

Managing Fungal Trunk Diseases in Plant Nursery Stock

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Recommendations to Improve the Quality of Plant Nursery Stocks

1. Reduce pathogen load in mother vines.
 - Protect pruning wounds for control of grapevine trunk diseases.
 - Control Phomopsis cane and leaf spot.
2. Sanitize cuttings
 - Dip cuttings in fungicide following harvest and before storage.
3. Sanitize water
 - Treat water rehydration or hot-water treatment tanks with ozone or chlorine.
 - Replace water tanks often.
4. Sanitize soils
 - Treat soil mix used especially during callusing as well as planting soil with hot steam.
 - Add biological control agents to callusing media.
 - Fallow land used for planting dormant vines to allow decline of soilborne pathogen populations.
5. Sanitize equipment
 - Clean water tanks, grafting machine, storage room, containers as often as possible.

1- Reduce Pathogen Load in Mother Vines

- Infection of pruning wounds leads to infection of cuttings.
 - The microbiome of grapevine cuttings (annual plant tissue) stems from the perennial structure of the vine (cordon and trunk). Fungi use the plant vascular system (xylem) to move around and colonize distant tissues.
 - Reducing airborne infection of GTD-pathogens (*Eutypa*, *Esca*, *Botryosphaeria*) in mother vines is key to decrease downstream pathogen load in field cuttings and later green and dormant vines.
 - **Protect pruning wounds with Thiophanate-methyl (Topsin M)** soon after harvesting cuttings. This will reduce spur, cordon and trunk infections with GTD pathogens and as a result infection of cuttings.
 - Start the pruning wound protection program **on new vineyard plantings** and reapply every year after dormant pruning as a preventative control strategy. This practice will have no significant benefits if applied on old blocks already infected with GTD pathogens.
- Infection of green shoots and leaves leads to infection of cuttings.
 - This is mostly targeted towards management of Phomopsis cane and leaf spot (*Diaporthe*). Wet springs lead to high disease pressure.
 - Reducing airborne infection of green tissues in mother vines will decrease downstream pathogen load in green and dormant vines.
 - **Spring foliar treatments with contact fungicides (Ziram, Mancozeb)** in wet springs on green shoots (0.5 inch up to 18 inches in length). **If several rains are predicted, use systemic fungicides (Pristine).**
 - **A treatment of liquid lime sulfur before rainfall in winter** will reduce the viability of spore-bearing structures. It will also control Botrytis.

2- Sanitize Cuttings.

- Infection of mother vine cuttings causes cross-contamination.
 - Latent infection of mother vine cuttings with GTD pathogens (mostly the causal agents of Eutypa dieback, Esca disease, Botryosphaeria canker, and Phomopsis cane and leaf spot) become source of inoculum during the plant propagation phase.
 - Fungi produce spore-bearing structures on cutting surfaces and spores are released in water tanks and cross contaminate cuttings.
 - GTD pathogens also colonize the grape vasculature and some endophytic spores are released in the environment when cuttings are pruned and submersed in water.
 - **Treat cuttings:** dip cuttings in a bath containing synthetic fungicide Thiophanate-methyl (i.e. 26/36) or biological products (Trichoderma, Bacillus) following harvest of mother blocks cuttings and before storage to reduce viability of spore bearing structures and likelihood of cross contamination later on and protect cuttings from latent infections.

3- Sanitize Water

- Water contaminated with GTD pathogens causes infection of cuttings.
 - GTD pathogens are waterborne.
 - Water in hydration tanks and hot water treatment tanks are contaminated with spores of GTD pathogens. Because the water is not being replaced after each batch of cuttings, cross contamination can occur.
 - Hot water treatment does not kill all fungal spores. It only reduces quantity of viable inoculum.
 - **Replace water from tanks often.**
 - **Treat water with ozone or chlorine.**

4- Sanitize Soils

- Soil contaminated with GTD pathogen causes infection of cuttings.
 - Soil mixes used during the callusing stage and planting soil are infected with soilborne GTD pathogens (mostly the causal agents of young vine decline, rhizoctonia and black foot).
 - Wounds are susceptible to infection for several weeks after wounding.
 - During the callusing period, cuttings are highly susceptible to infection because wounds are in contact with pathogen-infected substrate, with high temperature and humid environment that are both conducive to disease.
 - Potted green vines are also susceptible to infection (to a lesser degree than callusing vines) because wounds made on the rootstocks are in direct contact with soilborne pathogens from planting soil.
 - Dormant vines are also susceptible to infection (to a lesser degree than callusing vines) because wounds on the rootstocks are in contact with soilborne pathogens in the nursery fields.
- **Sanitize soils (steam).**
- **Add biological control agents to soils (e.g., Trichoderma, Bacillus).**
- **Fallow land used for planting dormant vines to allow decline of soilborne pathogen populations.**