FPMS GRAPE PROGRAM NEWSLETTER

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2001-2002 Grape Orders

California Foundation status grape materials available from FPMS for the upcoming dormant season are shown on the "Registered Grape Selections Offered by FPMS in the 2001-2002 Dormant Season" list. This list, as well as other ordering information, is available from the FPMS office. It can also be viewed on the FPMS website at http://fpms.ucdavis.edu. Twenty-three selections were added to the list because they were re-registered or registered for the first time this year. Among the public materials registered this year for the first time are: 10 Pinot noir selections; the USDA variety Princess; Sangiovese-05 which is reported to be from the Italian Bionde Santi clone; Sauvignon blanc-14, 20, 21, & 17 reported to be from French 316, 242, 378 and Italian clone ISV1 respectively; Syrah-07 reported to be from French 877; and Syrah-08 from the California Durell clone. If you have received provisional materials from any of the newly registered selections in the past, you may contact the FPMS office to request retroactive Foundation stock tags. Grape materials in short supply will be allocated among the orders received by November 15, 2001.

New Materials from FPMS

Thirteen selections planted in the FPMS Foundation block in 2001 are included on the "New Materials Available from FPMS in the 2001-02 Season" list. This list is available from the FPMS office and on the FPMS web site. Some of the selections on this list are available from FPMS for the first time this season including: Cabernet Sauvignon 38 from the Italian clone ISV-V-F-6; Chardonnay 99 and 100 reported to be from French clones 121 and 131 respectively; Pinot noir 98 and 100 reported to be from French clones 779 and 374 respectively; and two selections of Viognier from California vineyards.

All selections on the New Materials list have been checked for disease using the tests prescribed by the California Grapevine Registration and Certification Program regulations. Propagation materials from these selections qualify for California provisional Foundation stock status. The status will advance from provisional to Foundation stock if/when the mother vines are professionally identified.

Since freedom from Rupestris stem pitting (RSP) is no longer required by the California Grapevine Registration and Certification Program regulations, the RSP status of new and registered selections is not shown on the lists of materials available in 2001-02. Many selections in the collection have been tested for RSP using the field indicator St.George and/or PCR for detecting an RSP associated virus, but the meaning of the results is uncertain at this time. Research is in progress to develop methods for identifying RSP infections that may be targeted by certification programs in the future. All existing RSP test data for Foundation and provisional grape materials is available from FPMS upon request.

New materials are only available as green potted plants on their own roots (mist propagated plants, MPP) for the next few years because of the limited quantities of material available. Green plants ordered in the fall of 2001 will

be supplied about 9 to 12 months after they are ordered depending on the total quantity ordered/ selection. Sometimes it takes up to 2 years to supply large orders for new selections because of the small amount of material available for propagation. Hardwood cuttings will be available in about 2-3 years.

USDA Varieties

In May 2001 USDA released a new raisin grape variety named Selma Pete after the retired UC viticulturist, Pete Christensen. It is a white seedless grape which ripens three or more weeks before Thompson seedless. The berry size is slightly larger than Thompson seedless. The fruit is suitable for mechanical harvest by cutting canes and drying on the vine or picking and drying on trays. Selma Pete is only recommended for raisins because the fresh fruit can develop an astringent flavor. The raisin quality when dried on trays is better than both Thompson seedless and Fiesta. Four to five fruiting canes and a "T" trellis to spread the canes and allow for air circulation when drying fruit in cane cut vines is recommended. Very limited quantities of dormant hardwood cuttings with California Foundation stock status are available from FPMS in the 2001-02 season. FPMS will also produce green potted plants on their own roots (mist propagated plants) for customers who contract for this service.

In March 2001, David Ramming, Research Horticulturist, USDA, ARS notified FPMS that the name for a white seedless table grape released in February 1999 has been changed from 'Melissa' to 'Princess' due to trademark conflicts. All the Foundation mother vines at FPMS of this variety have consequently been renamed 'Princess'.

New Accessions for the Future FPMS Public Collection

Several new accessions were donated for the FPMS public collection this year. Testing and disease elimination treatments are currently in progress to qualify these materials for California Foundation stock status. The new accessions include: a Calera clone of Chardonnay donated by Larry Hyde; Mourvedre, Verdelho, Albarino, and Tempranillo selections from Duarte Nursery; and five table grapes from Iran donated by Hossein Heydari. The first tests on these accessions are expected to be completed by the spring of 2003. The release date will depend on the health of the original materials and any treatment necessary. Funding for the collection, treatment, and testing of these materials was provided by the California Fruit Tree, Nut Tree, and Grapevine Improvement Advisory Board (IAB).

Three New Grape Rootstocks With Broad Nematode Resistance

By Dr. Michael McKenry, UC Riverside Nematology Department

Shortcomings of commercially available grape rootstocks include: narrowness of soil pest resistance, excessive vigor except in the sandiest soils, and lack of durable (long-term) resistance specifically to root knot nematodes. A nematode/rootstock profile of twenty rootstocks revealed that among commercially available rootstocks Ramsey provided broadest resistance to endoparasitic nematodes including several species of root knot nematode, root lesion nematode and citrus nematode (1). It also possessed excessive vigor.

Schwarzmann rootstock possessed resistance to *Meloidogyne javanica* and also limited development of other root knot species to the youngest roots. Importantly, this rootstock exhibits broadest resistance to ectoparasitic nematodes including dagger nematodes and ring nematode (1, 2). Schwarzmann is a relatively low vigor rootstock.

At my request, Dr. David Ramming of the USDA horticultural lab in Fresno hybridized Ramsey and Schwarzmann rootstocks in spring 1991. Seeds were collected that fall and 820 progeny were placed in the presence of a gall-initiating *Meloidogyne arenaria* pathotype from Harmony and a non-galling *M. chitwoodi* that also attacks Harmony. Approximately sixty RS seedlings escaped these aggressive nematode populations and were then placed into field settings for two years to further characterize the breadth of their nematode resistance as well as their vigor (3, 4, 5). It should be noted that the parent rootstocks possess resistance to phylloxera but these offspring have not yet received evaluation.

By 1996 we had selected three RS rootstocks that conferred resistance to our most aggressive root knot nematode populations, including a pathotype aggressive to Freedom rootstock. These include RS-2, RS-3 and RS-9 with these latter two subject to patent by University of California.

RS-2 is the most vigorous selection providing a vigor level between Harmony and Freedom. RS-2 permits aggressive root knot populations to survive on younger roots but not on root systems older than 6 months. RS-2 does not impart resistance to *Xiphinema index* but does provide useful resistance to ring nematode. This rootstock is suitable in warm, sandy or coarse sandy loam soils where Freedom or Harmony rootstocks have been removed and *X. index* is not known to occur. Soils planted to this rootstock should receive a pre-plant soil treatment adequate to avoid nematode pressure for at least one full year.

RS-3 generally imparts slightly less scion vigor than RS-2. In sandy, frequently-irrigated soils it imparts 2/3 the vigor and yield of Freedom. This rootstock is most suitable for coarse to fine sandy loam soils. Resistance is available to all known aggressive populations of root knot nematode (4). Its resistance to ring nematode is slightly less than RS-2 but it also exhibits useful resistance to *X. index*, and root lesion, *Pratylenchus vulnus*. It is slightly susceptible to citrus nematode, *Tylenchulus semipenetrans*.

RS-9 is a low vigor rootstock, equivalent to Schwarzmann or 101-14. Its full range of soil and climate preference is unknown. It is suitable for evaluation in close-planted situations and should be considered primarily for coastal valleys and coarse-textured soils. RS-9 is resistant to all aggressive pathotypes of root knot nematode (5). It exhibits good resistance to *X. index*, and *P. vulnus*, and slight susceptibility to citrus nematode. This rootstock should be evaluated in cooler regions where ectoparasitic nematodes dominate.

These seedlings readily strike roots and appear generally compatible with scions evaluated thus far. RS-3 and RS-9 offer broader nematode resistance than VR 039-16, Freedom, Harmony, Ramsey or Teleki 5C (6). Durability of RS resistance mechanisms is not known, so pre-plant treatments giving at least one year of nematode relief are essential to conserving resistance mechanisms available. Field evaluations for tolerance to Grape Fan leaf Virus are underway with RS-2 and RS-3.

FPMS is currently conducting disease tests to qualify these rootstocks for California Foundation stock status. RS-3 was planted in the Foundation block in 2001. RS-9 is expected to qualify for planting in the Foundation block in 2002. These will become registered foundation mother vines after they are professionally identified.

The UC Office of Technology Transfer (OTT) is working to develop patents for RS-3 and RS-9. Nurseries interested in becoming licenced to propagate these varieties should contact Melissa Kimball at OTT phone: 510-587-6000.

Funding for the development of these varieties has been provided by the American Vineyard Foundation; California Table Grape Commission; California Grape Rootstock Commission, and UC Riverside.

Selected Literature:
(1) McKenry, M., J. Kretsch and S. Anwar. (accepted 2001) Interactions of selected *Vitis* cultivars with endoparasitic nematodes. Am J Enol and Vitic
(2) McKenry, M., J. Kretsch and S. Anwar. (accepted 2001) Interactions of selected *Vitis* cultivars with ectoparasitic nematodes. Am J Enol and Vitic
(3) Anwar, S., M. McKenry and J. Faddoul. 2000. Reproductive variability of field populations of *Meloidogyne* spp. on grape rootstocks. J of Nematol. 32 (3):265-270.
(4) Anwar, S. and M. McKenry. 2000. Penetration, development and reproduction of *Meloidogyne arenaria* on two new resistant *Vitis* spp. Nematropica 30 (1):9-17.
(5) Anwar, S. and M. McKenry. (accepted 2001). Development of a resistance-breaking population of *Meloidogyne arenaria* on *Vitis* spp. J of Nematol.
(6) Anwar, S, M. McKenry and D. Ramming. (submitted 2001). Results of a search for more durable resistance to root knot nematode. Am J Enol and Vitic

California Grapevine Registration and Certification Program Update

RSP Regulation Changes

Changes proposed last year, eliminating *Rupestris* stem pitting (RSP) from the diseases targeted by the California Grapevine Registration and Certification program, were enacted effective January 1, 2001 according to Kris Peeples, Permits and Regulation Office, California Department of Food and Agriculture (CDFA). This change was proposed by FPMS Director Dr. Deborah Golino in response to information generated by FPMS Plant Pathologist Dr Adib Rowhani. He has developed a PCR test that detects a virus associated with RSP (GRSPaV) and found that the St. George field indicator selection used to detect RSP is infected with GRSPaV. Rowhani has also shown that the St. George field index used to detect RSP in the past was not reliable and that a high percentage (25-30%) of Foundation mother vines may be infected with an RSP associated virus. Rowhani is currently working to develop a reliable method for detecting RSP.

Since the status of FPMS mother vines with regard to RSP is uncertain, and RSP is no longer of concern for the Registration and Certification Program, grape selections included on the FPMS materials lists for the 2001-02 season have not been sorted according to their RSP status. However, FPMS will provide all available St. George indexing and PCR test results for GRSPaV to our customers upon request.

Staffing Changes

Many staffing changes are in progress within the Nursery, Seed, and Cotton Program of the Pest Exclusion Branch at CDFA. Kathleen Harvey, who served as the Supervisor for the Nursery, Seed, and Cotton Program until July 2001, has taken a position at Cal-EPA. Denise Moncus, IAB Manager, and Paul Baca, Associate Agricultural Biologist, in Sacramento are also no longer with the program. Donna Cunningham, Umesh Kodira, and David Godfrey are currently sharing the responsibilities of the Program Supervisor position. Branch Chief, Aurelio Posadas, has indicated his target is to fill the program supervisor position before December 1, 2001.

Testing Services

CDFA is now providing *Xylella* testing services to California nurseries shipping grape nursery stock into Oregon. These tests were first required when Oregon implemented an emergency Pierce's disease quarantine in August 2000 followed by a permanent quarantine enacted December 15, 2000. This quarantine requires that *Vitis* plants from California for shipment to Oregon must be treated with a pesticide to kill glassy-winged sharpshooters or must originate from a nursery in compliance with specific CDFA protocols to ensure that shipped nursery stock is free of glassy-winged sharpshooters. The Oregon quarantine also requires that a representative sample of *Vitis* plants be tested and found free of *Xylella fastidiosa* using ELISA or PCR tests before shipment into Oregon.

Dan Opgenorth, CDFA Senior Plant Pathologist, is coordinating all the *Xylella* testing of California grapevine nursery stock for shipment to Oregon. Nurseries or other individuals planning to ship *Vitis* plant materials to Oregon are advised to contact their county Agricultural Commissioner's office to obtain the required quarantine compliance certificate. Opgenorth said that he conducted tests for about 4 California nurseries in 2000 and 3 in 2001. Gary McAninch, Nursery Program Supervisor, Oregon Department of Agriculture, said that hundreds of thousands of grape plants are still being shipped into Oregon from California. The Pierce's Disease quarantine has not affected the numbers being shipped according to McAninch.

Retesting of Foundation Mother Vines

FPMS is continuing to completely retest about 20 Foundation mother vines a year as part of the ongoing program to monitor the health of the Foundation vineyard. Field, herbaceous and ELISA tests are used to evaluate each vine rechecked. Results from tests conducted in 1998-99 and 1999-2000, as well as lists of selections being tested in 2000-01 and 2001-02 are shown here. All results were negative except that 5 vines in 98-99 and 2 vines in 99-00 were positive for Rupestris stem pitting (RSP). Since RSP is no longer excluded by the California Grapevine Registration and Certification Program regulations, positive RSP results do not affect the registration status of Foundation mother vines. Testing for some of the mother vines on the 1998-99 and 1999-2000 lists is incomplete because candidate buds on the field indicator plants did not survive. In these cases the result shown is "retest."

Field tests are conducted by the FPMS field staff under the supervision of Mike Cunningham, Principal Superintendent of Agriculture at FPMS. All herbaceous and ELISA tests are conducted by FPMS lab staff under the direction of Dr. Adib Rowhani, FPMS Plant Pathologist. Funding for these tests is provided by the California Fruit Tree, Nut Tree, and Grapevine Improvement Advisory Board (IAB).

Foundation mother vines retested in 1998-99:

Variety/sel #	Location	Results
Cabernet Sauv 04	BKN B2 V6	
Cabernet Sauv 06	BKN B2 V10	
Cabernet Sauv 07	BKN C2 V1	RSP+
Cabernet Sauv 15	BKN A3 V11	RSP repeat
Grenache 03	BKN A11 V4	
Malbec 04	BKS G3 V9	
Malbec 06	BKN B12 V9	
Petit Verdot 01	BKN B15 V2	
Petit Verdot 02	BKN B15 V8	
Pinot noir 32	BKS H2 V3	
Pinot noir 39	BKS G13 V7	
Sangiovese 02	BKS G16 V3	
Sangiovese 04	BKS H9 V10	
Semillon 05	BKN A18V10	RSP repeat
Shiraz 01	BKN B18 V7	RSP+
Tempranillo 02	BKS H10 V7	RSP+
Tinto Cao 01A	BKN B19 V1	
White Riesling 09	BKS H14 V1	RSP+
White Riesling 12	BKN C19 V8	
Zinfandel 06	BKS H13 V1	RSP+

Foundation mother vines retested in 1999-00:

Variety/sel#	Location	results
Couderc 3309 02	BKS N3 V2	RSP+ (StG repeat)
Freedom 01	BKS C3 V7	StG, LN,CabF repeat
Harmony 05	BKS C5 V9	StG repeat
Kober 5BB 06	BKS C7 V7	StG, LN repeat
LN33 01	BKN AA3 V6	StG repeat
M.G. 101-14 01	BKS N2.5 V1	
M.G. 420A 04	BKS N2 V31	
Malegue 44-53 01	BKS N .25 V7	CabF repeat
Malegue 44-53 01	BKS N .25 V3	StG, LN,CabF repeat
Oppenheim 4 09	BKS M1 V5	LN,CabF repeat
Paulsen 1103 02	BKS M3 V2	
Richter 110 01	BKS L8 V9	LN repeat
Richter 110 01	BKS M8 V2	StG repeat
Richter 99 01	BKS D2 V7	StG repeat
Riparia Gloire 03	BKS N1 V3	RSP+ (StG repeat)
Riparia Gloire 04	BKS N1 V6	CabF repeat
Ruggeri 140 02	BKS C1.5 V5	StG, LN repeat
Schwarzmann 01	BKS N1 V25	
Saint George 15	BKS D2.5 V7	StG, LN,CabF repeat
Teleki 5C 08	BKS E1 V1	StG, LN,CabF repeat

Foundation mother vines being retested in 2000-2001:

Variety/sel#	Location
Couderc 1202-02	BKS C1 V2
Couderc 1613-05A	BKS C1 V4
Couderc 1616-02	BKS N2 V5
Couderc 1616-03	BKS C2 V2
Couderc 3306-01	BKS M9 V7
Couderc 3309-05	BKS C6.5 V11
Dogridge-04	BKS C4 V7
Foex 333 EM-01	BKS C4 V10
Kober 125AA-01	BKS I17 V7
LN33-01	BKS D2 V2
MGT 41B-02	BKS D1 V1
MGT 420A-05	BKS D2 V4
039-16-01	BKS I13 V1
Paulsen 1045-01	BKS C8 V4
Paulsen 1103-01	BKS C8 V10
Paulsen 779-01	BKS M5 V1
Ruggeri 140-01	BKS M3 V11
Ruggeri 225-01	BKS D4 V8
Salt Creek-08	BKS D5 V1
V Rup Constantia-01	BKS N3 V31

Foundation mother vines being retested in 2001-2002:

Aleatico-01	BKN A1 V5
Alicante Bouschet-01	BKN A1 V11
Carnelian-02	BKN B5 V1
Chardonnay-05	BKN A6 V3
Chardonnay-07	BKN F8 V1
Grenache-01A	BKN A11 V1
Mataro-01	BKN B12 V11
Merlot-01	BKN A13 V1
Nebbiolo Lampia-01	BKS H7 V5
Palomino-01A	BKS G8V10
Petit Sirah-03	BKS G9 V3
Rubired-02	BKN A17 V11
Sauvignon blanc-01	BKS G16 V7
Semillon-02	BKS H16 V5
Shiraz-02	BKS B18 V9
Teleki 5C-09	BKS I17 V1
Thompson seedless-05	BKS H11 V7
Tinto Cao-04	BKN B19 V3
White Riesling-02	BKN C19 V1
Zinfandel-02	BKN A20 V1

The USDA Grape Germplasm Collections

By Dr. Chuck Simon, Research Leader and Curator of the USDA National Clonal Germplasm Repository at Davis

In 1898, Dr. David Fairchild, author of 'The World was my Garden: Travels of a Plant Explorer', and namesake of the Fairchild Gardens in Miami, established the 'Section of Seed and Plant Introduction' within the U.S.

Department of Agriculture (USDA). Fairchild was a plant pathologist with the USDA, and also an avid plant collector who traveled the world in search of new crop species for America. Fairchild administered this program from his office in Washington, DC, and from the present site of Fairchild Gardens in Coconut Grove, Florida. The original mission of this 'section' of USDA, which is now called 'Plant Introduction', was to introduce new crop species and test them in different places in America to see if they had potential to enhance American agriculture. Seeds and other propagules were sent to university scientists, private plant breeders, and farmers across the country for testing under the auspices of this program.

In the 1940's-1950's the mission of 'Plant Introduction' expanded considerably to include long term preservation of newly introduced material. Up until that point, new materials that didn't do well in the initial tests were sometimes lost. Plant breeders and others became concerned that materials being lost might contain valuable traits for future breeding programs. Starting in the late 1940s this lead to the development of a national network of germplasm repositories that we now call the National Plant Germplasm System (NPGS). The NPGS is a part of the Agricultural Research Service (ARS), which is the research division of the USDA. The mission of the NPGS is to acquire, maintain, characterize and distribute plant genetic diversity.

This system of repositories, which currently number about two dozen, is distributed across the country. For an overview of the various collections in the NPGS, you can visit our main website, at www.ars-grin.gov/npgs. Our repository in Davis, which was founded in 1981, specializes in collections of grapes, peaches, apricots, cherries, plums, almonds, walnuts, pistachios, olives, figs, persimmons, mulberries, pomegranates, and kiwifruit.

The grape collection, with nearly 3000 different accessions, represents about 60% of our 5000 accession inventory. There are 44 different species of *Vitis* in our collection, and five other species from three genera closely related to *Vitis* (ie. *Ampelocissus*, *Ampelopsis*, and *Parthenocissus*) that we also consider to be part of the grape collection. The species with the best representation is, not suprisingly, *V. vinifera*, with 1197 accessions. Other large groups are the interspecific hybrids, with 825 accessions, and the muscadine grapes of the Southeastern U.S., *V. rotundifolia*, with 104 accessions. Fifteen of the species in the collection are represented by only a single accession, and quite a few other species have fewer than ten accessions. There is another USDA grape collection maintained at the germplasm repository in Geneva, NY. That collection is roughly half the size of the Davis collection, and it specializes in the cool climate species of *Vitis*, while we have mostly warmer climate grapes.

We acquire our accessions from various sources. Our greatest source of material is from grape breeders. In fact, approximately half of our grape collection is from UC Davis breeder Dr. Harold Olmo. In earlier years, he traveled the world collecting new grape germplasm for his breeding program and later generously shared samples of his materials with the USDA for the repository collection. Other breeders have also donated plant materials. These gifts often occur as breeders retire to ensure valuable germplasm is not lost. Sometimes we receive new accessions from the plant exploration program that the NPGS administers out of our headquarters in Beltsville, Maryland. This program funds a number of explorations for various collections within the system each year. No explorations for grapes have been funded in recent years, but we expect to organize a collecting trip to Mexico in the next year or two. Germplasm also comes to the repository system via agreements made with other collections around the world. Two years ago, the Davis Repository received about 50 accessions of grapes from a repository in Turkmenistan that is falling on hard times due to limited resources. The Turkmen were happy to give us this material, with the understanding that in the event they lost theirs in the future, they could get it back into their collection from us. A final way we acquire material is from the general public. The California Rare Fruit Growers have been particularly generous in offering us their germplasm. They have given us numerous heirloom varieties for our collection.

We maintain our collection as living vines in a vineyard. We have about fifteen acres of grapes at the Wolfskill Experimental Orchard in Winters, CA. We also have potted grape plants in our screenhouses in Davis. With the concern about Pierce's disease infecting our collection, we are trying to develop facilities to have the entire collection replicated in both places to prevent losing accessions to the disease.

The nature of the material in the USDA collection is fundamentally different than the material in the FPMS

collection. While the purpose of FPMS is to provide disease tested propagation material of modern commercial varieties, our purpose is to preserve a wide diversity of grape genes and genotypes for use in grape research and variety development. Therefore, much of the material in our collection is of no immediate interest to industry, because of traits that the industry would consider unacceptable in a commercial variety. The value of such accessions is best appreciated by grape breeders who identify specific attributes in our accessions and use them in their crossing programs in combination with positive features from other varieties. For example, some accessions in the repository collection that express considerable resistance to Pierce's disease may be used to make resistant varieties for the future. As you might expect, we've been distributing a LOT of material from Pierce's disease resistant accessions the past couple of years.

Which brings us to the subject of distribution. One of the most important things we do is to share our collection with the grape research and development community. Preserving these irreplaceable genetic resources is certainly important, but using them is what gives them value. Because our program is fully funded by the federal government, and is unable to accept other money, our germplasm is distributed free of charge. Anyone with grape research and development interests can contact us and request samples of our accessions. They will typically receive four 9"–12"budsticks for each accession requested. It is certainly worth noting that we are not funded to test our materials for disease and we know that many accessions in our collection have some of the common diseases, like leaf roll virus. Repository materials are therefore not qualified to be sent into states with quarantine laws that require phytosanitary certification (Washington, Oregon, and New York). Anyone who wishes to keep their own collections disease free would also be wise to get their germplasm elsewhere. More information regarding distribution and other facets of our program can be found at our repository website, at: www.ars-grin.gov/dav. Chuck Simon can be contacted by phone at 530-752-6504 or email: csimon@ars-grin.gov.

FPMS Lab Activities

by Dr. Adib Rowhani, UC Davis Plant Pathology Department/FPMS

The laboratory at FPMS plays a crucial, increasingly important role in producing high quality, disease tested grape materials and monitoring the disease status of vines planted in the Foundation Vineyards. In general, the laboratory has four major functions: 1) testing the newly introduced grape materials for viruses and other pathogens; 2) eliminating viruses from materials which test positive; 3) monitoring the health status of Foundation plantings and 4) researching different areas related to virus.

1. New introductions and quarantine selections undergo extensive testing during the first two years at FPMS, including indexing on herbaceous indicator hosts in the greenhouse as well as ELISA and PCR tests for different viruses. New introductions are also tested using a 2-year woody field index. If all tests are negative, the selections qualify to be released from quarantine and/or planted in the Foundation Vineyard at FPMS.

2. Plants which do not pass the required tests, as described above, are candidates for virus elimination treatment. In this procedure plants are regenerated from micro shoot tips that are no more than 0.5 mm long in sterile artificial media. Regenerated plants are tested using the same methods used for new introductions to determine if disease was successfully eliminated.

3. To maintain the health status of foundation plantings the following procedures are followed:

a. Each individual vine in Foundation vineyards is visually inspected a few times during the growing season for different pathogens, genetic variation and any other growth problems. Two of these inspections (in Spring a few weeks after bud break and in the Fall) are prescribed by the California Grapevine Registration and Certification Program regulations. Biologists from the CDFA Nursery Service and Yolo County Agricultural Commissioner's office, scientists from the UC Davis Department of Plant Pathology and FPMS staff participate in required inspections. Any vine which shows suspicious symptoms of pathogen invasion will be put on hold and checked for disease using available ELISA, PCR, herbaceous and/or field tests as required. Distribution of propagation materials from vines on hold is severely restricted.

b. About half of the Foundation mother vines are tested annually in the early spring by ELISA for grapevine fanleaf virus and tomato ringspot virus (causal agent of grapevine yellow vein) and grapevine virus A. In the summer, about a third of the mother vines are tested annually by PCR for grapevine rupestris stem pitting associated virus and grapevine rootstock stem lesion associated virus (formerly Redglobe virus). In the fall, about a third of mother vines are tested annually for grapevine leafroll associated viruses types 1 to 4 by ELISA.

4. Several research projects are in progress in our lab. Some of the projects involve fully characterizing unknown and partially characterized grape viruses; studying their biology; and developing fast, sensitive, and reliable molecular detection methodologies (e.g., ELISA and PCR). One new virus being studied in the lab was found in the table grape variety Redglobe. It is associated with wood necrosis on certain rootstocks (e.g., 3309C, 5BB, 5C and 1103P) that eventually kill young grafted vines. This virus has been partially characterized and PCR methodology for its detection has been developed. We are continuing our efforts to fully characterize this virus and to optimize the detection methodologies. We also have been working to develop ELISA and PCR tests for the known and previously characterized viruses in grapevine including a virus associated with rupestris stem pitting disease. So far we have developed PCR methodology for about 14 different viruses and we are working toward fine tuning these procedures.

Support for the research and testing conducted in the lab has been provided by the California Fruit Tree, Nut Tree, and Grapevine Improvement Advisory Board, American Vineyard Foundation, Grapevine Consortium, California Competitive Grant Program for Research in Viticulture and Enology, California Table Grape Commission, and California Grape Rootstock Improvement Commission.

French Cabernet Sauvignon 337 and Leafroll Type 2 Virus

by Dr. Deborah Golino, Director of FPMS, UC Davis

Many sources of the well respected Etablissement National Technique pour l'Amélioration de la Viticulture (ENTAV) clone 337 of Cabernet Sauvignon have arrived in the United States over the years. In the English version of the "Catalogue of Selected Wine grape Varieties and Certified Clones Cultivated in France", the official ENTAV descriptions of the wine grape varieties and clones, Cabernet Sauvignon 337 is described as a superior clone which produces well balanced wines with good aging qualities. Clone 337 Cabernet Sauvignon has also proven popular with California's grape growers and winemakers.

However, Clone 337 Cabernet Sauvignon is infected with Grapevine Leafroll Virus Type 2. This is acknowledged by ENTAV (Robert Boidron, personal communication) but the great success of the clone in winemaking programs has resulted in an approach where the virus infection is tolerated and managed in France. Growers here are faced with the difficult task of deciding whether the value of the fruit to winemakers can compensate for the effects of the virus over the long term life of the vineyard. Unfortunately, it is difficult to determine the answer to that question for the many climates, management regimes, and rootstock combinations that may be involved. It could be predicted that the virus will reduce yields and delay ripening, but this may not be important if a premium price is paid for the fruit. On the other hand, most California growers expect higher yields from their vineyards than is the norm in France.

Because of this infection, no selections of 337 have passed through quarantine at FPMS. Leafroll infected imports cannot be released until they have been treated for virus and a virus-negative selection produced. Therefore, any selections which are currently available in the trade have entered the U.S. through other importation facilities where the virus was not detected or have come into the United States as "suitcase" clones.

The sources of Clone 337 Cabernet Sauvignon tested at FPMS have been negative for all the other grapevine viruses in biological testing, with ELISA testing, and against our full PCR panel of tests. Therefore, we believe that the original 337 ENTAV materials are only infected with this one virus. Since we know that severe virus problems are most commonly associated with multiple virus infections, it may be that the presence of the GLRV-2 in this clone has only mild influences on productivity. However, growers and nurseries should be cautioned that some sources of "Clone 337" have been found to harbor additional viruses. Grafting 337 onto dirty vines or misidentified selections of clone 337 could account for more severely infected materials, so caution is advised when selecting propagating wood. The closer a source of Clone 337 Cabernet Sauvignon is to the original ENTAV material, the less the chance of infection with additional viruses.

FPMS has a selection of French 337 Cabernet Sauvignon in the public collection. Plants produced from the original material using micro shoot tip culture are currently being tested to determine if viruses found in the original material have been eliminated. Tests will be completed by the spring of 2003.

Public Syrah/Shiraz Selections at FPMS

Inquiries about availability and identity of Syrah and Shiraz selections have been among the most frequently asked questions at FPMS the last couple of years. For most of the 1980s and 1990s the answer was simple because the only registered selections were derived from a single importation of Shiraz from Australia in 1970. Dr. Austin Goheen created seven selections (Shiraz-1,2,3,4,5,6, & 7) from the original introduction using heat treatments that ranged from 62 to 125 days in duration. Since there is no scientific evidence that heat treatment for virus elimination increases the chance of mutation, all seven of the Shiraz selections are likely to be genetically identical. The original material from Australia was identified as plant introduction (PI) #364287 from Bests R3V34, in the USDA plant inventory. This probably means that the source was Best's vineyard at Great Western, near Ararat in Victoria according to Richard Hamilton at Southcorp, Australia.

Efforts are now underway to expand the number of Syrah selections available from FPMS as California Foundation stock. Four French and Italian introductions that have been in collections at UC Davis for many years are currently being tested and treated for disease.

Syrah-01 was imported from Point de la Maye, France in 1974 by Dr. Harold Olmo. USDA plant inventory records show it was identified as INRA M VI-I SI and assigned PI # 391482. A plant produced from Syrah-01 using tissue culture is identified at FPMS as Syrah-10 and disease testing of Syrah-10 is expected to be completed by February 2003. If all tests are negative FPMS will start accepting orders for Syrah-10 in the fall of 2003.

Sirah-01 was imported from Domaine de l'Espiguette, France in 1973 by Dr. Austin Goheen. This introduction (PI #391452) was called Syrah in the USDA plant inventory records, so the origin of the misspelled name (Sirah) is uncertain. A plant produced from Sirah-01 using tissue culture is identified at FPMS as Syrah-09. Disease testing of Syrah-09 is expected to be completed by February 2004. If all tests are negative, FPMS will start accepting orders for Syrah-09 in the fall of 2004.

Two Syrah selections that had been preserved at the USDA National Clonal Germplasm Repository at Davis, PI #113643 imported from the Richter Nursery, France in 1936 and PI #173295 imported from Milan Italy in 1949, are now being tested at FPMS. Results from the first set of tests (to be completed by February 2002) will determine if these selections can be released in the fall of 2002 or (if all results are negative) later after disease elimination treatment is applied.

In the last 3 years growers, nurserymen and farm advisors have generously donated 3 generic Syrah clones reported to be French 99, 100, and 877 and one California Syrah selection from the Durell vineyard for the FPMS public collection. This fall 2001, disease tested Durell and generic French 877 vines were professionally identified and have become California registered selections Syrah-08 and Syrah-07, respectively, at FPMS. Retroactive Foundation stock tags for provisional materials of these selections purchased earlier from FPMS are available upon request. Generic French clone 100 has been disease tested and is now identified as Syrah-06. It is available from FPMS as provisional Foundation stock. Disease testing is still in progress to qualify generic French clone 99 materials for the FPMS Foundation block.

Two Syrah selections imported from France in 1995 by FPMS for Vinifera Inc. are reported to be French clones 174 and 300. California provisional Foundation status materials of both of these selections have been released exclusively to Vinifera as Syrah 05 and 04 respectively. Vinifera has generously agreed to make Syrah 05 and 04 materials at FPMS public in July 2005 and August 2002 respectively. Until then contact the Vinifera Grapevine Nursery to obtain these materials.

Even though the Syrah selections at FPMS have been referred to by several different names (Syrah, Sirah, Shiraz, and Syrah noir), all the evidence to date indicates that these are the same variety.
In the October 1999 FPMS Grape Program Newsletter, Dr. Carole Meredith reported that "...we compared all seven Shiraz selections as well as selections called Syrah-01 and Sirah-01, to four Syrah accessions from the French

national variety collection in Montpellier. All the FPMS vines have exactly the same DNA profile as the French Syrah." Mother vines of most of the selections mentioned in this article have been visually inspected by the French ampelographer, Jean-Michel Boursiquot who also confirmed that they are the same variety as the French Syrah.

Use of the name "Syrah noir" has been causing some confusion this last year. Many have been asking which is the "Syrah noir" clone. One nursery and an old UC Davis viticulture record associate the name Syrah noir with a 1974 import from Point de la Maye, France (PI #391482). However, the French consider Syrah N. (N. = noir) to be the correct variety name for all Syrah clones, so associating it exclusively with a single clone is misleading.

A spread sheet summarizing information about all the Syrah selections in the FPMS collections is available from the FPMS office upon request.

A Graft Union Disorder of Syrah

by Dr. Deborah Golino, Director of FPMS, UC Davis

Viticulturists have observed a phenomenon in Syrah vineyards in the last couple of years which suggests that this very popular variety may be subject to special propagation problems. Leaf reddening, swollen graft unions, and stem necrosis symptoms have been seen in some California Syrah vineyards. These kinds of symptoms are most often associated with genetic incompatibility and/or virus infection.

Dr. Andy Walker, UC Davis Department of Viticulture and Enology, reported on this phenomenon at the Syrah Symposium held as part of the June 2001 American Society for Enology and Viticulture annual meeting in San Diego. He noted that the cause of the Syrah phenomenon is unknown but several conditions have been associated with the symptoms observed including: poor graft unions, crown gall infection, genetic incompatibility, traditional viruses, new viruses, viroids, and environmental interactions.

Walker reported that problems with Syrah have also been seen in France. French Syrah vines with red leaves and swollen graft unions are dying within 1-2 years. These symptoms are associated with Syrah grafted to a number of rootstocks including: 110R on lime soils, 140Ru, *Vitis berlandieri* x *V. riparia*, and *V. riparia* x *V. rupestris* in France.

This winter, Dr. Walker, Dr. Adib Rowhani, and I plan to apply for research funding to study this problem. The project to be proposed will include a statewide survey of Syrah sites with the problem, as well as analysis of clone source, rootstock variety, site, and management techniques associated with the Syrah phenomenon. Tests will also be conducted to look for any associated graft transmissible agent(s).

The Discovery of a New Virus Explains Redglobe/Rootstock Incompatibility

Don Luvisi, Kern County Farm Advisor, was the first to notice problems in grafting Redglobe table grape scions to specific rootstocks. In a 1992 rootstock trial for the Table Grape Commission, he observed that Redglobe vines grafted on certain rootstocks (5BB, 5C, 1103P and 3309) declined and died after two or more growing seasons. Incompatibility problems were also evident when a Fantasy Seedless interstock was used between Redglobe and the rootstocks mentioned above. However, in extensive virus tests at FPMS, only grapevine rupestris stem pitting associated virus (GRSPaV) was detected in the Redglobe mother vines. All other virus tests were negative.

A group of Davis plant pathologists led by Dr. Jerry Uyemoto, USDA-ARS, and Dr. Adib Rowhani, FPMS UC Davis, have been working on this problem over the last five years. Recently, an article on this project has been published in California Agriculture 55 (4): 28-31. Copies can be obtained from the FPMS office.

Dr. Jerry Uyemoto conducted 3 research trials that confirmed Don Luvisi's observations. In the first trial, initiated in 1996, Uyemoto found that red leaf symptoms developed a year after Cabernet Sauvignon bench-grafts on 5BB,

5C, 1103P and 3309 were graft-inoculated with Redglobe. He also found distinct lesions in the woody cylinders of the symptomatic vines after peeling bark from the trunk which he called "grapevine rootstock stem lesions". In the same trial, Cabernet Sauvignon on Freedom, Harmony, Salt Creek, 039-16, and 101-14 with similar Redglobe inoculations, as well as own-rooted Redglobe, developed normal canopies and did not have stem lesions.

In the second 1996 trial, Redglobe scions were grafted directly to the rootstocks 5BB, 5C, 1103P and 3309 while own-rooted Redglobe was grown as a control; all these rootstock combinations died except for the own-rooted vines.

In Uyemoto's third trial, Redglobe grafted to the rootstocks 5BB, 5C, 1103P, 3309, Freedom and 101-14 were planted in a field site in 1997. In October 1999, surviving Redglobe vines from the 3rd trial were examined for stem symptoms. The scion/rootstock junctions for Redglobe on 5BB and 3309C were enlarged and showed necrotic, irregular fissures in the scion overgrowth. These symptoms were absent for Redglobe on Freedom and 101-14.

Results from these experiments suggested that a graft transmissible agent is causing the symptoms associated with Redglobe.

Dr. Adib Rowhani and his lab team were able to find a new virus in Redglobe grapevines. They isolated it from the variety using dsRNA purification techniques and were able to partially clone the virus, a previously undescribed closterovirus. A comparison of this virus with other grapevine viruses showed that the Redglobe closterovirus is similar to grapevine leafroll associated virus type 2 (GLRaV-2). However, the Redglobe closterovirus does not produce red leaf symptoms in the leafroll field indicator Cabernet Franc as does GLRaV-2. With these cloned sequences, Rowhani developed a polymerase chain reaction (PCR) test that can detect the virus readily. Since Redglobe virus is associated with the presence of the stem lesions observed by Uyemoto, the virus has been given the name grapevine rootstock stem lesion-associated virus (GRSLaV).

Research is continuing to characterize the GRSLaV Virus, characterize its effect on specific rootstock and scion combinations, and determine how common it is in commercial vineyards.

As a result of this research, FPMS decided on two main priorities for the Foundation Vineyard. First, a GRSLaV-free propagation of Redglobe is needed for the future. Shoot tip tissue culture plants have been produced and are undergoing testing to ensure that they have been freed of the virus. When this testing is complete, a new selection of Redglobe without GRSLaV will be established. Second, the decision has been made to screen the Foundation Vineyard for GRSLaV with the new PCR test to ensure that any additional GRSLaV infections are eliminated from the R&C program. In 2000, under Dr. Rowhani's supervision, the FPMS lab team performed the PCR test for GRSLaV along with the PCR for the Grapevine Rupestris Stem Pitting associated Virus (GRSPaV) during our IAB sponsored screening of our Foundation Vineyard. One third of the collection, including the major rootstock selections, were screened; no new vines were found to test positive for GRSLaV. Apparently, this virus is rare in the Foundation collection. By the fall of 2004, all of the FPMS Foundation Vineyard should be screened for this virus. If any additional vines are found harboring the virus, they will be placed on hold until a new, virus negative propagation can be produced.

Don Luvisi, Jerry Uyemoto, and Adib Rowhani, deserve a well earned "Thank you" for the great job they did in solving this mystery. The description of a virus in Foundation level Redglobe stock reminds us that our knowledge of the diseases which affect grapevines is not complete. It is important that research in the field continue and that researchers, nurserymen, and growers keep an open mind to new discoveries.