Grapevine Trunk Diseases

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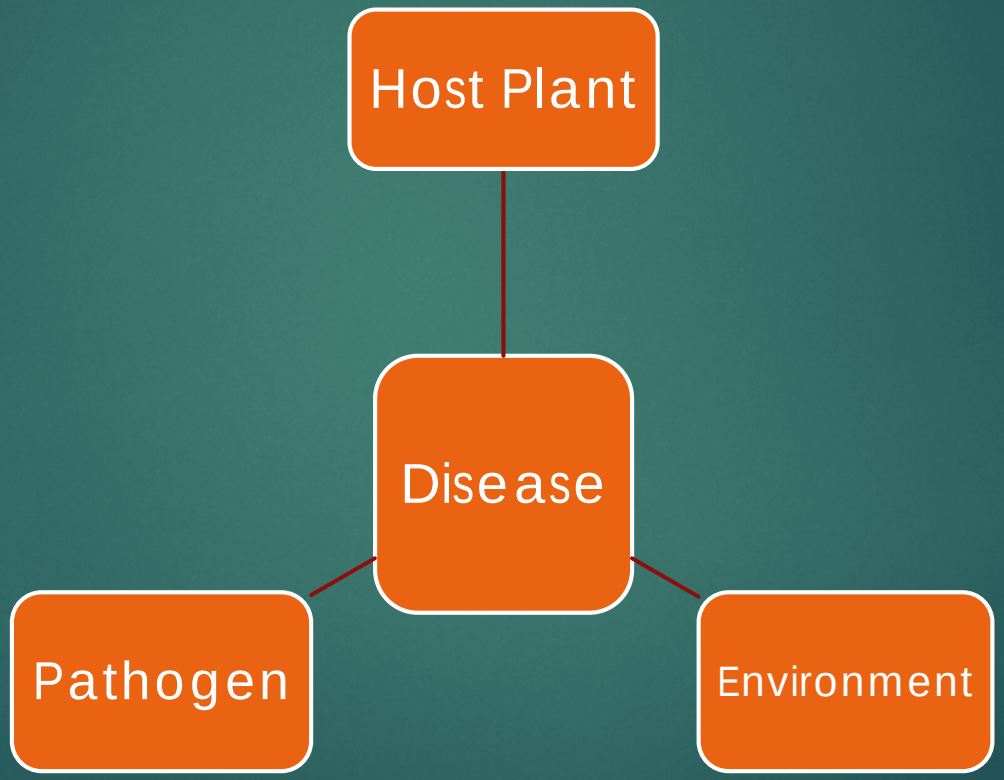
TEXAS A&M AGRILIFE EXTENSION

ADVANCED GROWER WORKSHOP 2020

What Are Trunk Diseases?

- Fungal diseases caused by 133 species in 43 genera worldwide
- Cause loss of production and decline of vine health
  - Estimated >$1.5B in replanting and >$1B in production loss worldwide every year
- Symptoms usually begin appearing in later years, but infection occurs early on
- Primary reason for early replanting, if vines are otherwise healthy and well-maintained
  - Decreases efficiency of inputs (fertilizer, water, etc) and wine quality (<sugars, >pH)
  - Eventually vines will die due to reduced flow of water and nutrients
- ALL *Vitis* vinifera grapes are susceptible, as are natives and hybrids

How Do They Work and Why Haven't We Found a Solution?



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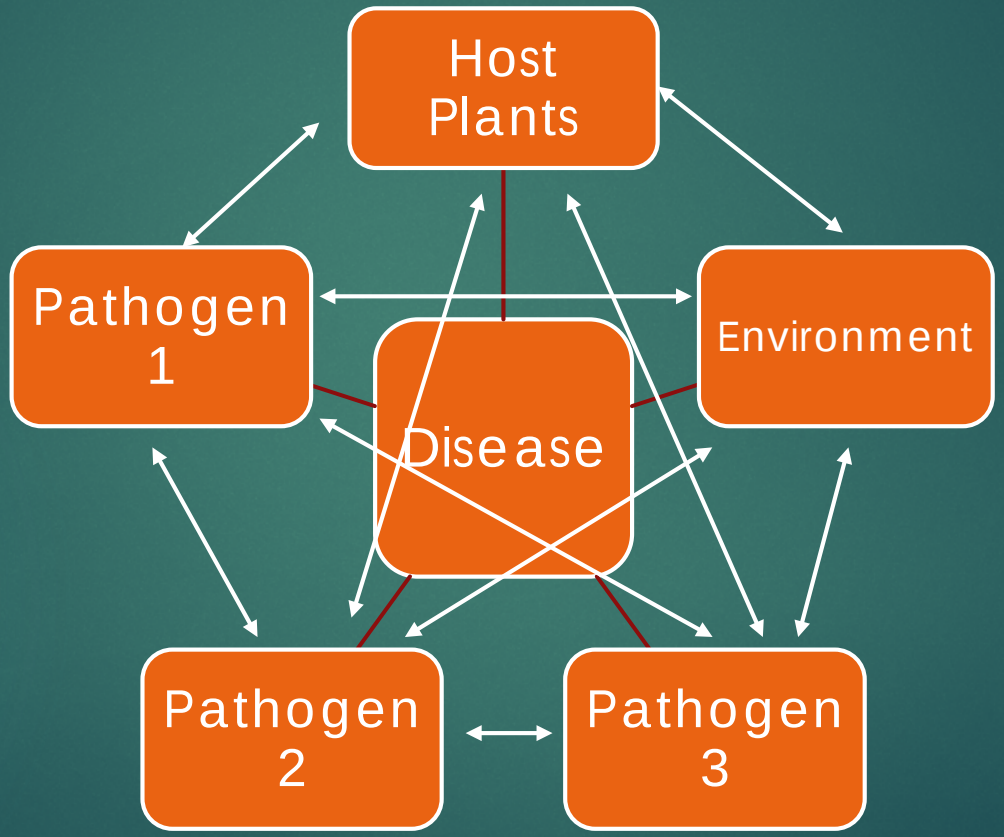
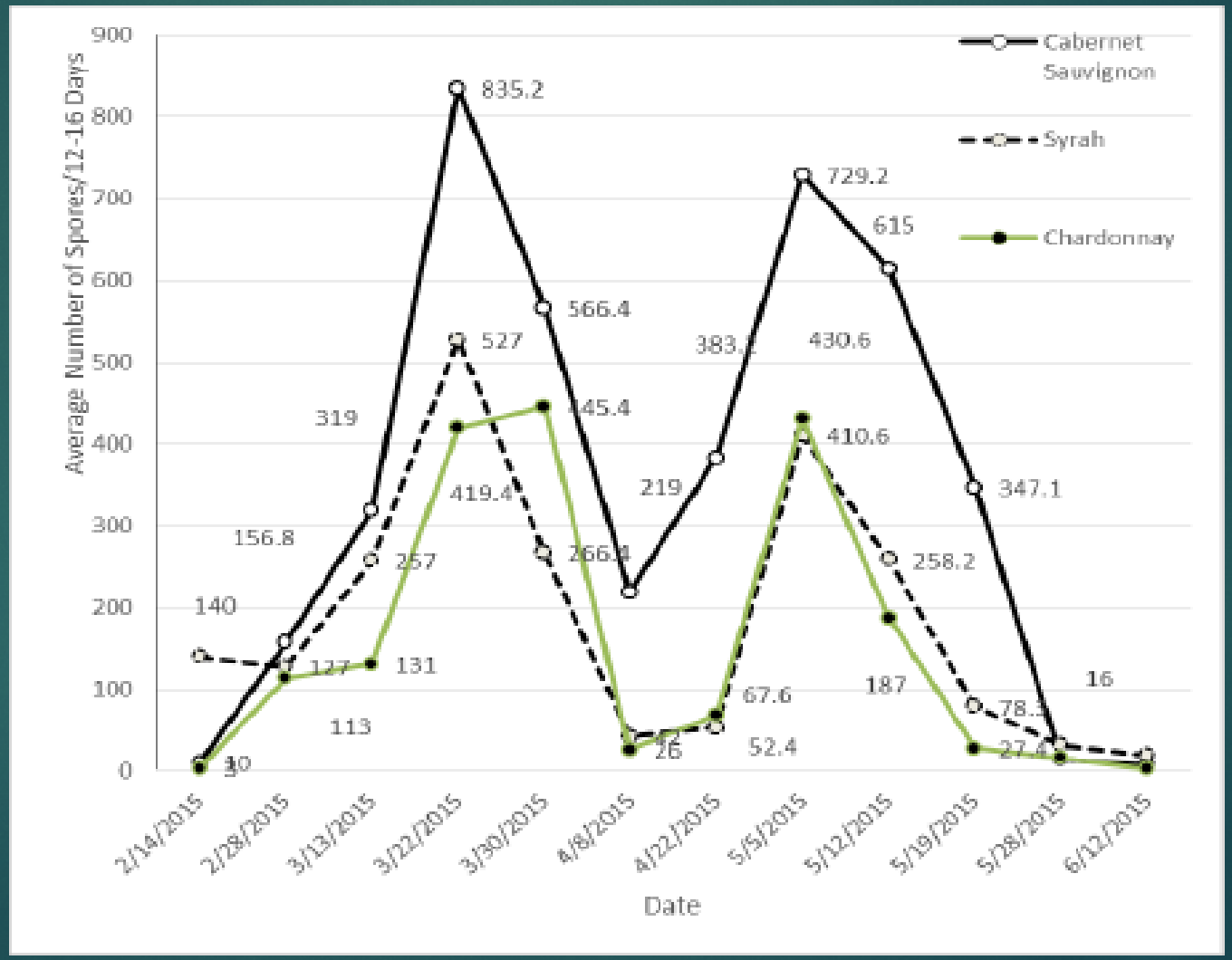


How Are They Spread?

Spore Release after Rainfall- Botryosphearia



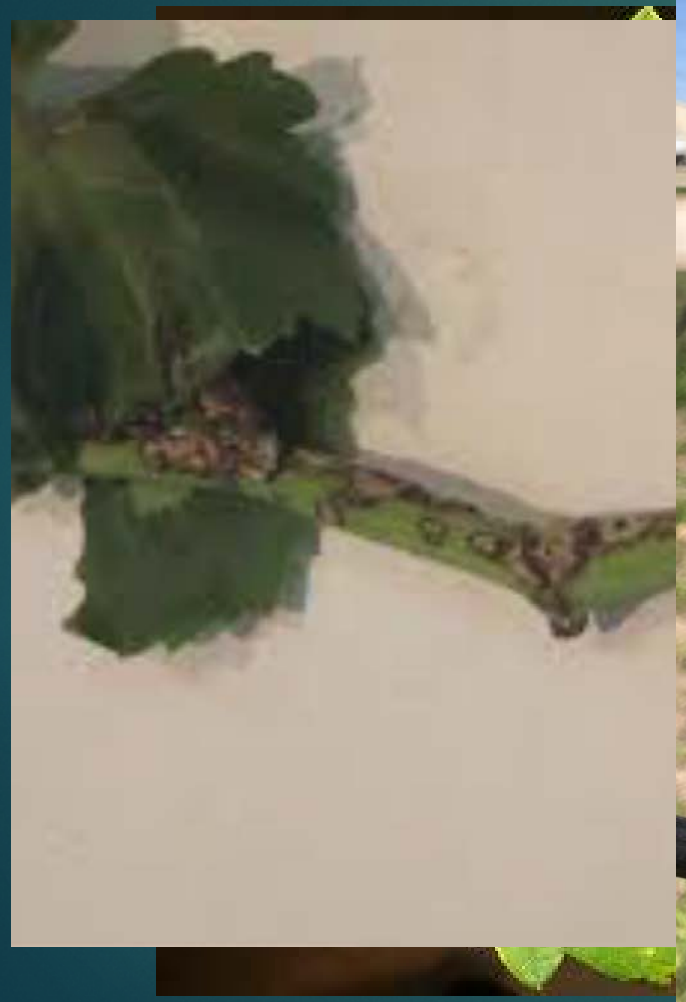
Infection Courts

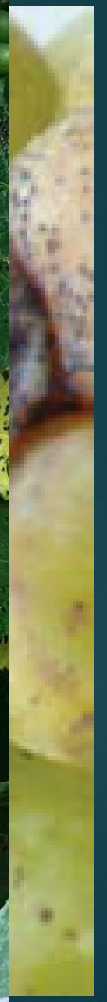
Phomopsis Dieback- “Dead Arm”

- Causal organisms: *Phomopsis viticola, Diaporthe noblis, D. ambigua,* and *D. foeniculina*
- Leaf symptoms appear in the first year of infection, and dead spots on the cordon only occur after years of chronic infection
- More severe in humid regions

- **Leaf Symptoms**
  - Small leaf spots
  - Small leaves crimped at the margins
- **Fruit Symptoms**
  - Rachis necrosis
  - Shriveled berries near harvest
  - Crop loss up to 30%
- **Cane and Cordon Symptoms**
  - Brown-black irregular lesions on canes
  - Dead spots on cordon

Phomopsis Dieback





Esca- "Measles"

- Causal organisms: **Phaeoacremonium minimum*, **Phaeomoniella chlamydospore*, *Fomitiporia sp., Cadophora luteo-olivacea*, *C. melinii*, *C. novi-eboraci*, and *C. orientoamericana*
- Symptoms typically first appear in year 5-7, but could be seen earlier in severe cases
- Direct damage to crop in the form of spotty fruit
- Indirect damage via gradual dieback or occasionally apoplexy (rapid dieback of one or multiple shoots)

Symptoms

- "Tiger Striping" on Leaves (Chlorosis/Necrosis)
- Black Spots on Berries
- "Measles" or Stippling of internal wood
- Apoplexy (Sudden Death)
- Fruit Symptoms:
  - Early infection (at fruit set): berries tend to not mature and will shrivel on vine
  - Late infection: fruit will have an acrid taste

Esca

Note: Secondary Infection

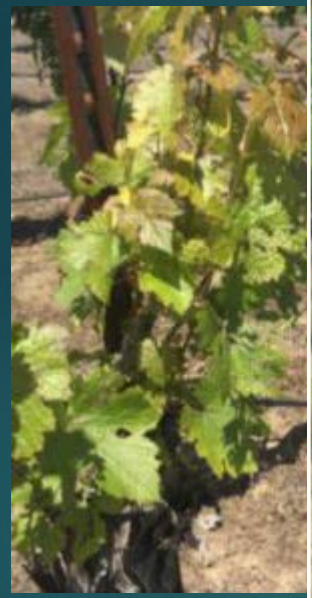
Eutypa Dieback- “Dying Arm”

- Causal organisms: *Eutypa lata*, *E. leptoplaca*, *Eutypella vitis*
- Symptoms typically appear in year 10+, sometimes earlier. Usually around 2-4 years after infection has actually taken place
- Most infected vines lose ~30% of their production, but in severe cases it can be up to 80%

Symptoms

- Stunted development
- Strong Chlorosis/ Necrosis on Leaves
- Cupping of Leaves
- Wedge Shaped Staining of Internal Wood
- Cankers on Shoots

Eutypa

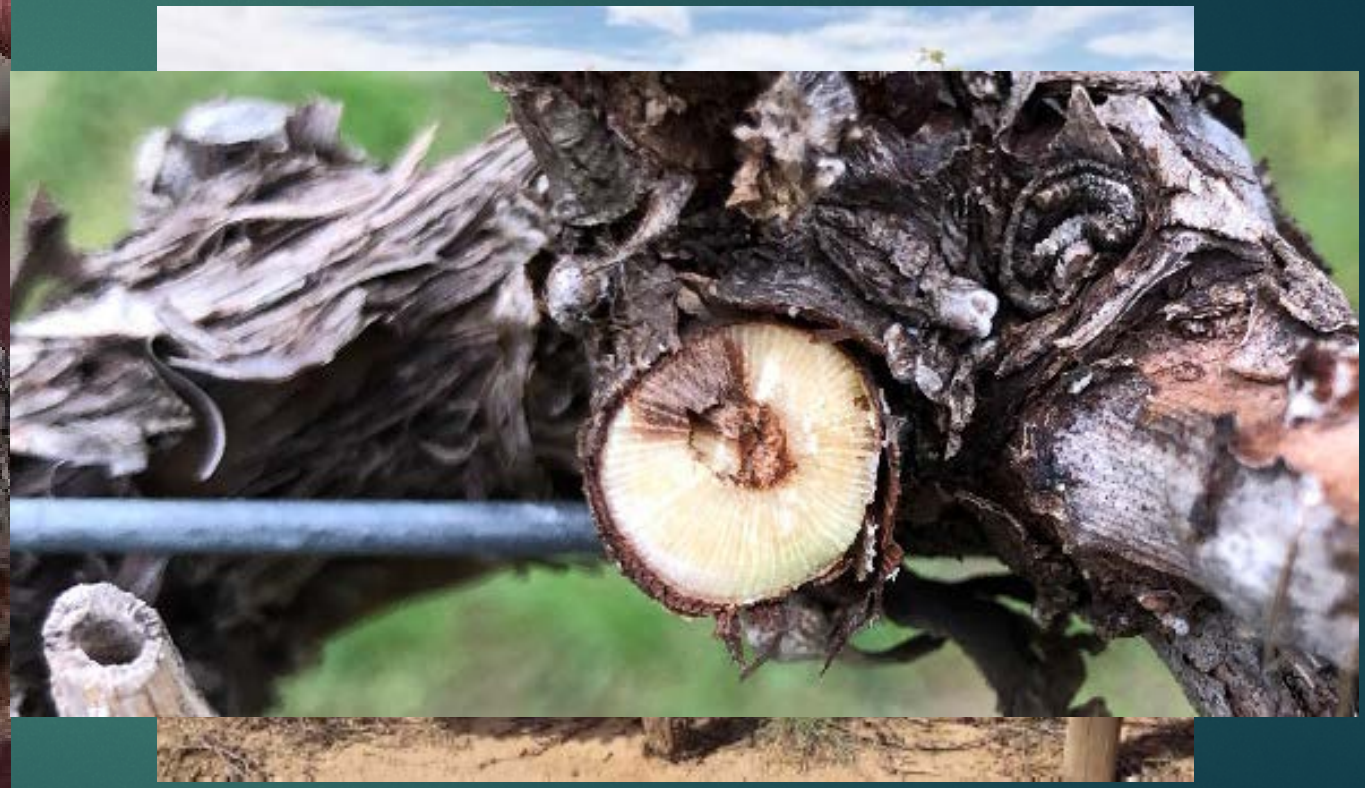


Botryosphaeria Dieback- “Bot Canker”

- Causal organisms: *Diplodia seriata*, *Lasiodiplodia crassisipora*, *Neofusicoccum parvum*
- Most common and widespread GTD
- Symptoms first seen in year 5
- Most aggressive, in the case of some species, like *Neofusicoccum parvum*

- **Symptoms**
  - Dead Spurs
  - Cankers on cordon and trunk
  - Stunted Shoots
  - Chlorosis/Necrosis on Leaves
  - Wedge-Shaped Internal Staining

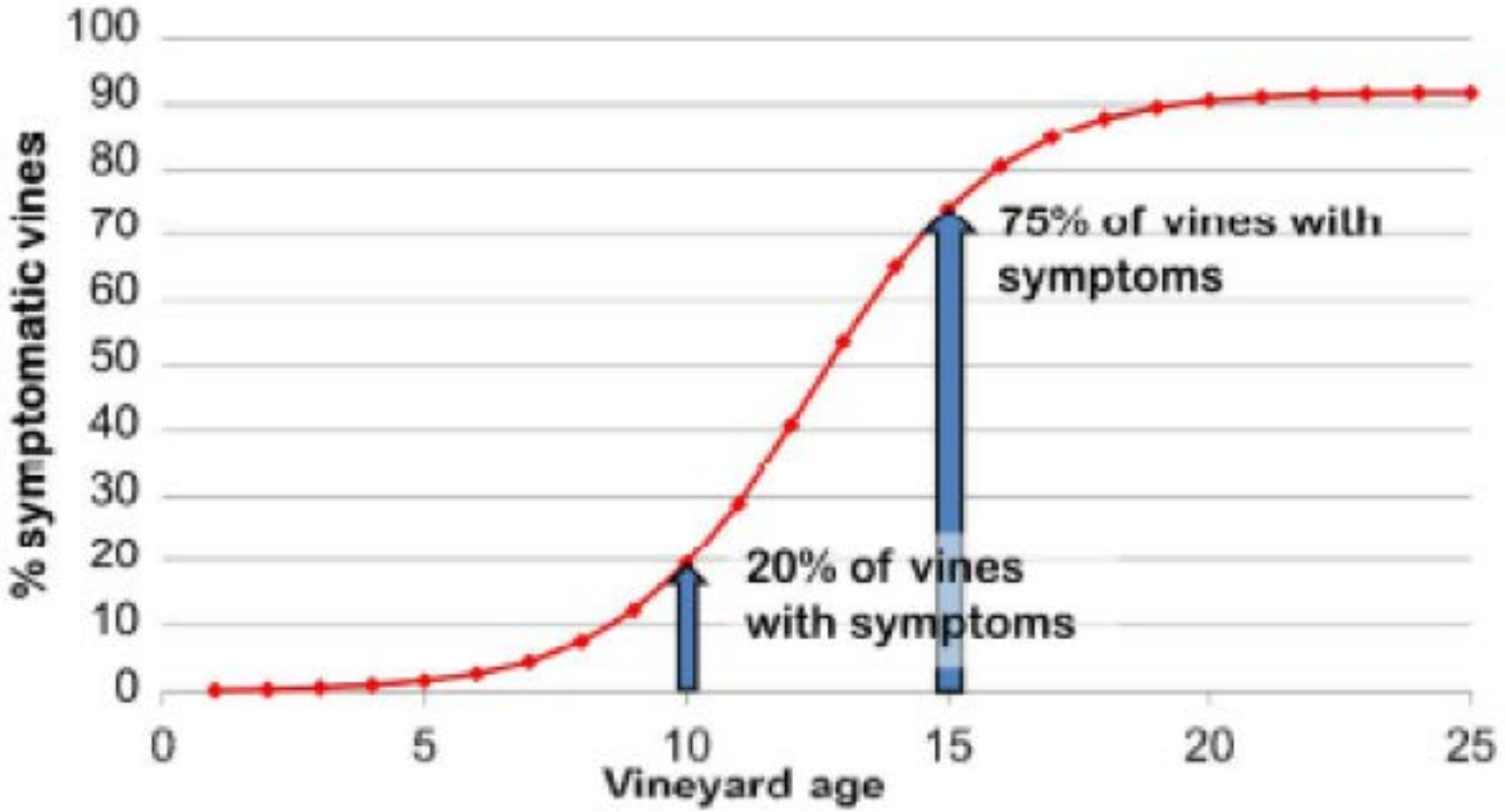
Botryosphaeria Dieback



Secondary Infections

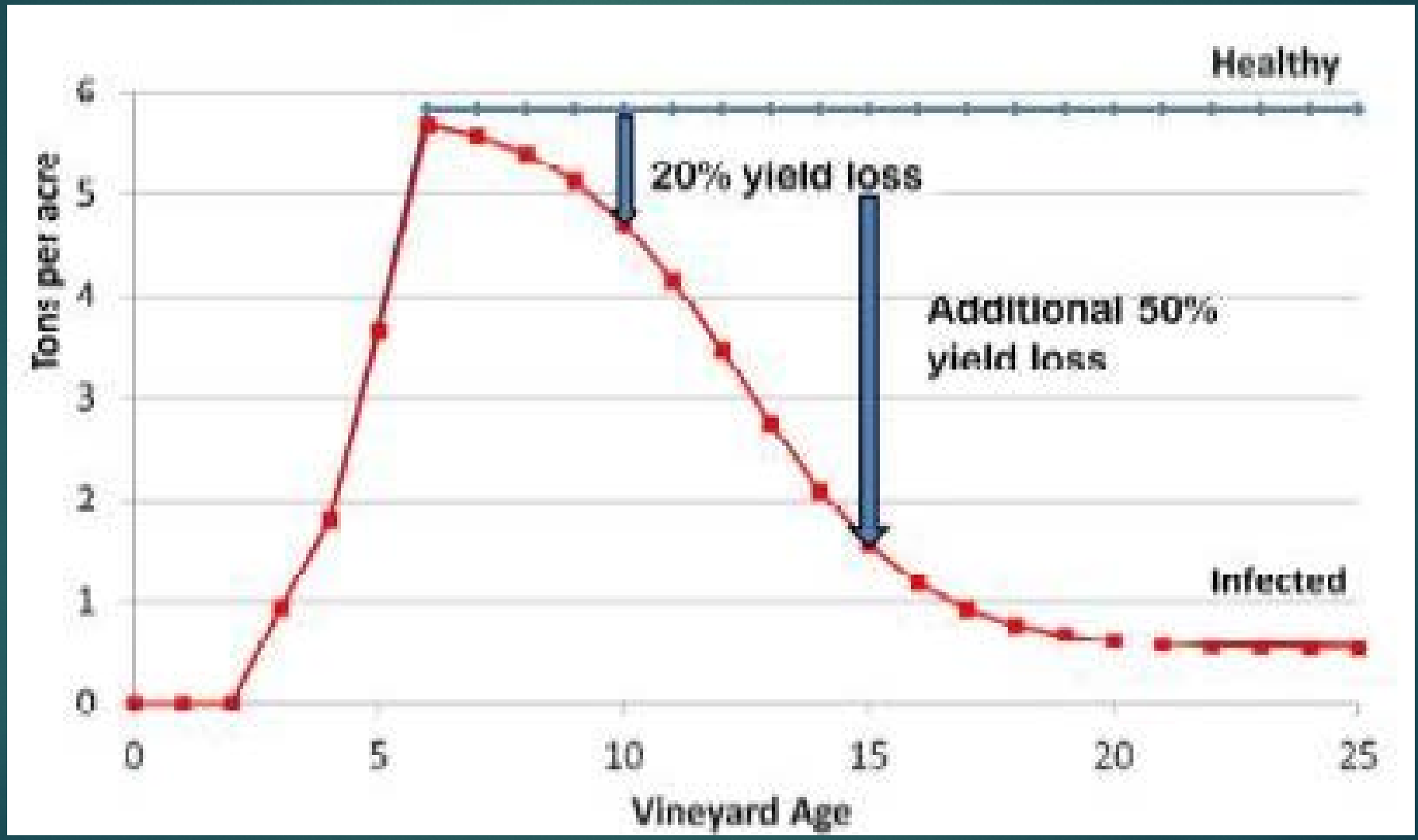
Disease incidence with vine age

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



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

Yield Impact of Trunk Diseases



De la Fuente Lloreda, et al., 2016

What can we do?

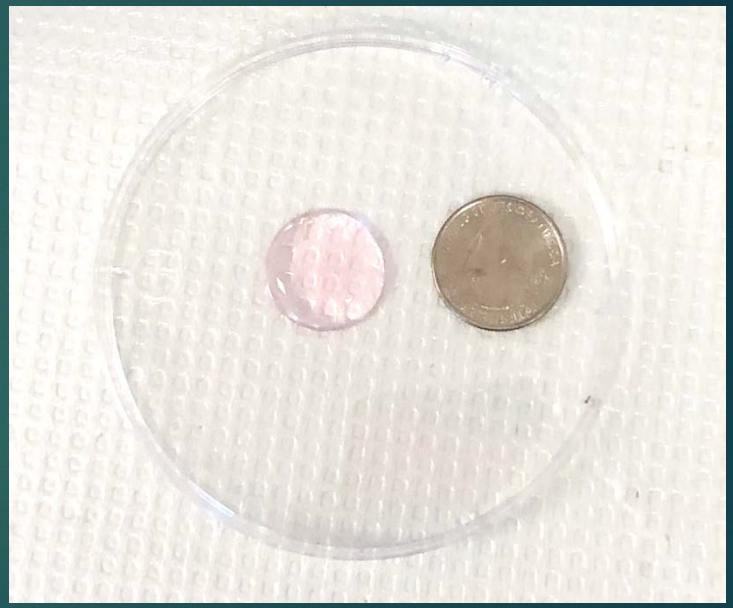
- Diagnose diseases present
- Implement good cultural practices
- Change pruning timing/ strategy
- Apply wound protection
- Perform surgery and re-training
- Practice sanitation

Cultural Practices

- Start with clean materials- rootstocks and scions
- Implement proper planting and training
- Avoid STRESSES- overcropping, under-watering, and poor canopy management only weakens the vines
- Regularly check fertility and augment as needed
- Regularly scout for signs of infection

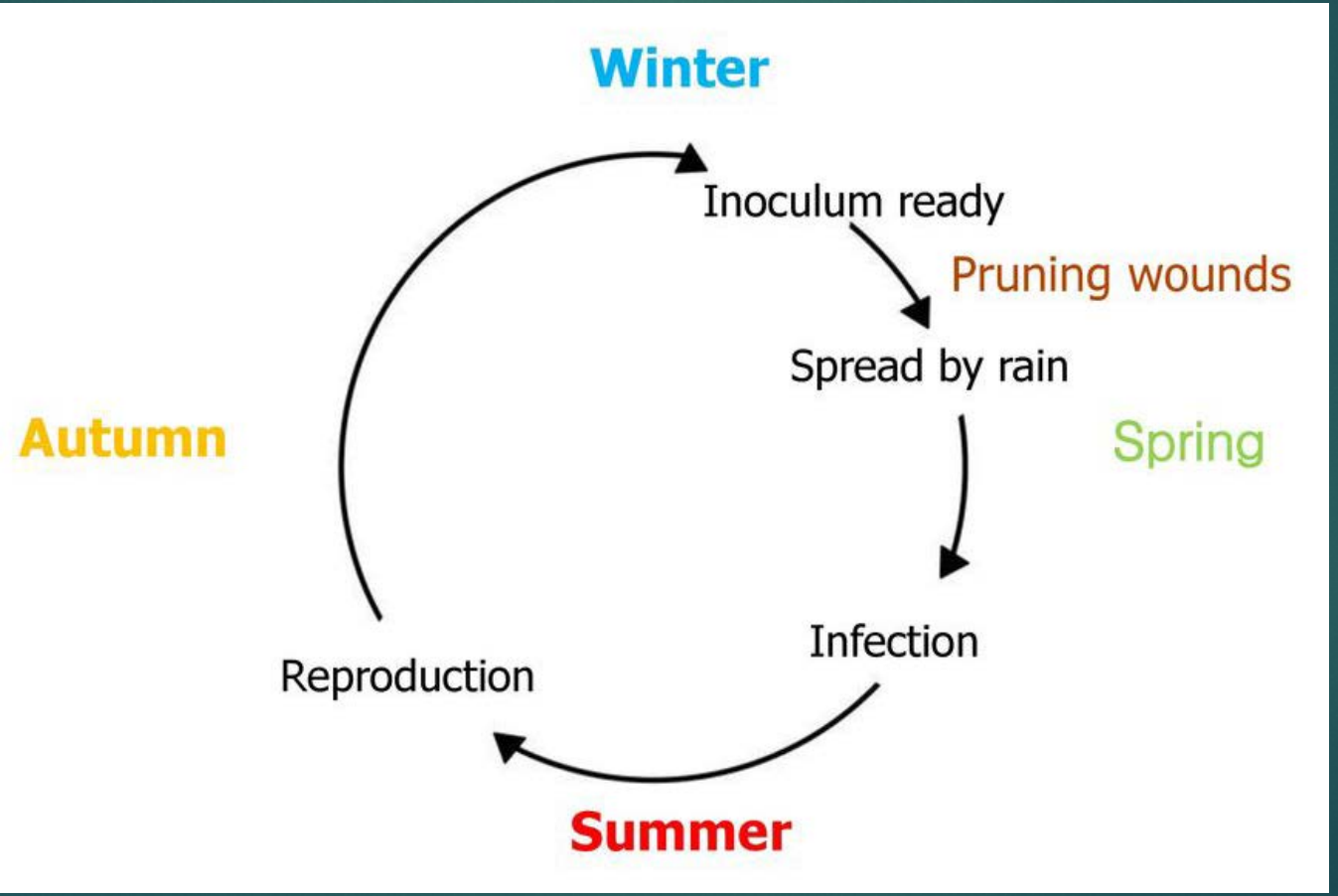
Pruning

- **Problem:** Studies show that pruning wounds take 3-4 weeks to heal in December
  - Wounds heal in a couple of days in March when temperatures are higher
- **Solution:** Delay pruning OR Implement a two-pass pruning system
  - While the initial cuts will be open for infection, it is unlikely that the fungi will have time to grow down to the point of the second cut
- **Results:** Research on the effectiveness of double pruning alone reduces Botryosphaeria infection by 58-72%, Esca by 28-87%, and Eutypa by 75-97%
- **The Question of Pruning Shears Spreading Infection:** Experiments have tested this under greenhouse conditions. Successful infection rates were low (3.6-28.6%) depending on the pathogen, and only when the shears were immediately pre-inoculated with high inoculum concentrations



Pruning

It’s All About Timing



Wound Protection

- The phasing out of sodium arsenite and methyl bromide in several countries, including the US, in the early 2000's eliminated the most effective chemical products against GTDs

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- Neurotoxin used for soil fumigation
- Can cause severe permanent injury
- Skin & eye irritation; severe pulmonary irritant (pulmonary edema); genetic defects; organ damage; and in severe cases of prolonged exposure, central nervous system depression, permanent brain damage and kidney injury
- Highly toxic to aquatic life and causes ozone destruction

Wound Protection: Viable Options

- **B-Lock (5%) or Vitiseal (1:10) Dilution**
  - Paints consisting of resins, oils, etc. with or without boric acid or another fungicide
  - Mainly a physical barrier- stops germination if dried before spores land on wounds
  - Effective for 2-12 weeks
  - Hand application- increased time and labor costs
- **Topsin M (1.5lbs in 50 GPA)**
  - Thiophanate-methyl
  - Chemical barrier- kills pathogens on contact
  - Effective 4-16 weeks
  - Spray application- minimal time and labor costs

- **Studies have shown that the use of Topsin reduces Bot infection by 60-80%, Esca by 52-58%, and Eutypa by up to 100%**
- **With either method of pruning wound protection, it should be completed and dry before a rain event when spores are released**

Surgery

- By year 10, particularly if ≥20% of vines are symptomatic, vine surgery should commence WHILE continuing preventative practices in the rest of the vineyard.
  - Economic studies in California indicate that vine surgery is most effective during years 10-15, after which, this practice doesn't significantly lengthen the profitability of vineyards and replanting should be considered.
- The main goal is renewal of whole vines to extend the lifespan of vineyard blocks while removing infected wood
- **NOTE:** This will not work for all GTDs. Esca can infect vines in nurseries, therefore the infection may extend too far (into rootstock) to control through surgical routes.

Surgery

Surgery

- **<u>Option 3: (Remedial Pruning)</u>**
  - Useful if only one arm or one portion of the cordon is symptomatic
  - Remove infected wood 4” after wood staining is visible in cordon
  - Retrain new arm through gradual extension
  - Potential risk: There are other areas infected which are simply not showing symptoms yet.

Sanitation

- Removal of infected shoots
  - If only one shoot demonstrates symptoms, only that one may be infected.
  - Look for signs of infection spreading past the individual shoot
- Removal of whole vines if infection is severe
  - In this case, you'll see symptoms throughout the canopy
- Removal and destruction of old wood that's been pruned out
  - ASAP
  - Effective spore dispersal is ~6ft.

Management Practices and Estimated Costs (per Ha/Yr) for Control of GTDs (Calif.)	
Preventative Measures	
Delayed pruning	$0
Double Pruning	$247.00
Protect Pruning Wounds (By Hand)	$135.00
Protect Pruning Wounds (By Tractor)	$127.50
Post-infection Measures	
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.

If All Else Fails, Get a GTD Detection Dog*