

grape growing

Nursery Industry Developments in California

James A. Stamp, Ph.D.

Since the peak planting period of 1999-2001, grapevine nurseries have faced annually reduced demand for their products. The fevered planting peak of that period was matched by an equally feverish cry for blood from nursery clients who cried "young vine decline," and "black goo," as their prized vineyards succumbed to these newly emerging disease conditions. Those heady days of accusation, lawsuits and massive replantings are to some degree behind us, and with a significantly reduced demand for their product, nurseries have, of necessity, focused more attention on the production of fewer plants. Whether grapevine plant products are of better quality now is debatable, but certainly nurseries are aware of the problems associated with poor quality and many have instigated new production procedures in an effort to answer their critics.

Nursery Production Issues

It is unfortunate that when vines fail, especially in newly established vineyards, the finger of blame is often pointed in the direction of the nurseries, the suppliers of the plant material. Examination of many poorly performing newly established vineyard sites indicates that nursery plant defects are less likely to be the cause of decline than mechanical and biotic factors under the control of the vineyard management team. Experience has shown that the most common cause of young vine decline is inadequate irrigation, followed by incorrect vine storage and planting technique. Stress imposed on vines resulting from improper handling often encourages the development of damaging levels of root pathogens that exacerbate the situation causing further weakening

of the vines. Defective vine products continue to be a problem, however, and pre-plant examination of nursery stock is a must.

In an effort to better assist his clients, **Galo MacLean** of **Galo MacLean Nursery** in Napa (707-255-8874) has recently chosen to retain vines from lots shipped to customers and plant them at his own facilities. In this way he can monitor vine growth and development under his own conditions. This serves as a reference for his customers and helps them eliminate potential vineyard pressures that may affect performance. In addition, MacLean provides a comprehensive after sales service. Nursery staff likes to be present at planting time to ensure that vines are handled correctly and according to company guidelines. Galo MacLean Nursery advises their clients to plant before June 1st if at all possible, because vine 'take' and growth and development are less certain after this period.

Climate and Location

Dan Martinez (530-795-0859), of **Martinez Orchards** in Winters, runs his nursery in an area more popular with row crop farmers and walnut operations than vineyards. This relative isolation provides a comfort zone against emerging pests and diseases such as Pierce's Disease, vectored by leafhoppers, and vine mealybug. As part of the **California Department of Food and Agriculture** (CDFA) nursery certification program, products finishing in the nursery row are inspected throughout the year for nematodes, disease symptoms and trueness to type. Growers can avoid annual fumigation of their growing grounds provided certain nematode populations are not detected. Should patho-

genic nematode populations be detected, CDFA demands use of hot water treatment to eliminate the pests. This treatment consists of dipping harvested, bundled vines in water for 10 minutes at 80°F, followed by 5 minutes at 125°F, prior to a cold-water dip.

American and Lake County Nurseries in Clearlake Oaks, Lake County, is perhaps the most isolated of California grapevine nurseries. Situated at the end of a stunningly beautiful ten-mile long valley populated by ancient Valley Oaks, the nursery seemingly has the world to itself. The nursery production facility, situated at an elevation of 1,200 ft, includes more than 100 acres of pristine growing grounds used for nursery stock finishing. When **Eckhard Kaesekamp** and **Joachim Hollerith** (707-942-4100) purchased the property several years ago they were impressed by its isolation from other grapevine operations and the altitude of the site, providing four definitive seasons. Cold winters keep pests and diseases in check and permit superior hardening and laying down of carbohydrate reserves in grapevine canes. American and Lake County Nurseries rootstock and scion mother blocks are situated in Vacaville and include many sought after **ENTAV/INRA** clones brought into California before ENTAV/INRA signed propagation agreements with a handful of California nurseries, effectively shutting off third party legal importation of desirable French stock. Nursery products are hot water treated according to CDFA standards before cold storage and shipping to customers around the nation.



Mother Vine Nurture

It is understood that grapevine cuttings are a primary source of infection of nursery stock by pathogens associated with Petri Disease and Esca (Black Measles), diseases involved in the 'young vine decline' condition. Observation of standard nursery procedures led **Rich Salvestrin** of **California Grapevine Nursery** (707-963-5688) to realize that basic production operations might be easily changed thereby providing vastly improved sanitation. Simply preventing cuttings from touching the ground at harvest, for example, eliminates a significant infection opportunity.

Just as great wines come from great fruit raised on great vines, so great vines are derived from great cuttings grown on healthy and well-maintained mother plants in the nursery. Salvestrin realized this and six years ago developed a program aimed at producing the highest quality vines in the industry. Salvestrin understood that vines derived from high quality cutting materials are more likely to resist disease and pathogen stress than weaker materials. California Grapevine Nursery embarked on its program by addressing the needs of rootstock mother vines through development of fertigation programs (applying nutrients through irrigation) designed to build carbohydrate reserves in canes destined for cutting production. The nursery currently subjects mother vines to routine tissue analysis while customizing fertigation programs to meet the demands of particular rootstock and scion varieties.

High quality cuttings are distinguished by a number of physical characteristics: wood to pith ratio, internode length, cross sectional shape of canes and end of season carbohydrate reserves. When these factors are optimal, propagation and grafting of such material is far more likely to be successful, resulting in vines with complete root systems, complete graft unions, minimal vascular discoloration and strong top growth. Vines of this quality provide growers with uniform vineyard development, higher take (fewer replants) and reduced susceptibility to stresses such as disease pressure and management error.

Bob Herrick of **Herrick Grapevines** (707-967-8000) in St. Helena, California prefers to use cuttings produced from trellised vines. In his system, cuttings are taken from canes trained above ground thereby eliminating potential soil-surface pathogen contamination. Cutting quality is potentially superior with this system but production costs are usually higher.

Sanitation Practices

Out of concern for maintenance of the health status of high quality cuttings between harvest and propagation, California Grapevine Nursery invested in the development of an ozonated water treatment facility to minimize contamination of plant materials. The procedure has now been optimized and every cutting that passes through the nursery's propagation program is ozone treated within 24 hours of harvest. Typically, cuttings are harvested from one of the nursery's northern California mother blocks in the afternoon, prior to counting, bundling and overnight cold storage. The following morning, bundled cuttings are submerged for 45 minutes in water containing 1-2 ppm ozone before being returned to cold storage.

Like California Grapevine Nursery, Herrick Grapevines takes great care to ensure that both rootstock and scion cuttings never contact the ground. Rather than using ozonated water to cleanse cuttings, Herrick treats them with a 1 percent solution of chlorinated water before cold storage. After cold storage and before propagation, cuttings are once again treated with chlorinated water.

At **Caldwell Nursery** (707-254-1294) in Napa, **John Caldwell** treats all his cutting materials with ZeroTol (**BioSafe Systems**), a broad-spectrum fungicide that kills fungi, bacteria and algae by contact oxidation. The active ingredient in ZeroTol is hydrogen dioxide (HO₂) and its mode of action is similar to that of hydrogen peroxide (H₂O₂) and ozone (O₃). Caldwell Nursery soaks all recently harvested cuttings in this material before cold storage and subsequent propagation.

California Grapevine Nursery maintains their high standards of production when vines are moved to the nursery row after propagation. Plants are irrigated through sub-surface drip tape and nutritional status is monitored three times per year by leaf blade and petiole analysis. Vines are grown in a sustainable manner with fumigation of growing grounds only being used as a last resort. Over the last three years nematode levels have been kept in check by crop rotation and the use of the nematode antagonists Sudan grass and Merced rye. Finally, all finished product is hot water dipped after grading at harvest time.

Although rootstock and scion mother blocks can be harvested over long periods of time, Martinez Orchards replant theirs regu-

larly and have found that this practice provides cuttings of higher and more uniform quality while keeping disease pressure low.

Working in collaboration with **Walt Bentley**, UC IPM advisor, **Kearney** (559-646-6522), **Vintage Nurseries** (661-758-4777) have developed procedures that allow hot water treatment of all cuttings and finished product.

Dormant Versus Potted Vines

Although potted grapevine plants do perform well, their utility is more restricted than dormant field-finished product. Potted products are more difficult to check for defects and can rapidly become stressed by remaining too long in the pot before planting. Furthermore, by using dormant field finished product, growers opt for a product in which the nursery has assumed more of the production risks and potential failures. Dormant potted product should be avoided. It is important to check the condition of roots, shoots, graft unions and trunks of all vines before planting.

Caldwell Nursery was a pioneer in the use of sponge as an artificial medium for the production of potted grapevines. The nursery has since turned away from this technology and is now using an artificial soil compost mix with large volume pots. John Caldwell commented that, in his production system, the sponge was difficult to maintain at correct humidity. Most other nurseries continue to use various soil-less composts in association with pots of various sizes for their potted product. **Sunridge Nurseries**, Bakersfield (661-363-8463), offer potted vines planted in a proprietary sponge soil system used in association with deep pots that tend to discourage root binding. **Duarte Nursery**, Hughson, near Modesto (209-531-0351) produces potted vines exclusively using proprietary propagation and grafting technology.

Production Numbers

California Grapevine Nursery is a moderate sized nursery based in the heart of Napa Valley. Its most popular rootstock this sales season was 101-14 MG, accounting for 35 percent of all rootstock sales. Following in order of importance were 110R, 420A, 3309C and Riparia Gloire. Sales were evenly split between rootstock rootings and grafted vines.

At Herrick Grapevines, potted vines accounted for 90 percent of all sales this season with dormant product constituting the

remainder. Of dormant product, Herrick sold 20 percent rootstock rootings with the remainder purchased as benchgrafts. Herrick's most popular rootstocks in order of importance were 101-14 MG, 110R and 3309C, with 101-14 MG accounting for 35 percent of rootstock sales. Most popular rootstocks ordered from Vintage Nurseries this season were Freedom, 101-14 MG and 3309C.

The focus at Martinez Orchards is on production of dormant rootstock rootings with 85 percent of their one million annual vine production falling into this category.

New French and Italian Clonal Releases

John Caldwell of Caldwell Nursery reported that several new highly rated ENTAV/INRA clones would be available in 2005 from nurseries affiliated with the ENTAV and INRA French government agricultural organizations. Clones to be released include Cabernet Sauvignon 170, 412 and 685, Syrah 471 and 877, Pinot Noir 943 and Cabernet Franc 623. ENTAV/INRA affiliated nurseries include Caldwell Nursery, California Grapevine Nursery, Sunridge Nurseries and Herrick Grapevines.

Novavine Grapevine Nursery of Santa Rosa (707-539-5678) will be releasing **Vivai Cooperativi Rauscedo** (Rauscedo, Italy)-developed clones of Trebbiano Toscano (VCR 8) and Arneis (VCR 2) and a **San Michele All'Adige** (Trentino, Italy)-developed clone of Pinot Noir (SMA 201) for the 2004/2005 season. Novavine will also be releasing VCR clones of the rootstocks 101-14 MG and 1103P.

Vine Mealybugs on Nursery Stock

Vine mealybug (*Planococcus ficus*) is a serious threat to California viticulture. The vine mealybug (VMB) exudes large amounts of honeydew that attracts the development of black sooty molds that can disfigure immature and mature berries. Heavily infested vines show dramatically reduced yields in association with spoiled fruit. In addition, honeydew attracts significant numbers of ants, which farm VMB populations. Furthermore, it has been demonstrated in experimental systems that mealybugs including VMB can successfully transmit Grapevine Leafroll Associated Virus types 3 and 5 between vines (Golino, D.A., Sim, S.T., Gill, R.

and A. Rhowani. 2002. California mealybugs can spread grapevine leafroll disease. *California Agriculture*, 56: 196-201).

VMB has now been identified in a number of Northern California vineyards. According to **Rhonda Smith** (707-565-2621), Sonoma County viticulture farm advisor, VMB may have been shipped to Northern California on dormant potted vines. To date, VMB has not been found on field grown dormant nursery stock. Cold conditions reduce the viability of VMB to some degree and it is has been observed that extended cold storage of dormant nursery product will reduce the mealybug population on contaminated plant materials.

Elimination of Vine Mealybug by Hot Water Treatment of Nursery Stock

A three-stage hot water treatment has been found to be effective in killing vine mealybugs in both experimental systems and large-scale nursery applications. The treatment developed and recommended by Walt Bentley calls for immersion of vines in a series of tanks containing water at different temperatures.

1st tank: 90°F for 5 minutes

2nd tank: 125°F for 5 minutes

3rd tank: 70-75°F (ambient) for 5 minutes

Vines are removed to cold storage after the treatment.

Reports from Walt Bentley, Rhonda Smith and **Ed Weber** (Napa County viticulture farm advisor, 707-253-4221) indicate that a minimum 98 percent kill of vine mealybugs (VMB) is standard for this treatment. 99.5 percent of adult females are killed while 98 percent of first and second stage crawlers are eliminated. Bentley states that the procedure is very effective under nursery implementation conditions and believes it "is as safe as it is going to get." Bentley also said that southern California nurseries treat their cutting materials for 30 minutes at high temperature before grafting, thereby providing an additional degree of security. Such hot water treatments have proven effective in killing all stages of VMB.

Research Goals for the Nursery Industry

One cent from the sale of every rootstock cutting and finished product containing rootstock material is collected for research funded by the **California Grape Rootstock Improvement Commission** (CGRIC). In addition to this tax,

\$20.00 per acre is collected from all rootstock mother block acreage used in the production of CDFA-certified rootstock cuttings. These funds are collected annually and are used to support a variety of research programs dedicated to increasing the utility of rootstocks in viticulture and winemaking. In order to support more comprehensive research efforts, funds from the CGRIC are often pooled with monies from other sources including the **American Vineyard Foundation**. According to **Jim Pratt**, CGRIC chairman, a large proportion of the funds collected to-date have supported **UC Davis** professor **Andy Walker's** on-going rootstock breeding and improvement program. The primary goal of Walker's program is development of nematode resistant rootstocks that will surpass the utility of VR 039-16, a variety with good nematode resistance but excessive vigor and less than ideal viticultural characteristics.

Pratt noted that CGRIC income from nursery product sales had dropped substantially over the last two years as a result of reduced vineyard plantings, but that now the commission could solicit donations from private bodies to supplement its traditional source of income. Pratt reported that current nursery sales generated income is about half of that realized during the peak planting period.

New Rootstocks Soon to be Released

Perhaps the most exciting news from the nursery industry in several years is the imminent release of two new rootstock varieties with superior nematode and Fanleaf degeneration resistance. A series of promising rootstock varieties resulting from crossing Ramsey and Schwarzmann rootstocks have been under evaluation by **Dr. Michael McKenry** of **UC Riverside** (559-646-6500) for several years. Two of these rootstocks (RS-3 and RS-9) are scheduled for release from Foundation Plant Service (FPS) at UC Davis within the next month, pending passage through a professional identification process. Growers are desperate for alternatives to the Fanleaf virus resistant rootstock VR 039-16, and it is expected that these new rootstocks will become popular throughout California in areas where Fanleaf virus pressure is a factor.

Describing the rootstocks in the *FPMS Grape Program Newsletter # 7*, 2001, McKenry noted that rootstock RS-3 imparts two thirds the vigor and yield of Freedom in sandy, fre-

CGRIC Wine Related Projects Funded for the 2003/2004 Research Year

Development of grape rootstocks with broad and durable nematode resistance.

Howard Ferris (hferris@ucdavis.edu), UC Davis.

Ferris is working in collaboration with Andy Walker on the development of grape rootstocks with broad and durable resistance to important nematode species. Together they have screened rootstock candidates against standard root knot nematode, two additional aggressive strains of root knot nematode that are able to overcome the natural resistance of Harmony and Freedom rootstocks, dagger nematode (*Xiphinema* index, Grapevine Fanleaf virus vector) and combinations of these nematodes. Utilizing crosses between *Vitis* and *Muscadinia* species, Ferris and Walker have isolated 14 seedling genotypes with broad, multi-species nematode resistance from thousands of candidates. These 14 genotypes are currently being evaluated in an ongoing program including examination of the durability of resistance to multiple nematodes and field-testing of selected rootstocks for horticultural characteristics. Evaluation of resistance against ring, pin and citrus nematodes as well as the effect of temperature on resistance are ongoing. Tests of Fanleaf degeneration resistance in a series of rootstock candidates are in their eighth and ninth year of field trials.

Breeding grapevine rootstocks for resistance to soil-borne pests and diseases.

Andrew Walker (awalker@ucdavis.edu), UC Davis.

This project is integrated with Ferris and Walker's nematode project. Broad program goals focus on breeding new rootstocks with improved nematode resistance, Fanleaf degeneration resistance, phylloxera resistance, fungal resistance (especially to Oak Root fungus and *Phytophthora* species), drought and salinity tolerance, adaptation to specific soil types (especially sites with high magnesium) and control of vegetative vigor (for improved canopy management and altered fruit ripening). Walker is using a variety of strategies to accomplish these goals including standard breeding and genetic engineering. Prospective rootstock candidates with valuable traits are still some years away from commercialization and are currently undergoing field trials around California.

Identification and control of *Cylindrocarpon* Black-Foot disease in California.

Doug Gubler (wdgubler@ucdavis.edu), UC Davis.

Gubler's work on *Cylindrocarpon* Black-Foot disease is focused on development of rapid diagnostic tests for the causative agents of this

disease, the fungal species' *Cylindrocarpon destructans* and *C. obtusisporum*. Although this disease is not a primary cause of grapevine yield losses in California or worldwide, it affects young grapevines and recently planted nursery stock and may be transmitted through propagation material. The pathogens are known to be present in vineyard soils at the time of planting. Black-Foot disease is part of the disease complex including Petri Disease that is sometimes referred to as 'young vine decline'. Some progress has been made in the development of a PCR-based test for rapid diagnosis of the pathogens but this is not yet commercially available. Gubler's laboratory is also investigating the use of promising *Cylindrocarpon*-antagonistic mycorrhizal fungi to combat Black-Foot disease in replant and new vineyard establishment situations.

Infection of grape nursery stock by *Botrytis cinerea* in cold storage and its control.

Themis Michailides (themis@uckac.edu). UC Kearney Agricultural Center, Parlier.

Michailides is investigating reports of the decline of young established vineyards as a result of *Botrytis cinerea* contamination of dormant grapevine nursery stock under cold storage at nurseries. The goals of this new project are to establish that *B. cinerea* is indeed responsible for the observed decline of young vineyards, to determine when nursery stock becomes infected by the pathogen and how the disease develops in cold storage and to develop control methods for the disease.

Investigation of a reliable method for the detection of grapevine viruses in grapevine rootstocks.

Adib Rhowani (akrhowani@ucdavis.edu). Foundation Plant Services, UC Davis.

It has been noted that ELISA-based testing can fail to detect Grapevine Leafroll associated viruses (GLRaV) in rootstock varieties, especially those with *Vitis rupestris* in their parentage (101-14 MG, 3309C, 110R, 1103P). Rhowani's work is focused on inoculation of various rootstock materials with known strains of Leafroll virus followed by comparison of the effectiveness of reverse transcriptase polymerase chain reaction (PCR) and ELISA technologies for their detection. Preliminary results (CGRIC 2001-2002 Final Research Report) indicate that PCR is more reliable than ELISA in detecting GLRaV 1-3 in various rootstocks. Some rootstocks apparently exhibit greater resistance to infection (Harmony, 101-14 MG, 110R, 5BB) than others while AxR #1 appears to be the most susceptible to the three GLRaV strains. **wbm**

quently irrigated soils. According to McKenry, this rootstock is most suitable for coarse to fine sandy loam soils and exhibits resistance to all known aggressive populations of root knot nematode. RS-3 provides useful resistance to ring nematode and also exhibits resistance to *Xiphinema index* (vector for Grape Fanleaf virus) and root lesion nematode, *Pratylenchus vulnus*. RS-3 is slightly susceptible to citrus nematode, *Tylenchulus semipenetrans*.

McKenry notes that RS-9 is a rootstock with low vigor, equivalent to Schwarzmann or 101-14. According to McKenry (FPMS *Grape Program Newsletter*, 7, 2001), the full range of soil and climate preferences for RS-9 is unknown but it is apparently suitable for evaluation in high density 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 and exhibits good resistance to *X. index* and *P. vulnus*, and slight susceptibility to citrus nematode. McKenry suggests that this rootstock should be evaluated in cooler regions where ectoparasitic nematodes such as *X. index* and root knot species predominate.

In comparative studies to date, RS-3 and RS-9 offer broader nematode resistance than VR 039-16, Freedom, Harmony, Ramsey or Teleki 5C (McKenry, FPMS *Grape Program Newsletter* #7, 2001).

A small number of plants of these rootstocks will be released from Foundation Plant Service within in the next few weeks. Legal identifica-

tion of the varieties and propagation licensing details for the patented stocks are still being finalized, but it is hoped that nurseries will be able to deliver rootstock rootings or vines grafted to this material for the 2006 planting season. **wbm**

Acknowledgements

Thanks are gratefully offered to all those who assisted in the compilation of this information.

Dr. Stamp is a Sebastopol, California, consulting scientist specializing in critical evaluation of vine performance issues and grapevine nursery plant material quality and propagation.