The Impact of Fungal Trunk Pathogens in Grapevine Nurseries

The International Council for Grapevine Trunk Diseases meets in Valencia, Spain.

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LAST JUNE'S INTERNATIONAL COUNCIL for Grapevine Trunk Diseases (ICGTD) meeting held in Valencia, Spain was well attended, with scientists from 23 countries representing all continents except Antarctica. There were over 100 scientific presentations grouped into five main sessions related to grapevine trunk disease caused by fungi: Pathogen Detection and Characterization, Grapevine Nurseries, Epidemiology, Host-Pathogen Interactions and Disease Management. The meeting also included a special roundtable session on grapevine nurseries that focused on fungal trunk pathogens as they affect the quality of grapevine propagation and planting material.

A panel of experts that represent influential wine growing areas throughout the world was invited to discuss their knowledge on the "Importance and Impact of Trunk Pathogens in Grapevine Nurseries." The roundtable, moderated by **Laura Mugnai** (Italy) and **Josep Armengol** (Spain), consisted of **David Gramaje** (Spain), **Doug Gubler** (U.S.), **Francois Halleen** (South Africa), **Philippe Larignon** (France), **Lucy Morton** (U.S.) and **Helen Waite** (Australia).

Prominence and Causes of Grapevine Trunk Disease

David Gramaje reported that an increasing number of newly established vineyards in Spain face economic loss because of young vine decline caused by fungal pathogens. He said that either the foundation mother vines are infected with fungal pathogens before grafting or that the vines become contaminated during the grafting process. The most likely sources of infection include the rootstock mother fields (soil and/or planting material), hydration tanks, grafting tools, callusing media and nursery row fields.

Gramaje said that he has found nursery personnel to have little awareness of the issues. He presented data from a survey that was conducted to assess the knowledge of nursery personnel on grapevine trunk disease. The survey showed that, while most Spanish nurseries were familiar with young vine decline (the disease), most had a poor understanding of causal agents of fungal trunk disease (i.e., the pathogens that cause disease). Other findings from the survey included: a practice that favors fungal pathogen spread—hydration—used by all nurseries (some soak the cuttings for long periods of time—up to four days), an alarming proportion (50 percent) do not use any type of sanitation practices and many do not understand or trust available sanitation practices.

Nursery production in Northern Spain

Francois Halleen reported that the worldwide prominence of grapevine trunk disease is attributed to the rapid expansion of the grape growing industry around the globe. For example, the number of wineries in South Africa increased from 245 in 1990 to 582 in 2011. Along with the shift from predominantly white varieties to about 50/50 white/red during the last decade, this has created a higher demand for plant material that has resulted in the production of lower quality nursery vines and poor vine establishment in new vineyards.

Trunk Disease in Australia

Helen Waite presented an overview of trunk diseases and propagation practices in Australia. She said that the growing demand for Australian wines in the early 1990s led to the development of "Strategy 2025"—a 30-year plan to increase grape production by the year 2025. Unfortunately, the essential role of nurseries in vineyard development was not included in the plan. Nurseries were unprepared to meet the increased demand for vines. As a result, they streamlined production by cutting corners: primarily by using bench grafts to replace field-grafted material. The presenter and other viticulturists believe that field grafting is superior because more care is taken during grafting.

Initially, the hot water treatment to control phytoplasmas was done incorrectly, leading to increased vine failure in the vineyards. Though the hot water treatment methodology improved with research, nurseries remained reluctant to use hot water treatments. Poor nursery sanitation, prolonged hydration of cuttings and substandard cold storage conditions have contributed to cross contamination, physiological stress and vine failure. Waite compared the present fungal pathogen situation to virus transmission in propagation material that occurred over 30 years ago. She hopes that awareness by nursery personnel and growers—with the help of plant pathologists—will allow effective methods for the control of pathogens in propagation material.

Waite concluded that the best nursery practice to produce bench-grafted planting materials is to avoid cold storage and hydration steps altogether. Ideally, the harvest of cuttings from rootstock and scion material would be planned to coincide with daily grafting activities. Nursery personnel would need to switch and adapt to a new system that potentially would avoid the propagation or dispersal of fungal and other microorganisms in the nursery. **Guidelines for the Production of High Quality Planting Material,** authored by Helen Waite, David Gramaje and Lucie Morton, was distributed to all participants to complement the presentations.

Best Practices for Trunk Disease Management

Halleen discussed research that showed the major source of infection in new or replanted material was from infected rootstock mother vines. Similar to what was discussed earlier by Gramaje, sources of fungal contamination were traced to all major propagation steps. Hot water treatment (50°C for 30 minutes) was identified as the most effective tool to improve the phytosanitary status of nursery vines. After many years of applied research, the group has developed recommendations to nurseries that include nursery sanitation and an integrated management strategy. The sanitation practices include pruning wound protection and sanitation of vines in foundation mother blocks, hot water treatment and incorporation of chemicals and/or

biological control agents in hydration tanks during all stages of preparation in the nursery.

Philippe Larignon presented results from their assessment of grapevine nursery plant material in three different regions of France. The results of testing rootstock and scion plant material revealed variable levels of infection of *Phaeomoniella spp.*, *Phaeoacremonium spp.*, *Phomopsis spp.* and species of the Botrosphaeriaceae family. The hot water treatment (50°C for 45 minutes) was effective in eliminating these pathogenic fungi. However, the use of standard nursery propagation, steps after the hot water treatment, resulted in reinfection with fungal pathogens. The results suggest that the best practice is to apply hot water treatment to the nursery-finished product instead of during the intermediate steps.

Preventative Measures

Lucy Morton presented her experience with planting material and how it frequently becomes compromised by fungal pathogens in American vineyards. She strongly recommended that growers visit the nursery field to inspect the planting material prior to purchase. Additionally, external and destructive examination should be performed on representative planting material to determine the presence of internal (streaking, pitting, brown exudates, etc.) or external (deep disbudding sites, incomplete graft unions, galling, etc.) symptoms.

Subsequent laboratory testing for specific fungal and viral pathogens of representative samples is also recommended. To be effective, the vine inspection and testing must be applied prior to planting. She concluded that pre-delivery field inspection reduces risk but does not guarantee pathogen-free planting material. She wondered if pathogen-free material is even possible. However, awareness of the presence of trunk disease pathogens in mother and propagation material is the first step in the implementation of control measures.

Group Discussion and Conclusions

A group discussion allowed nursery representatives, viticulture consultants and other scientists in the audience to share their experiences and opinions. Blame was placed primarily on nurseries for propagating and cross-contaminating planting material with fungal and other microorganisms. However, there is growing acknowledgement that fungal pathogens could originate in the grapevine mother blocks and later disperse in hydration tanks and/or nursery soils.

Of interest was a study applying the green grafting technique in France. The method consists of grafting vegetative (i.e., green growing scion and rootstock) cuttings that have the ability to heal rapidly. The work with greenhouse-grown material showed that the final finished plants were free of trunk disease-causing pathogens with the exception of *Cylindrocarpon spp.* Although the green grafting technology appears to be promising in terms of avoiding trunk disease pathogens, the study's author did not indicate if the initial plant material used in the study was previously tested or at what age the resultant bench grafts were tested.

A nursery representative in the audience, **Olivier Zekri,** indicated that French growers are not interested in purchasing green-grafted vines because of the additional cost compared to the traditional bench-grafted vines. The author of this article noted that the green grafting technique was applied at **Vinifera, Inc.** nursery in the early 1990s. Vinifera's goal was to provide disease-free material by using advanced strategies and included a plant pathology group headed by the author. Ultimately, green plant material (initially propagated aseptically by tissue culture to control Agrobacterium and fungal pathogens) was grafted routinely, and it was almost impossible to discern where the graft union was found.

Every winegrowing country around the world has developed certification programs that establish a foundation of disease-tested grapevines for distribution to nurseries and growers. However, current certification programs concentrate their testing efforts on viral diseases. There is no program that certifies vines to be tested (disease-free) for fungal pathogens. Routine testing for fungal pathogens and implementation of appropriate sanitation measures to worldwide certification programs would increase the cleanliness and quality of planting material (one infected vine can produce millions of other infected vines). Subsequent revision of nursery propagation and grafting practices will further help stop the dispersal of pathogens. The key will be in the implementation of diagnostic tools, isolation and sanitation methods throughout the process to prevent pathogen spread and propagation.

Ultimately—even with an advanced certification program in place—nursery personnel and growers must work together to plan propagation and planting activities to avoid perpetuating pathogens in the vineyard. What time better than now to undertake these changes while the growers are in the middle of a planting boom period? Now is the time to reflect, think and plan carefully before making expensive mistakes. WBM