tissue pieces (groups of cells called 'explants') are separated from a source plant and cultured in sterile growth media apart from that plant. In recent years, there has been some confusion about the role of microshoot tip culture and macroshoot tip culture in disease elimination. We hope to clarify the difference between the two types of therapy in this article as well as answering some frequently asked questions.

Microshoot tip culture

Shoot tip culture is a disease elimination technique whereby pieces of the apical growing point are excised from a plant and cultured in a sterile growth media apart from the plant.

In **microshoot tip therapy**, as practiced at FPS, a growing tip that is less than 0.5mm is excised from the shoot tip. Many pathogens, including viruses and the crown gall bacterium, are eliminated by this technique. A microshoot tip includes the meristematic dome and two to four leaf primordia (Fig. 1). A meristematic dome is a rounded group of undifferentiated cells that divide and have the capability to become leaves, flowers and other structures. Leaf primordia are very small, immature leaves. A microshoot tip is just barely visible to the naked eye.

To excise such small pieces we use a binocular dissecting scope with 10–80X zoom magnification.The shoot tips are cleaned and surface sterilized to prepare for aseptic excision under a transfer hood. The young growing tip is removed and placed into a test tube with sterile tissue culture growth medium, where the new plant develops. Incubation in a growth chamber under controlled conditions until roots and shoots have developed is essential. This phase continues until the explant produces a shoot and roots and is about 10 cm long. This takes 6 to 18 months (Sim, 2006). The combination of low hormone levels combined with a minimum time in culture reduces the chance of mutation and regeneration of an off-type plant. For grapes, the success rate of microshoot tip culture for eliminating viruses is far higher than for any other known type of therapy.

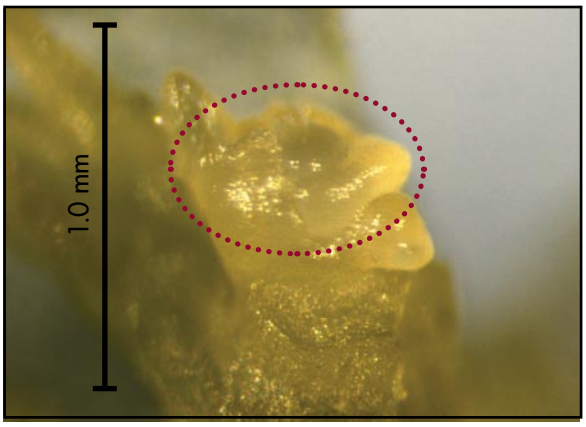

Figure 1. A **microshoot tip** (inside dotted red line) is less than 0.5mm and is exposed after peeling off scaly leaves. Shown at approximately 50X magnification.

Macroshoot tip culture

In **macroshoot tip therapy**, a growing tip that is about 5 to 10 mm in length is cut from the shoot tip. A macroshoot tip includes a microshoot tip, small, scaly leaves, and a short section of stem (Fig. 2). This piece is 10 to 20 times larger than the piece cut for microshoot tip culture. It is surface sterilized and stuck in nutrient medium until it produces a shoot and roots and is about 10 cm long. This takes about three months.

Macroshoot tip culture reliably eliminates the A*grobacterium vitis* bacterium, which causes grape crown gall disease. It does not reliably eliminate virus infections.

Figure 2. A **macroshoot tip** (inside dotted red line) is 5 to 10mm and includes a microshoot tip and scaly leaves. *Photos by Susan T. Sim*

Table 1. Comparison of Micro vs. Macro Shoot tip culture

Key	Microshoot tip culture	Macroshoot tip culture
Explant size	< 0.5 mm	5 to 10.0 mm
Result	Eliminates many pathogens—including viruses and crown gall	Eliminates one pathogen - crown gall
Number of tips excised per hour	10 (approx.)	50 (approx.)
Average time required to grow into a 10 cm tall plant with roots	6 – 18 months	3 months
Cost	$$$$/ plant to produce	$/plant to produce
FPS Location	All selections planted at Russell Ranch will be treated with microshoot tip culture. Many selections in the current Foundation Vineyard were treated with this technique.	All selections planted in the Goheen Block (Next Generation Vineyard) were treated with a minimum of macroshoot tip culture; some of them received microshoot tip culture instead. These selections were propagated from registered vines in the current Foundation Vineyard.

FREQUENTLY ASKED QUESTIONS

Q: What is the difference between microshoot tip and macroshoot tip culture therapy?

A: As the names imply, the difference between micro and macro shoot tip culture is in the size of the growing tip excised. In microshoot tip therapy, we excise a miniscule piece of tissue—less than 0.5 mm. Depending on the variety and condition of the shoot, the pieces range from as small as 0.2 mm to 0.45 mm at their largest diameter.

In macroshoot tip therapy, a growing tip that is about 10 mm in length is cut from the shoot tip. This macroshoot tip includes the meristem dome, many leaf primordia, small, scaly leaves, and a short section of stem (Fig. 2). It is surface sterilized and stuck in nutrient medium until it produces a shoot and roots and is about 10 cm long. This takes about 3 months.

Microshoot tip therapy is more difficult and much slower, but reliably eliminates virus infections. If crown gall disease is the only reason to perform therapy, macroshoot tip culture is faster and less labor intensive, and therefore less expensive.

Q: Which pathogens does microshoot tip tissue culture therapy eliminate?

A: Microshoot tip therapy effectively eliminates many grape pathogens including fungi, bacteria, and, most important to FPS programs, grapevine viruses. More than 60 grapevine viruses have now been described (Martelli, 2009); to date, any grapevine infected with a known virus can be treated successfully with microshoot tip culture. Among those viruses are: *Grapevine leafroll-associated viruses*, that are associated with leafroll disease; Nepoviruses, examples of which are *Grapevine fanleaf virus* and *Tomato ringspot virus*; Vitiviruses, such as *Grapevine virus A, B, and D* that are associated with rugose wood diseases; and *Rupestris stem pitting-associated virus*, also associated with rugose wood disease. In addition, the A*grobacterium vitis* bacterium, which causes grape crown gall disease, is also eliminated with this therapy. It is generally believed that some fungal diseases can also be eliminated with both macro- and microshoot tip culture, but data on this is limited.

Q: Which pathogens does macroshoot tip tissue culture therapy eliminate?

A: In contrast to microshoot tip culture, macroshoot is not known to eliminate any viruses or virus-like pathogens. It is known to effectively eliminate A*grobacterium vitis* bacterium, which causes grape crown gall disease. It is generally believed that some fungal diseases can also be eliminated with both macro- and microshoot tip culture, but data on this is limited.

Q: What does meristemming mean?

A: One of the textbook disease elimination methods for plants is known in the nursery industry as 'meristemming' or, more technically, as 'meristem tip culture' which is very effective for eliminating most viral, bacterial and

fungal contaminants (Faccioli and Marani, 1998). In this technique, the tissue pieces (cells known collectively as the explant) are harvested from a meristem tip of the plant. The meristem tip is the actively growing tissue at the tip of the shoot which has not yet differentiated into leaves or shoots (Figure 1). Many scientists reserve the term meristem tip culture for explants that only include a very few cells which make up the meristem which would be approximately 0.1 mm long depending on the plant species (Murashige, personal communication); others define a meristem culture as those taken from much larger explants as long as they are smaller than 1 mm (Hartmann et al., 1997). In the trade, this term is sometime even used to include explants as large as those we call macroshoot tip cultured. Since this term is often misused to include clonal propagation and shoot tips far larger than a meristem, we avoid use of this term at FPS.

In our experience at FPS, for satisfactory virus elimination in grapevines, a meristem tip of less than 0.5 mm must be cut (Golino et al., 2000). We refer to this as 'microshoot tip tissue culture' to avoid any ambiguity about the term 'meristemming' and/or 'meristem tip culture'. The piece excised includes the meristem dome and one or two leaf primordia. Theoretically, to optimize successful virus elimination, only the meristem dome would be excised. However, when we have excised just the meristematic dome of a grape shoot, it has not survived.

Q: If microshoot tip therapy can eliminate so many more pathogens than macroshoot tip therapy, why don't we always use it?

A: As mentioned above, we always use microshoot tip therapy for the elimination of viruses. However, it is much more difficult and requires much longer than macroshoot tip culture. In certain instances, macroshoot tip therapy to eliminate crown gall bacterium was the only therapy needed. This was true for the Next Generation Vineyard which was originally created to provide selections free of crown gall disease so that grapevine nurseries could propagate planting stock that was crown gall free.

Q: Which therapy was used to produce the current Foundation Vineyard?

A: The current Foundation vineyard contains a mix of vines which have received no therapy, heat treatment therapy (generally pre-1990), and/or microshoot tip therapy (generally post-1990). Selections that tested negative for viruses of quarantine concern and were qualified according to regulations current at the time to be registered with the CDFA Grapevine Registration and Certification program were planted in the Foundation Vineyard without therapy. Heat treatment or microshoot tip therapy was used on selections planted in the Foundation Vineyard if they had tested positive for pathogens when FPS received them and, in some cases where the selections were very valuable, as a precaution in case the original selection didn't pass the required tests. After therapy, plants were tested, and planted in the Foundation Vineyard if all required tests were negative.

Q: Which therapy was used to produce the Goheen block or Next Generation Vineyard?

A: Macroshoot tip therapy to eliminate crown gall was used to produce all rootstocks in the Next Generation Vineyard and some of the scion selections. At the time this vineyard was planned, there was much concern about possible crown gall in the FPS Foundation Vineyard. Although this is not a primary concern in many California vineyards, it is in colder climates. FPS wants to supply the best possible plant material, so in response we re-propagated the most popular rootstock and scion varieties from the Foundation Vineyard using macroshoot tip therapy to eliminate crown gall. The vines we re-propagated were already registered and virus tested negative, so they did not need to be treated for virus elimination with the much more difficult and time-consuming microshoot tip culture method. The Next Generation Vineyard contains 40 selections that have received only macroshoot tip therapy and 22 selections that have received microshoot tip therapy. All Next Generation vines are registered and tested negative for viruses of concern to the CDFA Grapevine Certification Program at the time of planting. Dr. Tom Burr, Cornell University, has tested all the rootstock vines for crown gall and they have tested negative. The Next Generation Vineyard was planned and propagated before FPS received the new 100 acres of land at Russell Ranch and funding to allow an accelerated testing and therapy program for this new Foundation.

Q: How does a nursery or a grower learn about the type of tissue culture therapy received by a particular selection?

A: All FPS grapevine selections available to nurseries and growers are included on the National Grape Registry (NGR) website *www.ngr.ucdavis.edu*. Selections with Registered or Provisional status in the California Grapevine

R&C Program, including all the vines in the current foundation vineyard and the Goheen Next Generation planting, are accessible on the NGR via the 'Varieties' button located at the top of each page on the site. A website user searching for a particular FPS selection should first proceed to the Variety page for the selection of interest. A click on the phrase 'View Clone List' will reveal a series of descriptive profiles of all the FPS selections for that variety, e.g., Harmony FPS 05.

One of the components in the profile for each selection is a line entitled 'Treatments,' which provides information about any virus therapy the selection has received. Examples of treatments are 'None,' 'Heat Treatment 168-2 days' (the second vine removed from heat treatment after 168 days), or 'Microshoot tip tissue culture therapy.'

The words 'Macroshoot tip tissue culture therapy' will not appear on the Treatments line for the selections in the Goheen vineyard. When the original foundation material of an FPS selection underwent macroshoot tip tissue culture therapy in order to be planted in the Goheen vineyard, FPS did not give the new treated Goheen vines a new selection number (as is done when microshoot tip tissue culture is used). Therefore, the original (untreated) foundation grapevine material and the treated Goheen vines both have the same selection number and are both available for distribution through FPS. In order to inform NGR users that both versions of the selection are available, the comment section on the NGR website for the Goheen vines reads:

> "In addition to the plant material in the regular blocks in the Foundation Vineyard, Harmony FPS 05 is also available from FPS' Next Generation Vineyard. All vines in that vineyard were created using shoot tip tissue culture therapy designed to eliminate bacterial contaminants such as *Agrobacterium vitis* (crown gall disease)."

This wording was developed for the NGR site before the term 'macroshoot tip culture' came into use at FPS. Discussions are now underway about renumbering or renaming selections that have been through shoot tip tissue culture therapy, particularly for those selections which are well known by their existing FPS selection numbers and which are now undergoing therapy for transfer to the Russell Ranch Foundation.

Q: Which therapy will be used to produce the new Russell Ranch Vineyard?

A: All selections that will be planted in the Russell Ranch Vineyard will be produced using microshoot tip tissue culture disease elimination therapy for viruses. We believe this will provide planting stock free of unknown cryptic viruses as well as those viruses for which we have developed tests. By default, this material should also be free of the bacteria which cause crown gall disease.

Additionally, the material will be subjected to rigorous testing using advanced technology and innovative pathogen identification methods as defined by the 'Protocol 2010' (see article in this newsletter page 10). FPS has identified ~200 scions and rootstocks that most likely will meet that protocol. By the winter of 2011, we hope to have completed testing of those scions and rootstocks so that we will be able to plant a large number of the selections in the spring of 2011 as well as distribute mist-propagated plants (MPPs) from those selections.

Q: Do some of the vines in the current Foundation Vineyard meet the '2010 Protocol' standard? Which ones qualify?

A: We expect to have a list by January or February of 2011 of vines in the current Foundation at FPS which meet the standards of the '2010 Protocol'. They will be the highest level of material (for virus status) from FPS.

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Leafroll Disease Research at FPS

by Vicki Klaassen, Foundation Plant Services

The FPS lab is both a high-throughput diagnostic center and a research facility. These functions are complimentary. As we discover new information through research, it can be applied to disease testing. In turn, development of more efficient and sensitive assays leads to more rapid hypotheses testing. The end goal is reduced disease incidence.

Although we work on multiple plant diseases, FPS testing and research efforts have focused for a number of years on leafroll disease, the most widespread and economically damaging disease of *Vitis vinifera* in the world. Due to these efforts, and those of other researchers, we know that at least 11 different viruses are associated with this disease, that they are all graft transmissible, and that at least four of them are also transmitted by several species of mealybugs and soft scale insects. This knowledge, in turn, has led to the development of effective techniques for detecting and eliminating the leafroll-associated viruses from planting stock. And the availability and use of virus-tested stock helped decrease leafroll incidence in California vineyards throughout the 1970s and 80s.

In the early 1990s, however, leafroll disease began to appear and spread within vineyards planted with clean stock. In several cases, the source of the disease appeared to be an adjacent older, infected vineyard. But we wanted to know if there were additional external sources of the leafroll viruses. Diverse plant communities that include wild *Vitis* often surround vineyards, and plant viruses typically infect more than one type of plant species. Deborah Golino was the lead scientist for this study, which was funded by the American Vineyard Foundation.

Collecting samples of wild *Vitis* growing next to a Napa County vineyard with leafroll disease. *Photo by Susan T. Sim*

In the fall of 2008 and 2009, we collected numerous different species of both herbaceous and woody non-*Vitis* species, in addition to wild *Vitis*, from the non-cultivated areas surrounding nine Napa County vineyards that had characteristic leafroll symptoms. We also included two riparian areas that weren't near vineyards but had large populations of wild *Vitis*. These samples were assayed for the most common grapevine leafroll-associated viruses (GLRaVs) and another group of grapevine viruses, the vitiviruses GVA, GVB, and GVD.

We found that two of the leafroll viruses, GLRaV-2 and -3, in addition to vitiviruses GVA and GVB, infect *V. californica* and *V. californica* x *V. vinifera* hybrids, the two most common wild *Vitis* species in our samples. We did not find virus-positive non-*Vitis* species.

Now that we know *V. californica* and *V. californica* x *V. vinifera* hybrids are alternate hosts for several of the leafroll and vitiviruses, this fall we will collect and test more wild *Vitis* to estimate virus incidence. The end goal is to determine whether *V. californica* and its hybrids are significant virus reservoirs that could affect leafroll disease incidence in adjacent vineyards. If the answer is "yes" we can begin work to devise effective control strategies.

GLRaV-3 and GVA positive *Vitis californica* x *V. vinifera* hybrid. Infected hybrids do not always have bright red coloration—and most red samples tested negative, making color an unreliable indicator of infection. *Photo by Susan T. Sim*

Determining the GPS coordinates of wild *Vitis* samples. *Photo by Alex Dougherty*

Sauvignon blanc: Past and Present

by Nancy Sweet, Foundation Plant Services

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

HISTORICAL BACKGROUND

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

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

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

CULTURAL TRAITS

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

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

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

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

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

SAUVIGNON IN FRANCE

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

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

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

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

Some of the finest examples of this sweeter style of wine have been made since the 18th century at Château d'Yquem in the Sauternes region. *Olney, 1986.* The château property containing the vineyard and winery was acquired by the Lur-Saluces family in 1785 by marriage into the Yquem family. George Washington stocked the presidential cellar with a 1787 Yquem, at the recommendation of Thomas Jefferson, the Ambassador to France. The golden sweet Château d'Yquem wine made from overripe grapes affected with noble rot received the classification of *Premier Cru Supérieur* ('Great First Growth') in 1855. The highest price paid for any French white wine is said to be a tonneau (900 litre tun) of 1847 Château d'Yquem (Sémillon blended with Sauvignon blanc) which the Marquis de Saluces sold in 1859 for 20,000 francs to Grand Duke Constantine, brother to the Emperor of Russia, at the time of his visit to Bordeaux. The price was four times the amount paid for a French white wine until that time. Amédée de Lur Saluces was the Marquis in 1884 when Charles Wetmore visited Château d'Yquem to collect French varieties for his vineyard in Livermore, California. *Bolter, 1988; Olney, 1986.*

SAUVIGNON BLANC IN CALIFORNIA

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

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

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

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

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

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

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

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

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

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

SAUVIGNON BLANC IN NEW ZEALAND

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

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

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

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

SAUVIGNON BLANC IN SOUTH AFRICA

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

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

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

SAUVIGNON BLANC IN CHILE AND AUSTRALIA

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

Chile

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

Australia

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

SAUVIGNON CLONES AT FOUNDATION PLANT SERVICES

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

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

Sauvignon blanc FPS 01 has the longest history in the FPS program. The history of the selection can be traced directly back to Bordeaux. As noted above, Charles Wetmore commented in 1884 that it would be necessary to bring plant material directly from France for California growers to have an adequate stock of the Sauternes varieties. The State Board of Viticultural Commissioners charged Wetmore with travelling to Europe to obtain better varieties. He consulted with a Livermore Valley grower, Louis Mel, before going to France for plant material. *Stoll, 1935.*

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

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

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

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

Sauvignon blanc FPS 03/29 (Foothill Experiment Station)

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

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

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

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

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

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

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

Sauvignon blanc FPS 22 (Oakville)

Sauvignon blanc FPS 22 came to Davis around 1990 from a very old head-trained, gnarled and neglected vine in the southeast corner of the UC Davis Oakville field station. Phil Freese, former vice president of Wine Growing at Robert Mondavi Winery, encouraged FPS to preserve this selection because he suspected that the vine might have been part of a very old vineyard that originated before the UC importation programs and modern Sauvignon blanc introductions. Pierre Galet looked at this vine during one of his trips to California in the 1980's and told Freese that it was 'true Sauvignon blanc.' *Nelson-Kluk, 2002.* At the time Galet visited California, Sauvignon vert (Muscadelle) was cultivated alongside true Sauvignon blanc, which was sometimes referred to as Savagnin musqué. *Galet, 1998.*

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

Sauvignon blanc FPS 23 (Howell Mountain, Napa)

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

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

Sauvignon blanc FPS 26 (Napa County)

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

Sauvignon blanc FPS 27 (the musqué clone)

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

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

Savagnin musqué FPS 01 disappeared from the registered list and was removed from the foundation vineyard in 1978. Index testing in the late 1970's revealed a stem pitting problem, which at the time disqualified plant material from the California Grapevine Registration & Certification Program. The plant material thereafter underwent heat treatment for 80 days and reindexing between 1983 and 1986, after which it was renamed Savagnin musqué FPS S1.

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

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

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

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

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

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

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

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

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

Sauvignon blanc FPS 30 (Larry Hyde)

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

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

Other French clones at FPS

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

Official French clones

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

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

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

Generic French clones

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

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

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

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

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

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

Italian Sauvignon blanc clones

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

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

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

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

Many of the finer Sauvignon blanc wines from the northeast region of Italy are made from the "extremely pungent

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

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

Sauvignon gris clones

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

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

Sauvignon gris FPS 03

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

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

Sauvignon gris FPS 03 vine in the Foundation Vineyard at FPS. Foundation Plant Services vineyards are managed for the healthy production of budwood rather than for fruit qualities.
All photos in this article by Deborah Lamoreux, Winters, California.

UC SAUVIGNON BLANC CLONAL AND TRELLIS TRIAL

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

Clonal Trial

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

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

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

The average number of clusters per vine was 'fairly similar' but with some statistical differences. The clones with higher cluster count (e.g., FPS 01, 17, 18, 22, 25, 26) experienced good fruit set. FPS 07 and 14 were consistently smaller in cluster weight than the others. The clones with the highest Brix at harvest (target 21.5 to 23°) usually had the smallest clusters. The trial is in Winkler heat summation zone 3 (3100 degree hours). The yield to pruning weight data (all under 4) indicate that the vines in the trial are being undercropped.

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

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

Trellis Trial

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

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

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

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

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

ACKNOWLEDGMENTS

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Sauvignon Selections at Foundation Plant Services

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

Key: Proprietary selections are indicated in boldface type
FPS Status: R = on the registered list for the California Grapevine R&C Program

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

The National Plant Diagnostic Network

by Richard Hoenisch, WPDN Training and Education Coordinator, Carla Thomas, WPDN Associate Director, and Richard Bostock, WPDN Director and NPDN Executive Director. Department of Plant Pathology, University of California, Davis

Since its inception in 2002, the National Plant Diagnostic Network (NPDN) has become an important program in U.S. efforts to protect crop agriculture from invasive or introduced pests. The Agricultural Bioterrorism Protection Act of 2002 directed the USDA to develop a network of diagnostic facilities to help address the threat posed by high consequence plant pests and diseases. The NPDN operates with support from the USDA-NIFA (National Institute for Food and Agriculture) and through the collective efforts of many individuals representing land grant universities, federal agencies, state departments of agriculture, and other stakeholders. It links all these agencies into a cohesive network designed to quickly detect and diagnose plant pests and diseases and disseminate information concerning plant pathogens, insects, and invasive weeds. The specific purpose of the NPDN is to provide a nationwide network of public agricultural institutions with a distributed system to quickly detect pests and pathogens that have been introduced into agricultural and natural ecosystems, identify them, and immediately report them to appropriate responders and decision makers. To accomplish this mission, the NPDN has invested in plant diagnostic laboratory infrastructure and training, developed an extensive network of first detectors through education and outreach, and enhanced communication among agencies and stakeholders responsible for responding to and mitigating new outbreaks. NPDN allows land grant university diagnosticians, state and federal regulatory personnel, and first detectors to efficiently communicate information, images, and detection methods in a timely manner. The NPDN has grown into an internationally respected consortium of plant diagnostic laboratories.

Dr. Richard Brown demonstrates dissection at an NPDN Adult Lepidoptera ID Workshop at UC Davis, March 2009.

The NPDN does not implement quarantines or other response actions, and thus has no formal regulatory authority. The NPDN helps guide response and mitigation efforts by providing rapid and accurate diagnoses, and the most up-to-date scientific information concerning outbreaks of biological pests. Regulatory actions are coordinated by state departments of agriculture and the federal Animal and Plant Health Inspection Service (APHIS). Additionally, pest control recommendations or programs are generally implemented through regional Integrated Pest Management (IPM) Centers, state IPM coordinators, or Cooperative Extension.

The NPDN is divided into five regions, each with a lead university that coordinates regional activities. Regional centers are located at Cornell University (Northeast region, NEPDN), Michigan State University (North Central region, NCPDN), Kansas State University (Great Plains region, GPDN), University of Florida at Gainesville (Southern region, SPDN), and University of California at Davis (Western region, WPDN). Regional centers ensure all participating land grant university and state diagnostic laboratories are alerted to possible outbreaks and/or introductions and are technologically equipped to rapidly detect and identify pests and pathogens. The Center for Environmental Regulatory Information Systems (CERIS) at Purdue University serves as the central repository for archiving diagnostic data collected from each region.

Our First Detector training and education programs have trained over 9,000 first detectors nationally, with over 3,900 registered in the western region (WPDN). Our expanded awareness programs have reached several thousand more. Connection with this registry is maintained through regional and national newsletters (see *www.npdn.org* and *www.wpdn.org*), and listservs that can rapidly alert all or selected groups of first detectors and diagnosticians to a new outbreak. Recent initiatives include development of eight on-line first detector training modules and advanced entomology and plant pathology workshops for diagnosticians and specialists.

The NPDN Exercise program works with officials from federal, state and regional departments of agriculture to practice and perfect a chain of communication, of sample custody and the National Incident Management System (NIMS) in case of an actual occurrence. These exercise scenario programs provide valuable training opportunities for participants at every level. The exercises thoroughly test interagency communications to help find policy and procedural weaknesses within the national network as well as provide a training environment for first detectors. The NPDN has completed at least one exercise training in every state and territory. There have been several exercises with the border governors of the U.S. and Mexico.

Explore our website *www.npdn.org* to learn more about the NPDN and our programs.

National Clonal Germplasm Repository for Tree Fruits, Nut Crops and Grapes

by John E. Preece, Supervisory Research Leader, NCGR, Davis

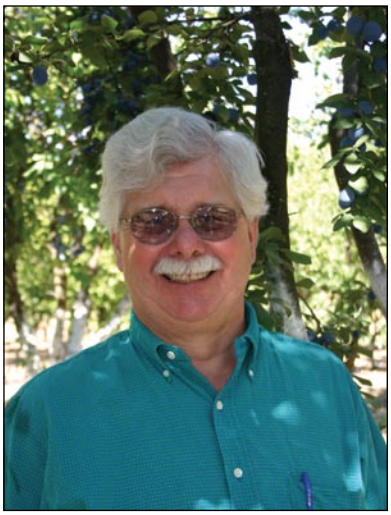
The National Clonal Germplasm Repository (NCGR) is situated across the road from FPS in Davis, California. This federal USDA-ARS Repository is a genebank with 7,001 accessions of Mediterranean tree fruits, nut crops and grapes representing 22 genera and 212 species.

Approximately half of our accessions are grapes. The tree fruit crops are apricot, cherry, fig, kiwifruit, mulberry, olive, peach, persimmon, plum, and pomegranate; the nut crops are almond, pistachio, and walnut. An accession can be a cultivar or a wild form of a plant collected from a specific location. Each accession represents a portion of the genetic diversity of that species, and our accessions were collected world-wide.

The NCGR is within National Program 301: Plant Genetic Resources, Genomics and Genetic Improvement. We are one of more than 20 genebanks in the USDA-ARS National Plant Germplasm System (NPGS) where more than 530,000 samples of crop genetic diversity (accessions) are conserved.

The NPGS makes propagules (seeds, cuttings, or scionwood) available to scientists and others throughout the world. The Davis Repository primarily sends out dormant stem pieces during March. However, we also distribute some green leafy cuttings and, when requested, pollen is collected and shipped to breeders. During 2010, approximately 500 requests were made for dormant cuttings and scionwood from the repository. The average order was for 10 different accessions. Overall, more than 5,000 bundles of 3-5 dormant cuttings were shipped to clientele in the United States and abroad. These are provided free-of-charge; however, it is a great help if a FedEx number can be provided to help defray Repository shipping expenses.

The genebank system is important because it is a way of preserving valuable genetic material for the future. Over time, plants are lost from their native habitat because of climate changes, pressure from animals (i.e. grazing), and human activities. Maintaining at least a portion of this diversity in genebanks ensures that it will be available for future research or other purposes. Some of the diversity maintained in genebanks is of little direct commercial interest. However, some of this germplasm may contain valuable genes that may confer resistance to insects, disease causing pathogens, or tolerance to environmental stresses. Therefore it is impossible to assess its future value.



John Preece became the Research Leader at the Davis Repository in January 2010. Previously a horticulture professor, his current research focuses on clonal propagation of woody plants, a high priority for the NCGR. Here, he is shown monitoring conditions at the NCGR Wolfskill orchards.
photo by Susan T. Sim

Our crops, such as grapes, are ancient cultivated species that have been propagated clonally for centuries or millennia. For example, old cultivars, such as 'Cabernet Sauvignon' have been under cultivation for a long time and if propagated by seed, the resulting progeny would not "come true," or would segregate for various traits. The long history of clonal propagation of our crops has resulted in two challenges: pathogens, such as viruses, have accumulated in the crops; and naming of some accessions is ambiguous.

When many plants go through a seed generation, the resulting seedlings are often free from internal pathogens, including viruses. However, when cuttings are rooted, or shoots and buds grafted, internal viruses and other pathogens are propagated along with the cultivar. Historically, there has been limited effort to clean up the NCGR collection from internal pathogens. Therefore, it is a priority for the Repository to clean up the collection and reestablish and maintain clean accessions. This can be accomplished by using plant tissue culture techniques and propagating using very small growing points known as micro-shoot tips. Sometimes this is combined with thermotherapy (growing plants at high temperatures). This is an important area of collaboration between the NCGR and FPS.

Over the history of cultivation of many of the NCGR crops, when a named clone was moved from country to country, it was often renamed. Nurseries have also renamed clones to help their sales. A challenge for repositories is to learn which accessions with different names

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The European Grapevine Moth

by Richard Hoenisch, WPDN Teaching and Education Director

The **European Grapevine Moth** (EGVM), *Lobesia botrana*, has been detected to date in six counties in California. EGVM is a serious pest of grape, *Vitis vinifera*, a preferred host, although it is reported from other cultivated and wild hosts as well. It was first described in 1775 from specimens from southern Italy. This moth spread into Austria and is now distributed throughout Europe, North and West Africa, the Middle East, and eastern Russia. More recently, it was inadvertently introduced to Japan. In April, 2008, it was reported in Chile and later in Argentina, the first occurrence in the New World. EGVM was first detected in September 15, 2009 in the Rutherford/Oakville region of Napa County CA, marking its first occurrence in North America. Because the vines were going into winter dormancy at that time, it was hard to detect the presence of the EGVM. The EGVM pupates during the winter under the bark of the vine. With bud break, the pupae hatch and the adults begin to mate and lay eggs in the flower clusters of the vine. "Its unique biology causes significant damage to clusters and reduces yields. Eggs are laid singly and almost exclusively inside grapevine clusters and larvae feed on and inside developing flowers and berries. In the second generation, females lay their eggs individually on berries. Initially the larvae will form a silken tunnel by the cluster rachis, tie several berries together and feed on berry surfaces. Larvae penetrate mid-size berries where two berries touch."[1]

Detection at the adult stage is done by the California Department of Food and Agriculture (CDFA) and the USDA placing EGVM pheromone traps across the state and keeping careful record of the catches. "Grapes are our state's top crop," said CDFA Secretary A.G. Kawamura. "We have set an array of more than 40,000 traps statewide to determine exactly where the infestations exist. Detecting the pest is an important first step toward controlling it, and quarantines are the next step in the process. These regulations allow us to protect surrounding uninfested areas by preventing movement of the insects on crops, harvesting equipment and related articles." In Sonoma County, there are 16 traps per vineyard square mile. If two or more adult male moths are caught in traps placed no further than three miles apart, then quarantine is established by CDFA. Quarantine is also triggered if more than one adult moth is caught in a single trap. The quarantine encompasses a five-mile radius from the trap(s) that caught moths. Trapping density increases to 25 traps per vineyard square mile inside a quarantine area. Traps are serviced every two weeks.[1] As of May 1, 2010, there have been over 40,000 EGVM moths found in Napa County. Monica Cooper, Cooperative Extension Director for Napa Co., maintains an excellent website with updates on trapping and control of the EGVM at: *http://cenapa.ucdavis.edu/newsletterfiles/newsletter2084.htm.* A significant portion of Napa, Sonoma, Solano, Fresno, and Mendocino counties are currently under quarantine for this pest (see map at right).

UC IPM Grape Pest Management Guidelines describes the damage caused by EGVM: In May and June, first-generation larvae web and feed on the flower clusters. Second-generation larvae (July-August) feed on green berries. The first report of the second generation adult was made on June 10 from EGVM traps in Oakville and Rutherford, Napa County. Young larvae penetrate the berry and hollow them out, leaving the skin and seeds. Third-generation larvae (August-September) cause the greatest damage by webbing and feeding inside berries and within bunches which become contaminated with frass (excrement). Third generation larvae can cause the most damage to clusters, preventing them from being harvested for wine and table grape production. Larvae penetrate and feed on ripening fruit immediately after hatching. Additionally,

[1]Smith, R.J., Varela, L.G. "Second-generation EGVM trapped in Sonoma County." Western Farm Press. June 17, 2010

[2]Varela, L.G., Zalom, F., Cooper, M. L.. European Grapevine Moth, *Lobesia botrana*: A New Pest in California. UC IPM Online. 2009

[3]Varela, L.G., Smith, R.L., Cooper, M.L. , Hoenisch, R.W. European grapevine moth, *Lobesia botrana*, in Napa Valley vineyards. Practical Winery & Vineyard. March/April 2010

At top: European grapevine moth female, photo by Jack Kelly Clark, courtesy of UC Statewide IPM Program.

feeding damage to berries after veraison exposes them to infection by *Botrytis* and other secondary fungi such as *Aspergillus*, *Alternaria*, *Rhizopus*, *Cladosporium*, and *Penicillium*. Secondary pests such as raisin moth (*Cadra figulilella*), fruit flies, and ants may also be attracted to damaged berries."[2]

Previously quarantined areas in Napa, Solano and Sonoma counties are expanding by approximately 900 square miles. New quarantine areas are being created in Fresno County (approximately 96 square miles) and in Mendocino County (approximately 140 square miles). The state's total EGVM quarantine area now stands at approximately 1395 square miles. Maps are at: *http://www.cdfa.ca.gov/phpps/PE/InteriorExclusion/egvm_quarantine.html* The EGVM has recently been detected in Monterey Co. (Soledad area) on May 10th and Merced Co. (Snelling) on May 13th. View the video on the home page demonstrating the size and number of EGVMs with Greg Clark *http://www.cdfa.ca.gov/phpps/egvm/index.html*. This site also has several links about the pest.

Control of EGVM: First it is imperative to know the life cycle of the EGVM. In fall, pupae overwinter under the bark of the vine. With warming temperatures coinciding with bud break, the adults emerge from the pupal stage under the bark and begin to mate. The adults fly at dusk when the temperature is 54°F or more, mating occurs in flight, and most females mate once per lifetime.[3]

The fertilized female lays her eggs in grape flower clusters. She is also attracted to other flowers, especially olive. At this point mating disruption with pheromone traps confuses the mating cycle. ISOMATE®-EGVM pheromone dispensers use the insect's own communication system to its detriment. In the wild, female moths release a sex pheromone into the air to attract male moths. Male moths detect the pheromone "scent" and follow it upwind to locate and then mate with the females. In plantings treated with ISOMATE®-EGVM dispensers, the dispensers emit, over a 120–180-day period, the same pheromone as the female moths. This small amount of additional pheromone confuses and disorients the male, delaying or preventing him from finding and subsequently mating with the female. The result is a reduction of mating success and suppression of the target pest population.

As the egg develops into the larval stage, *Bacillus thuringiensis* (larvicide); the Spinosad group (from an actinomycete, *Saccharopolyspora spinosa*); Success and Entrust (larvicides); insect growth regulators (methoxyfenozide) Delegate™ and Intrepid 2F® (ovicides and larvicides; (chlorantraniliprole) Altacor® (ovicide and larvicide); pyrethroids; and possible predators. See *http://cenapa.ucdavis.edu/newsletterfiles/European_Grapevine_Moth21006.pdf* and *http://cenapa.ucdavis.edu/newsletterfiles/European_Grapevine_Moth21060.pdf*

Sanitation of equipment will be critical to minimize movement of this insect from infested vineyards to non-infested vineyards and to avoid the spread to other regions of California. Equipment should be washed prior to leaving an infested property, preferably with a high pressure sprayer and hot water. This is especially important for all machinery and containers that come in contact with fruit during harvest. Larvae can hide in tight places, and fully formed larvae may form a cocoon and pupate in any protected place. When hiring an outside company to harvest fruit, verify that the contractor follows good sanitation practices. Loads will need to be covered during shipment to the winery, and winery waste that does not undergo fermentation will need to be composted.[1]

National Clonal Germplasm Repository… continued from page 33

are actually the same clone and therefore, which names are synonyms. In addition, over the centuries, it has been common for different clones to be given the same name. For example, the name of a city or region may be used more than once resulting in different clones with the same cultivar name that are indeed genetically different. This also presents a challenge for repositories seeking to have crop species diversity in the collection. Resolving these and other naming issues is also an important priority of the Repository. By using DNA technologies, the genetic makeup of individuals can be partially elucidated. This can tell us if two plants with the same name are genetically the same or different. If different, it could be because two genotypes were given the same name, or because of faulty information from the time of collection to planting in the field. If DNA genotyping tells us that two plants with different names appear to be the same, the next step is to carefully compare the growth and fruiting characteristics to determine if they appear identical or different.

Continuing priorities for the Repository are maintaining this important collection and expanding it. New accessions are added with a strategic goal: to add as much diversity in our crops as possible. This includes adding new species that are missing, new ecotypes adapted to various conditions, and new forms that have horticultural value. The National Clonal Germplasm Repository in Davis is a national treasure. If any of our accessions will fit your research needs, please go to our website to make a request: www.ars-grin.gov/dav.

Spotted Wing Drosophila found in California, Oregon, Washington, and British Columbia

by Richard Hoenisch, WPDN Teaching and Education Director

Spotted wing drosophila (SWD), ***Drosophila suzukii*** (Matsumura) has recently been found in many West Coast areas infesting ripening cherry, raspberry, blackberry, blueberry, strawberry crops. It has also been observed attacking other soft-flesh fruit such as boysenberry, plums, plumcots, peach, nectarines, apple and persimmons. As of October 13, 2009, the Oregon Department of Agriculture (ODA) reports that it is also found in wine and table grapes.[1]

The reports note that the larvae are found in ripe but undamaged looking fruit. The skin of the fruit has small holes resembling ovipositor scars. SWD is native to China, Korea, and Thailand. Adults and maggots closely resemble the common vinegar fly, *Drosophila melanogaster*, and other Drosophila species that primarily attack rotting or fermenting fruit. The spotted wing drosophila, however, readily attacks undamaged fruit. See this key to SWD from the ODA for help with distinguishing this pest from other flies.[2] *www.ipm.ucdavis.edu/PDF/PMG/SWD-ID-Dsuzukii.pdf.*

SWD was detected by the California Department of Food and Agriculture (CDFA) in fresh cherries near Gilroy CA in 2009. It now has been detected all along the west coast, including Oregon, Washington, and British Columbia. On August 4, 2009, SWD was also detected in Florida.[3] It has been in Hawaii since 1986.

BIOLOGY

In Japan, 13 generations have been observed per year. Three to ten generations are predicted for most Californian production climates. It is believed that this fly can have several generations per season in Oregon. Flies are most active at temperatures of 68° F. Activity, longevity, and egg laying decrease at higher temperatures (above 86° F). They thrive at cool temperatures typically experienced during the most of early summer and fall, but do poorly at temperatures above 86° F. A single life cycle can be as short as 8-14 days, depending on the weather. Flies can be active from April to November. In mid-season, adult life span is 3-9 weeks. Late summer or fall emerging flies can overwinter. They will lay eggs during the following summer on early ripening fruit. Females typically will insert their ovipositor into the fruit, lay 1-3 eggs per fruit, 7-16 eggs per day, and greater than 300 eggs in their lifetime. Pupation can take place both inside and outside of fruit in about 3 to 15 days.[4]

DAMAGE

Infestation in cherry initially is manifested by scars in the fruit surface left by "stinging" (ovipositing) females. As egg hatch time is very short (about 1 day), larvae soon begin feeding inside the fruit. Within as little as 2 days, the fruit begins to collapse around the feeding site. Thereafter, mold and infestation by secondary pests may contribute to further damage. Oregon State University has an excellent SWD website, updated frequently, at: *swd.hort.oregonstate.edu*. The California Department of Food and Agriculture (CDFA) has a Power Point presentation on the biology and damage of by SWD: *cesonoma.ucdavis.edu/files/69686.ppt*.

Photo by Gevork Arakelian

Photo by Martin Hauser

Photo by Martin Hauser

Drosophila suzukii male (left and center) and female (right). Note that only the male has spotted wings.

MANAGEMENT

Spotted wing drosophila attacks ripening fruit, and unfortunately is often not noticed in commercial and backyard trees until fruit is being harvested. Sprays at this time will not protect the crop, because maggots are already in the fruit. In the immediate post-harvest period, remove any fruit that has fallen on the ground and any infested fruit remaining on trees. This may reduce populations of flies that might infest next year's crops or later ripening varieties. This remaining fruit should be bagged and buried. Composting may not be a reliable way to destroy eggs and larvae in fruit.

Because this pest is so new to the West Coast and in Florida, there has been limited research on treatments to manage SWD. Malathion is one mode of control of SWD. Application should be made about 2 weeks before harvest. Sprays must kill adults before they lay eggs. Malathion will not control larvae in fruit.

An alternative to malathion with fewer negative environmental effects would be Spinosad (Monterey Garden Insect Spray); however, it is not believed to be as effective against the fruit fly adults as malathion. Two sprays may be required at about 14 days and 7 days before harvest to get satisfactory control. As with malathion, all foliage and fruit on the tree must be covered with the spray. Partial coverage will not be effective. A compressed air sprayer will give more reliable coverage than a hose end sprayer.[1]

Before making a chemical application, be sure the product is registered for your crop. The permissible rate of application is subject to change, so consult the label and all updates before application.

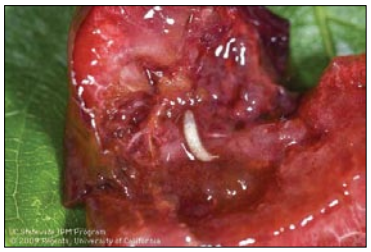

Photo by Larry L. Strand

Larva of spotted wing drosophila, *Drosophila suzukii.*

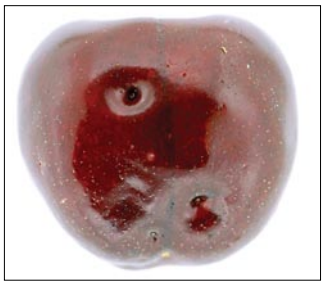

Photo by Martin Hauser

Oviposition scars caused by spotted wing drosophila.

Photo by Ed Show

Black spots can be seen on the male spotted-wing drosophila that landed on this raspberry.

Photo by Mike Reitmajer

Fully emerged larva of *Drosophila suzukii.*

Photo by Ed Show

SWD mating pair.

Photo by Mike Reitmajer

SWD pupae next to dime for size comparison. They develop three days after last larval instar.

[1]Dreves, A.J., Walton, V. Fruit fly, "Spotted Wing Drosophila," identified in wine grapes. Oregon State University, Extension Service News. October 13, 2009.

[2]Caprile, J., Flint, M.L., Bolda, M.P., Coates, W.W., Grant, J.A., Zalom, F.G., Van Steenwyk, R. Spotted Wing Drosophila, *Drosophila suzukii*: A New Pest in California. University of California, UC IPM Online. June 18, 2010 *http://www.ipm.ucdavis.edu/EXOTIC/drosophila.html*

[3]Steck, G.J., Dixon, W, Dean, D. "Spotted Wing Drosophila, *Drosophila suzukii* (Matsumura) (Diptera: Drosophilidae), a fruit pest new to North America." Florida Department of Agriculture and Consumer Services. Division of Plant Industry. 2009 *http://www.doacs.state.fl.us/pi/enpp/ento/drosophila_suzukii.html*

[4]Dreves, A.J., Fisher, G., Walton, V. A new pest attacking healthy ripening fruit in Oregon: Spotted Wing Drosophila, *Drosophila suzukii* (Matsumura). Regional Pest Alert (Submitted as OSU Extension Publication) 09-09-09 ajd

Field Preparation Progress 2010 at the Russell Ranch Foundation Vineyard

Photos by Mike Cunningham

Plowing up alfalfa, above; and deep ripping the soil.

Field crew holds a tailgate session.

Below: Leveling with the land plane.

Russell Ranch Foundation… continued from front page

Proposals for obtaining funding to establish the infrastructure for the new Russell Ranch Vineyard were submitted by FPS to the NCPN in both 2008–09 and 2009–2010. The 2008–09 funds have been distributed and are being used at FPS to develop a new well and pump for irrigation, and to purchase a tractor and implements for exclusive use at the Russell Ranch location. Proposals submitted by FPS to NCPN in May 2010 and allocated in August 2010 have been earmarked for fumigation, fencing, installation of a trellis system, and above ground irrigation lines. As of mid-September 2010, 20 acres at the Russell Ranch site have been plowed to remove the existing alfalfa crop, ripped to open the ground and remove alfalfa roots as much as possible, leveled with a tri-plane, and disked in preparation for methyl bromide fumigation in early October. (Photographs on page 38 and 39 show the transformation).

Initially 20 acres are being prepared; however, FPS has been assigned a total of 100 acres at Russell Ranch, which should accommodate our needs for 5 to 7 years. All grapevines used to populate the FPS Russell Ranch Foundation Vineyard will be generated from the FPS laboratory using microshoot tip tissue culture for disease elimination. This regenerates the grapevine selections as free of disease as is possible. (For an in-depth discussion of the process see article on page 12). In order to qualify for planting in the Russell Ranch vineyard, grapevine plant material must also be tested using the most extensive RT-PCR panel for viruses that is available at FPS. This propagation and testing scheme, called "Protocol 2010," is explained beginning on page 10.

The first Russell Ranch Foundation Vineyard grapevines are scheduled to go from containers to the field in Spring 2011. Both rootstock and scion vines will be planted. Initial distribution of propagation materials sourced from this vineyard will be limited to mist-propagated, own-rooted vines generated from green shoots taken from young vines. Graftable size wood will not become available until several years later, as the FPS field crew uses the new growth to establish and train the new vineyard to a trellis system designed to encourage production of optimal quality vegetative growth.

FPS nursery technician Josh Puckett tending grapevines destined for the Russell Ranch Foundation Vineyard that were propagated by microshoot tip culture and tested by the 2010 protocol. *Photo by Susan T. Sim*