Managing Grapevine Fungal Trunk Diseases

Advanced Grape Growers Workshop

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Hill Country University Center

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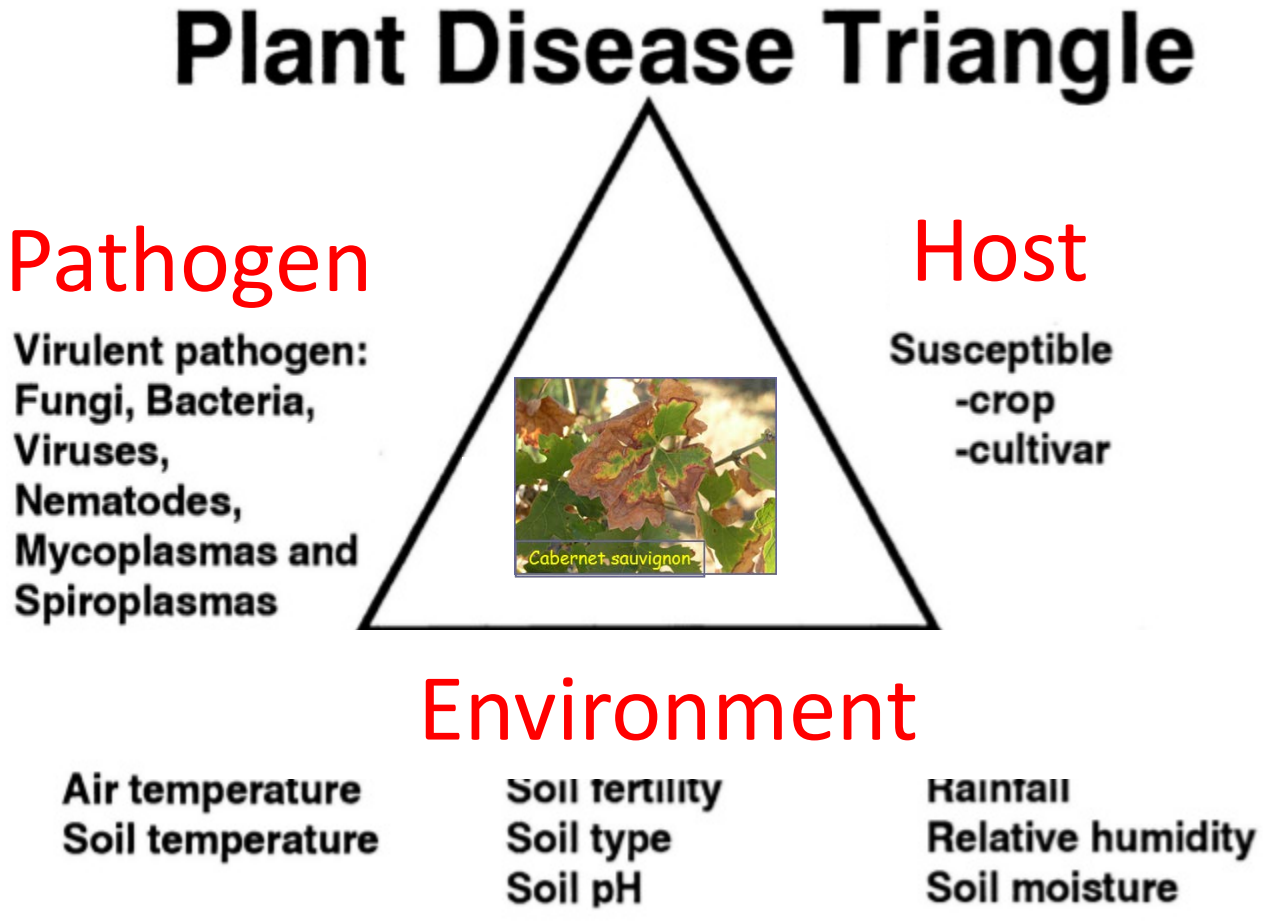
Presentation Outline

- Some basics of plant pathology,
- Trunk disease and grapevine cankers defined,
- Impact of cankers,
- The Texas situation,
- Control of grapevine cankers.

What is Plant Disease?

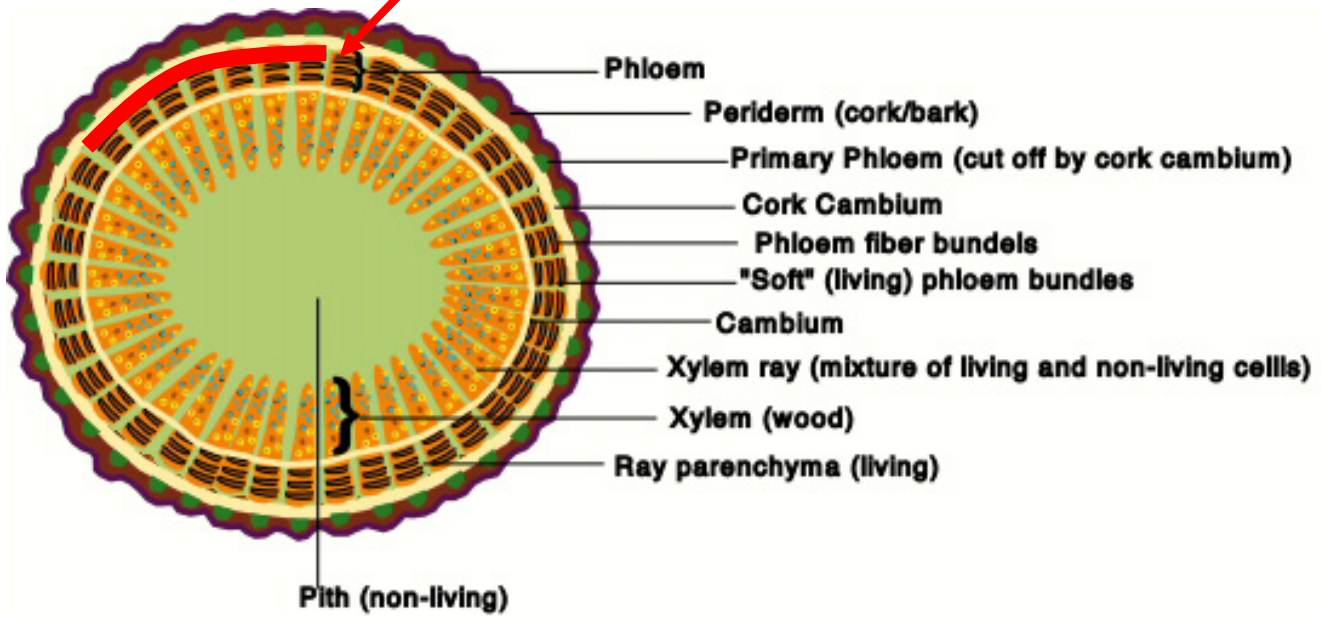


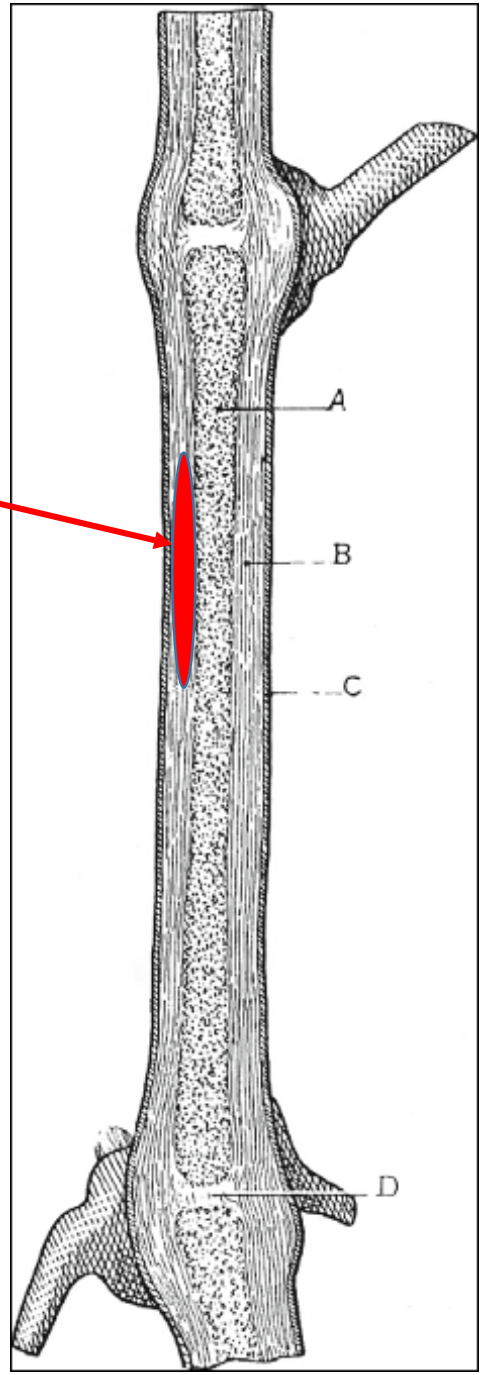
What are Trunk Diseases?

- Disease category consisting of necrotic, perennial lesions of mature wood (=cankers),
  - from small to large, often found near spurs,
  - sometimes characterized as vascular diseases,
- Mostly caused by fungi – well over 20 species,
- Usually associated in vineyards 10 yrs. or older,
- Occur worldwide, on all grape varieties,

Trunk/cane Anatomy

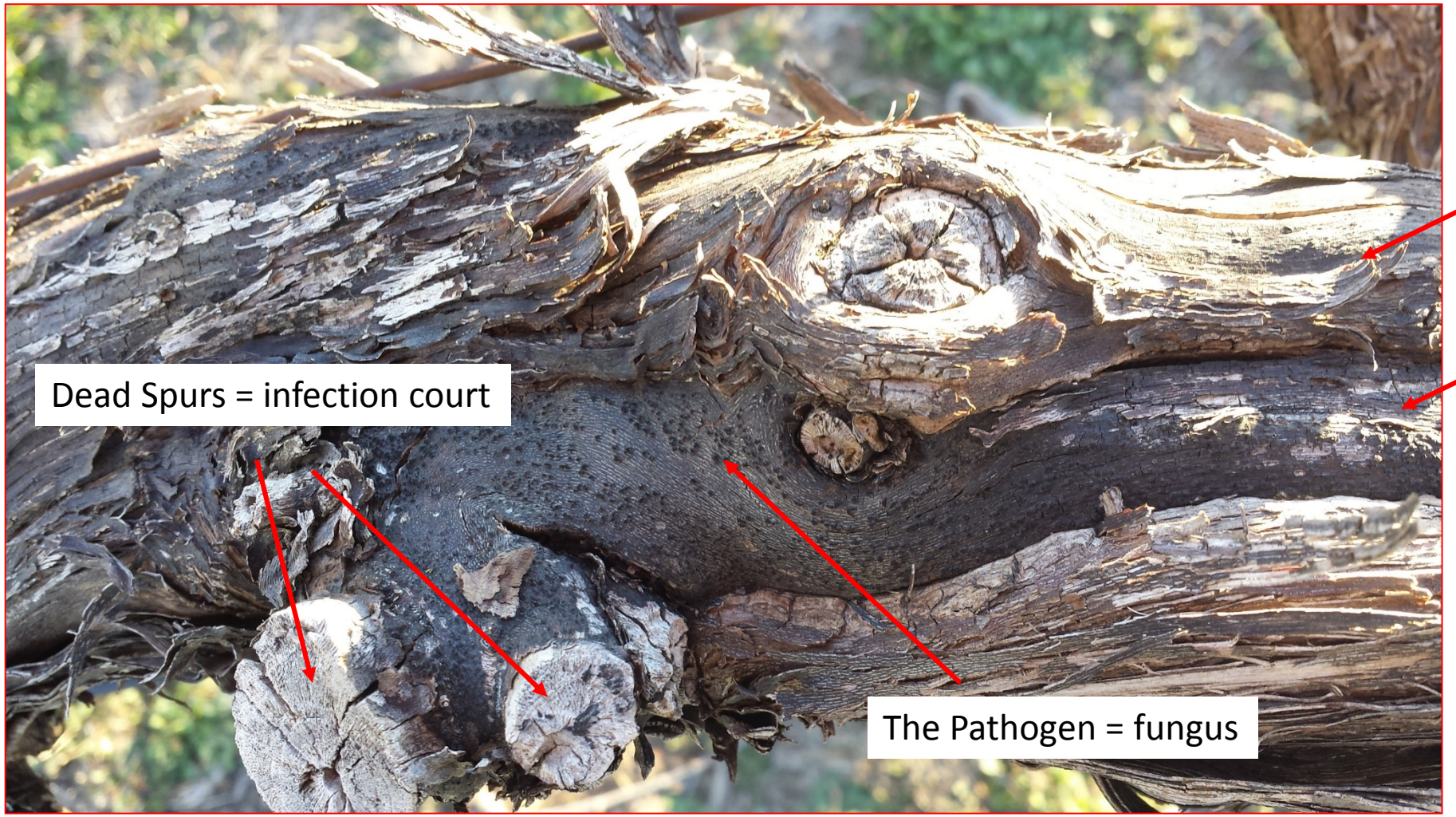
Location of affected tissues by GTDs





Cornell Fruit http://www.fruit.cornell.edu/grape/pool/winterinjurycanes.html

Anatomy of a Canker



Living tissue = callus

Dead tissue

Impact of Grapevine Trunk Diseases

Can cause increased costs through several avenues

- In CA, economic consequence is 14% lost revenue annually,
- Reduced yield,
  - loss of fruiting wood,
- Costs of preventative and post-infection measures,
- Decrease efficiency of inputs,
  - fertilization, watering, etc,

Impact of Grapevine Trunk Diseases (GTDs)

- Reduce lifespans of vineyards,
- Increase production costs,
- Occur worldwide,
- *Vitis vinifera* universally susceptible,
- Native American grapes and hybrids also susceptible,
- Caused by fungi killing woody cordons and trunks.

What Causes Trunk Diseases?

- Caused by a long list of taxonomically diverse fungi,
  - mostly Ascomycetes,
- They form spores in tiny “containers” growing on the surface of the dead, cankered wood,
  - “fruiting bodies”,
  - containers = pycnidia,
- Fungal spores are airborne,
  - Sexual and asexual conidia,
- Infection occurs through wounds,
- More than one potential pathogen in any given canker.

Typical Disease Cycle of a Grapevine Trunk Fungus

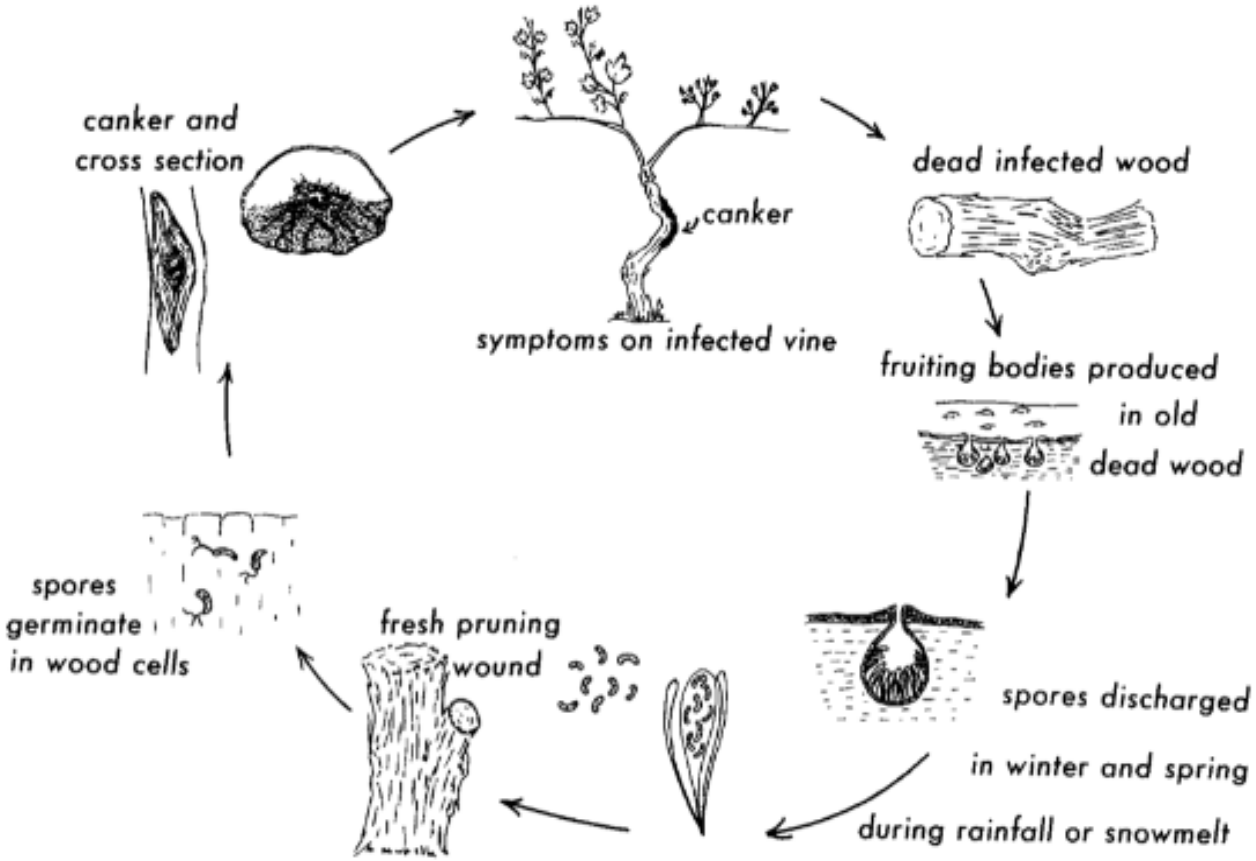


Figure 7

Published by the New York State Agricultural Experiment Station, Geneva, A Division of the New York State College of Agriculture and Life Sciences, A Statutory College of the State University, Cornell University, Ithaca. Authored by R. C. Pearson and T. J. Burr. Funded in part by an Extension Service—USDA, IPM Grant.

What Do they Look Like?

"It is difficult to associate one type of symptom with a particular pathogen"

- Internal and External Trunk Symptoms
  - perennial, expanding necrotic lesions (canker),
  - longitudinal splits and cracks
  - dead cordon arm, loss of spurs,
  - wedge shaped necrotic lesions in cross section (internal)
- Foliar Symptoms
  - chlorotic, tattered and cupped,
  - stunted shoots,
- Berries
  - bunch rot,
  - spotting.

Causes of GTDs

Three diseases and the pathogens that cause them

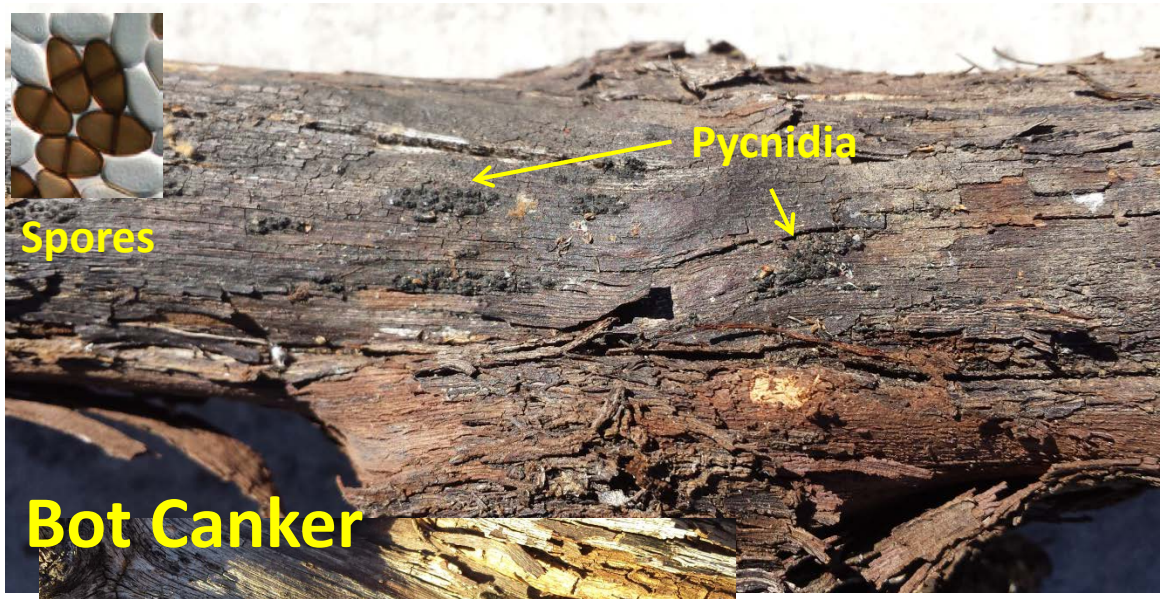
- Bot Dieback, Dead Arm
  - *Diplodia seriata* and *Lasiodiplodia crassisipora*
  - dieback of canes, cordons trunk caused by cankers,
- Esca, Petri Disease, Black Measles, Apoplexy
  - *Phaeomoniella* and *Phaeoacremonium*
    - vascular pathogens
  - and*, Fomitiporia*
    - white rot
- Eutypa Dieback, Dying Arm
  - *Eutypa lata*,

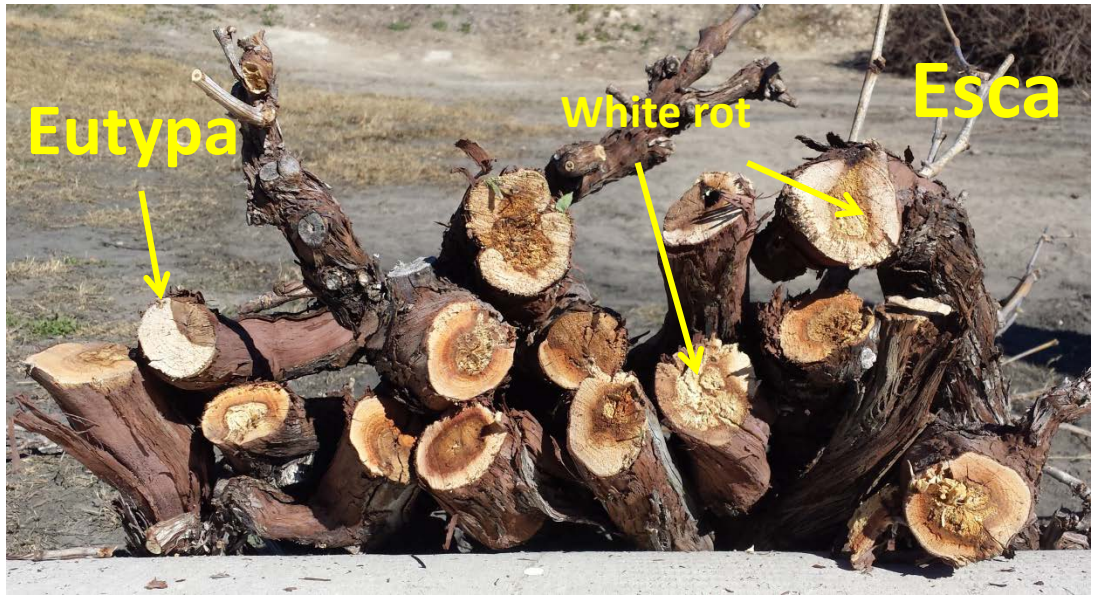
http://www.goodfruit.com/knowing-washingtons-trunk-diseases/

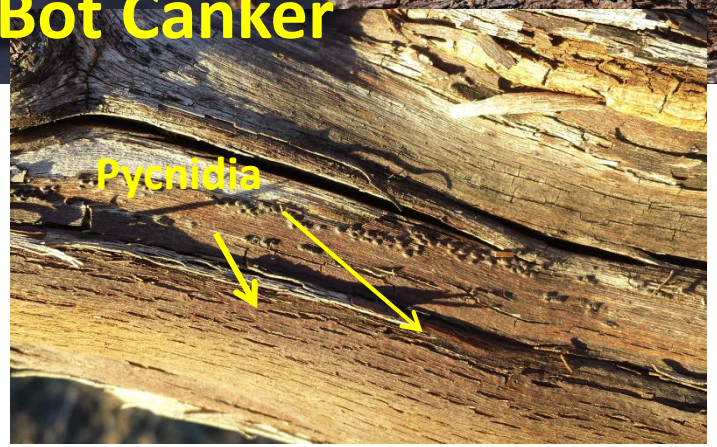
Good Fruit Grower

Recognizing GTDs

The wood – signs and symptoms







Eutypa

Petri Disease
(ResearchGate)

Recognizing GTDs

The vine - symptoms

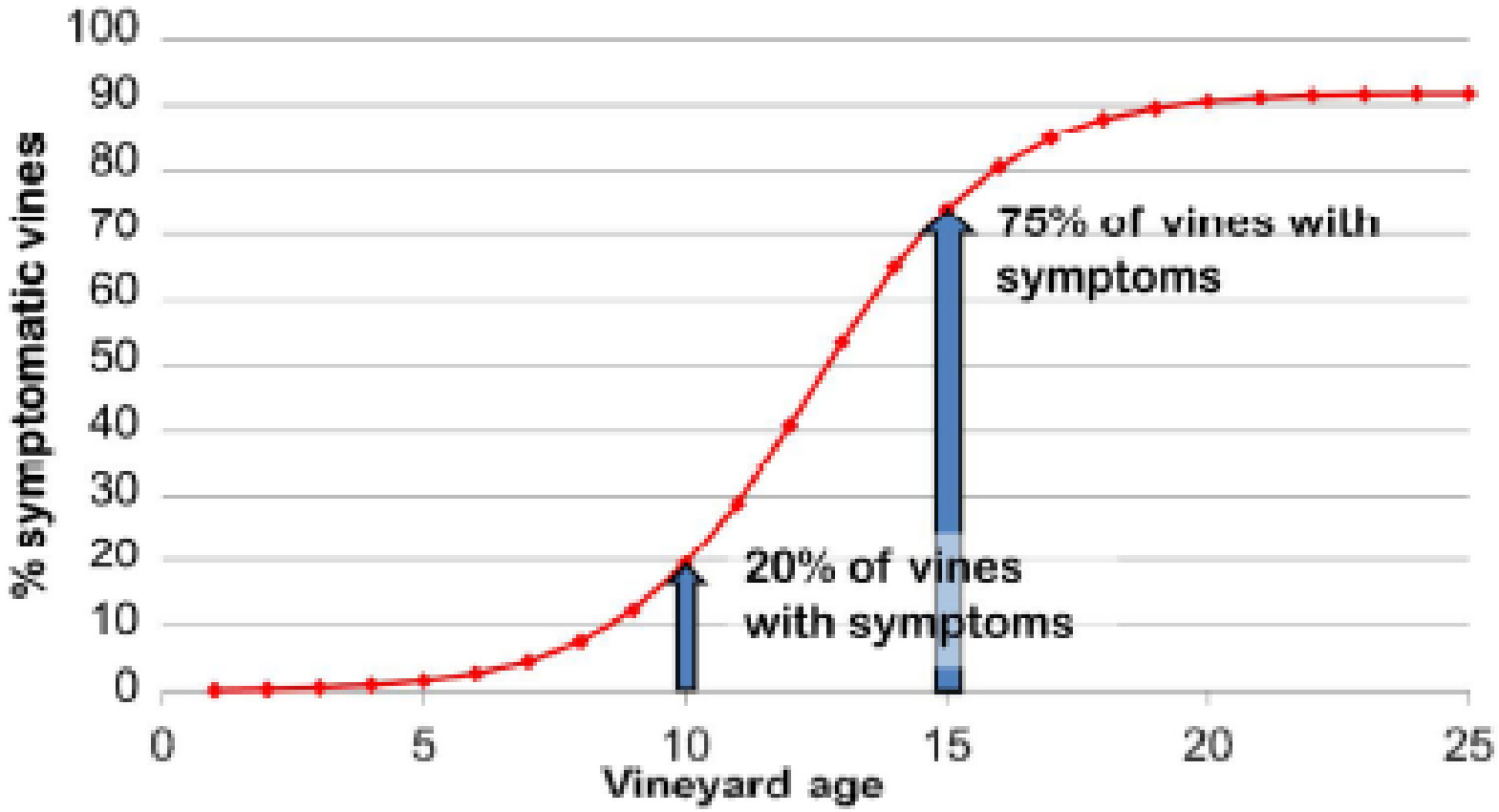
Photo credits: K. Baumgartner and R. Travadon

Fundamentals of Managing GTDs

- Early prevention!!!!
  - cankers are slowly developing – long lag phase between infection and appearance of symptoms
  - disease is present long before vines start dying back.
- Proper diagnosis is often difficult.
  - more than one fungus often involved,
  - may not be necessary!
- Any practices that promote vine health are going to be beneficial.
- Complete control, eradication, impossible.

Disease incidence with vine age

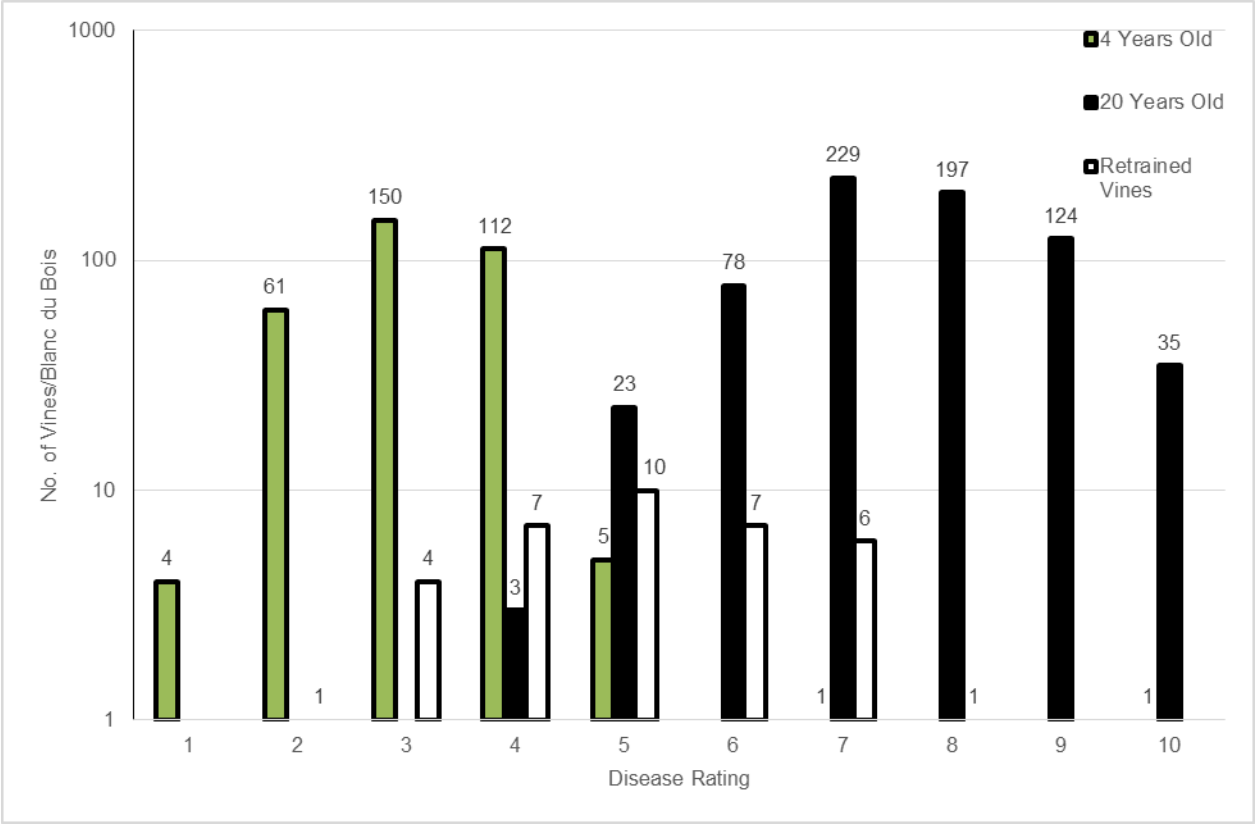
(% vines w/ dead spurs, stunted shoots, symptomatic leaves)



From Duthie et al. 1991 and Munkvold et al. 1994

Disease Incidence With Vine Age

- Results of a canker survey in a Gulf Coast Bland du Bois vineyard,
- Three age classes,
- Disease ratings (1-10),
- No.s vines/rating class,
- Note distributions between ages and no.s of vines.



Early Prevention is Critical!!!

- There is a long lag phase between infection and appearance of symptoms,
  - several years,
- Most of these fungi grow slowly in the vine wood,
- Foliar symptoms do not appear until several years after the onset of infection, so that by the time the symptoms become visible the fungi are well-established,
- The disease is present long before the vines begin to die back.

List of Management Practices

- Starts with diagnosis,
- Cultural practices,
- Modify pruning practices to avoid risk,
- Protect wounds,
- Surgery and re-training vines,
- Sanitation.

Cultural Practices

Keeping vines in a good state of health

- Recognize clean propagation materials, including rootstocks and scions,
- Proper planting and training practices,
- No over-cropping or other avoidable stresses,
- Maintain good fertility,
- Scout regularly for potential problems.

Modify Routine Pruning Practices
Wound Management – Double Pruning

- “pre-pruning”,
- 10 – 12 inches above intended spurs,
- made during the dormant season, December – January,
  - first cut exposed to primary infections,
- Second prune, In February just before or at bud break,
  - second cut removes the primary infections,
- Advantage – vines more able to resist infections, any previous infections removed.
- Weber, E.A., Trouillas, F.P., and Gubler, W.D. 2007. Double pruning of grapevines: a practice to reduce infections by Eutypa lata. Am. J. Enol. Vitic. 58:1.

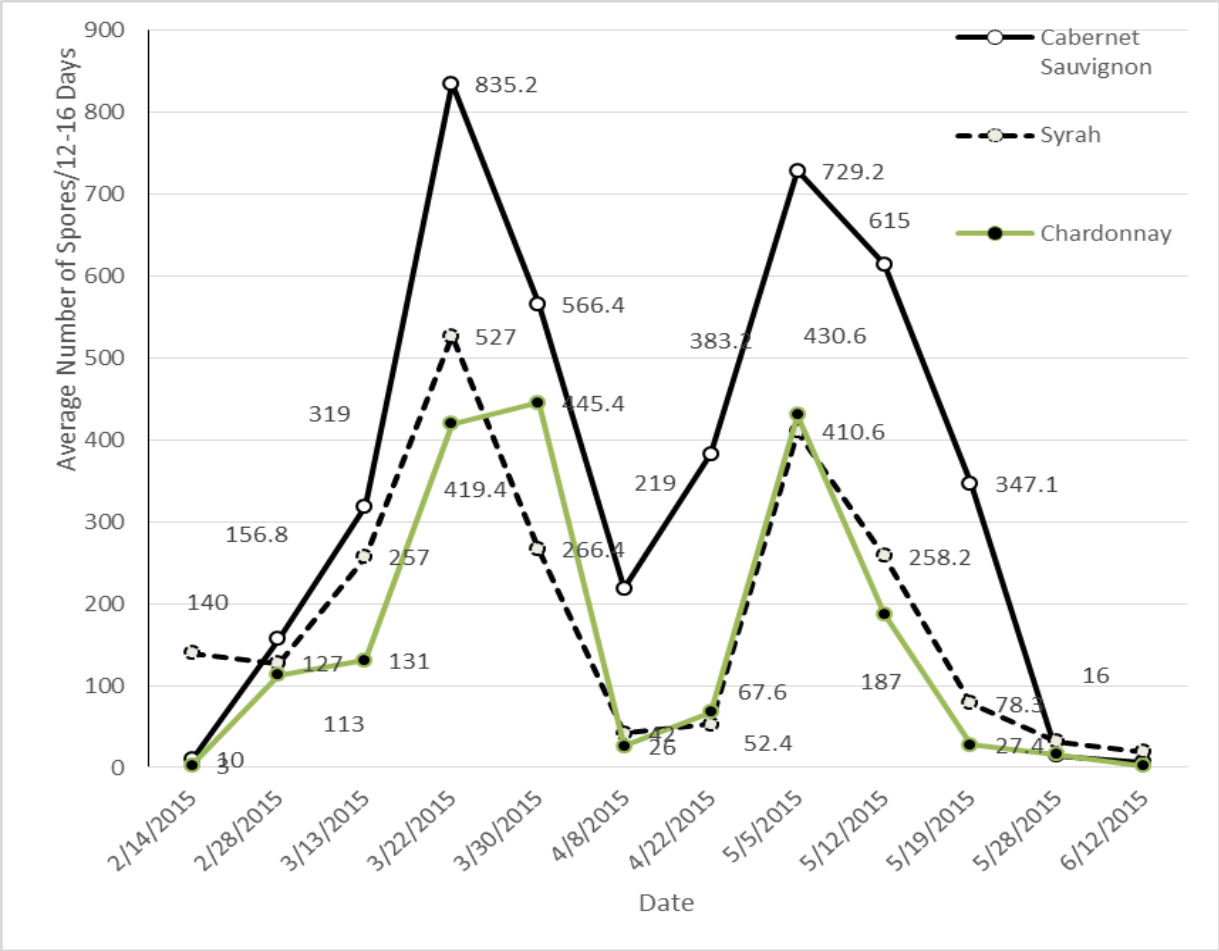
Double pruning can help prevent canker infection. Photo Credit: Rhonda Smith

Modify Routine Pruning Practices
Wound Management – Delayed Pruning

- Late in the dormant season,
- Promotes delayed infections and limits damage,
  - “healing” late in dormant season proceeds more quickly,
  - “resistance” is achieved sooner after cut is made,
- Don’t prune during rainy, wet weather.

Spore release and rainfall

Bot canker – *Diplodia* sp.



Protect Wounds

Barriers to infection

- Use wound paints,
  - Must be durable,
  - Effective for 2 – 12 weeks,
  - Consist of resins, essential oils, other carrier,
  - Manual application to wounds,
  - May contain boric acid or a fungicide to debilitate pathogen.
- Fungicide sprays,
  - Dormant season sprays,
  - Prevent GTDs caused by *Botryosphaeria*, *Eutypa*, *Phaeoacremonium* and *Phaeomoniella* ,
  - 2017 Grape Pest Mangement guide (HT-085) at the website of the Texas A&M AgriLIfe Bookstore .

Surgery and Re-training Vines

Extends productive lifespans of vines

- Remedial pruning,
  - late dormant season,
  - excisions made min. 4 in. below discolored wood,
  - won't work for Esca,
  - creates more wounds!
- Renew trunks,
- Re-train cordons.
- Sanitation important!

Current Recommendations for Control

In older, infected vineyards

- Vine surgery – cut away infected canes/cordons, trunks,
  - retrain – considered to be a last resort,
  - must cut back to healthy tissue,
  - protect wounds as previously recommended.
- Sanitation –
  - remove from vineyard/burn,
  - effective spore dispersal distances?
    - 6 ft.

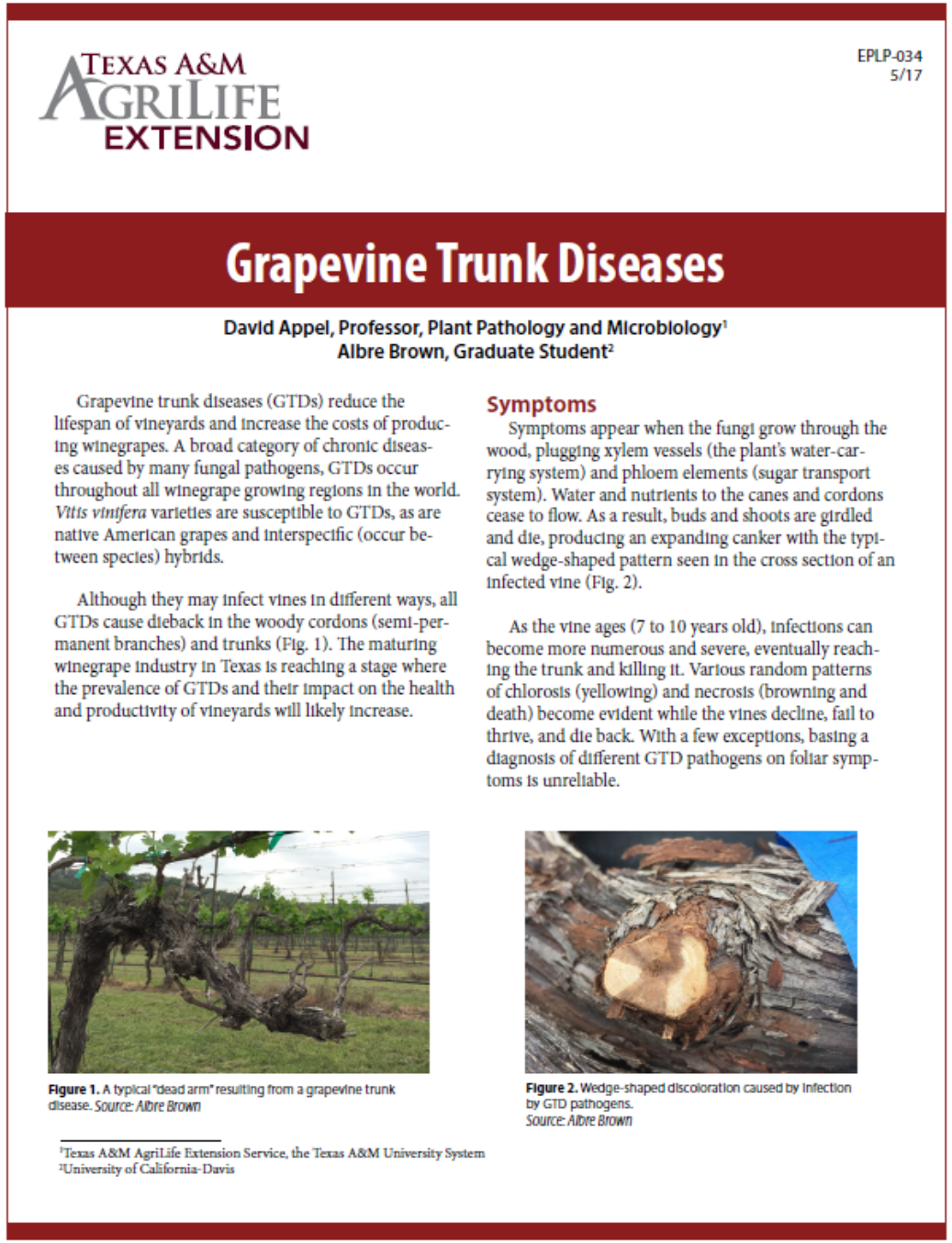
Management practices and estimated costs (per ha/yr) for control of grapevine trunk diseases in California vineyards

Preventative measures	
Delayed pruning	$0
Double pruning	$247.00
Protect pruning wounds – hand	$135.00
Protect pruning wounds – tractor	$127.50
Post - infection	
Replant specific vines	$401.38
Replant whole block	$37,050.00
Retrain cordon	$277.88
Retrain trunk	$988.00
Sanitation	$222.30

Hillis et al. 2016. The role of pest control advisors in the preventative management of grapevine trunk diseases. Phytopathology 106:339-347.

Summary

- The Texas industry reaching a stage where GTDs will become more prominent,
- Infections start in young vines and conglomerate over time,
- Declining productivity accompanies premature aging of vines,
- Management starts early in vineyard establishment and must be sustained thereafter.



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5/17

Grapevine Trunk Diseases

David Appel, Professor, Plant Pathology and Microbiology[1]
Albre Brown, Graduate Student[2]

Grapevine trunk diseases (GTDs) reduce the lifespan of vineyards and increase the costs of producing winegrapes. A broad category of chronic diseases caused by many fungal pathogens, GTDs occur throughout all winegrape growing regions in the world. *Vitis vinifera* varieties are susceptible to GTDs, as are native American grapes and interspecific (occur between species) hybrids.

Although they may infect vines in different ways, all GTDs cause dieback in the woody cordons (semi-permanent branches) and trunks (Fig. 1). The maturing winegrape industry in Texas is reaching a stage where the prevalence of GTDs and their impact on the health and productivity of vineyards will likely increase.

Symptoms

Symptoms appear when the fungi grow through the wood, plugging xylem vessels (the plant's water-carrying system) and phloem elements (sugar transport system). Water and nutrients to the canes and cordons cease to flow. As a result, buds and shoots are girdled and die, producing an expanding canker with the typical wedge-shaped pattern seen in the cross section of an infected vine (Fig. 2).

As the vine ages (7 to 10 years old), infections can become more numerous and severe, eventually reaching the trunk and killing it. Various random patterns of chlorosis (yellowing) and necrosis (browning and death) become evident while the vines decline, fail to thrive, and die back. With a few exceptions, basing a diagnosis of different GTD pathogens on foliar symptoms is unreliable.

Figure 1. A typical "dead arm" resulting from a grapevine trunk disease. *Source: Albre Brown*

Figure 2. Wedge-shaped discoloration caused by infection by GTD pathogens.
Source: Albre Brown

[1]Texas A&M AgriLife Extension Service, the Texas A&M University System
[2]University of California-Davis

Resources

- https://www.agrilifebookstore.org/
- Search for *Grapevine Trunk Diseases*

Resources

- For assistance in diagnosing GTDs and other grapevine diseases, see the website of the Texas Plant Disease Diagnostic Laboratory to get instructions on submission of samples (http://plantclinic.tamu.edu/).
- Specific recommendations for pest management of insect and diseases with fungicides and insecticides can be obtained from the 2016 Grape Pest Mangement Guide (HT-085) at the website of the Texas A&M AgriLIfe Bookstore (http://www.agrilifebookstore.org/Texas-Grape-Pest-Management-Guide-p/ht-085.htm).
- Additional information on current research and developments on GTDs can be obtained from the project website of the USDA Specialty Crops Research Initiative on GTDs in California (http://treeandvinetrunkdiseases.org/).

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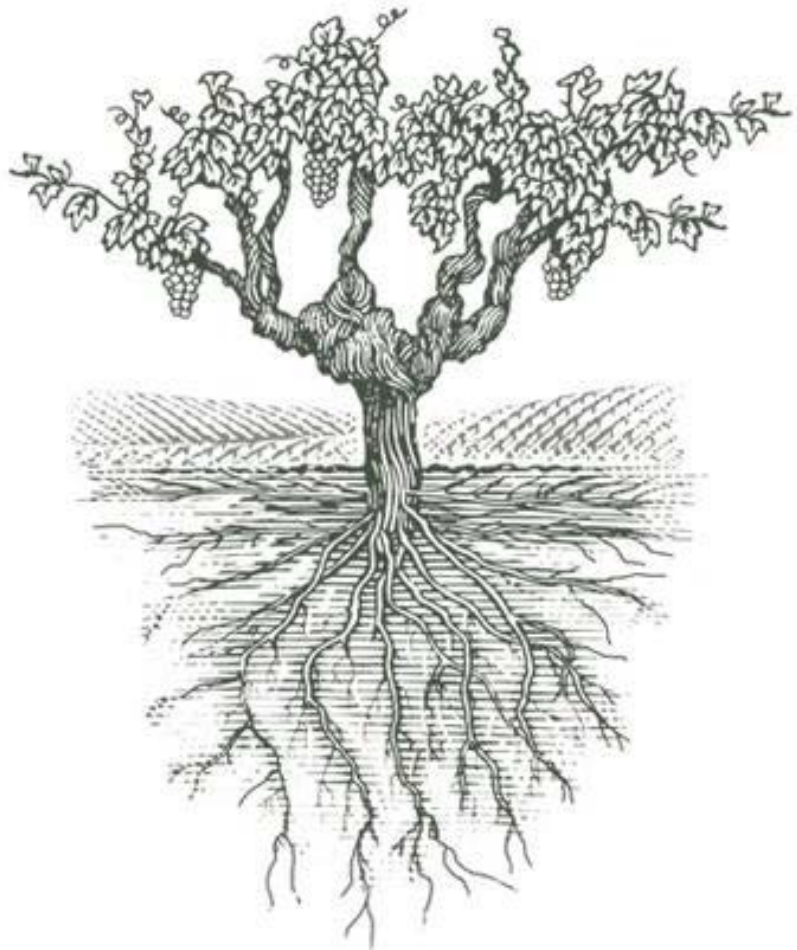

Current Recommendations for Control

Prevention – newly planted vineyards

- Treat pruning wounds with a protectant
  - Topsin M (70WP) @ 2lb/acre (Group 1 Benzimidazole, Thiophanate-methyl),
  - Rally 40W @ 4-6 oz/acre (Triazole, Myclobutanil),
    - tractor applied post-pruning,
  - Tractor applied post –pruning
    - repeat as needed to be effective for 1 month,
    - particularly after rain.
  - Topical wound paints,
    - Vinevax (Trichoderma),
    - 5% Boric Acid paste,
    - fungicide amended wound paints.