

# Trunk Diseases in Grapes

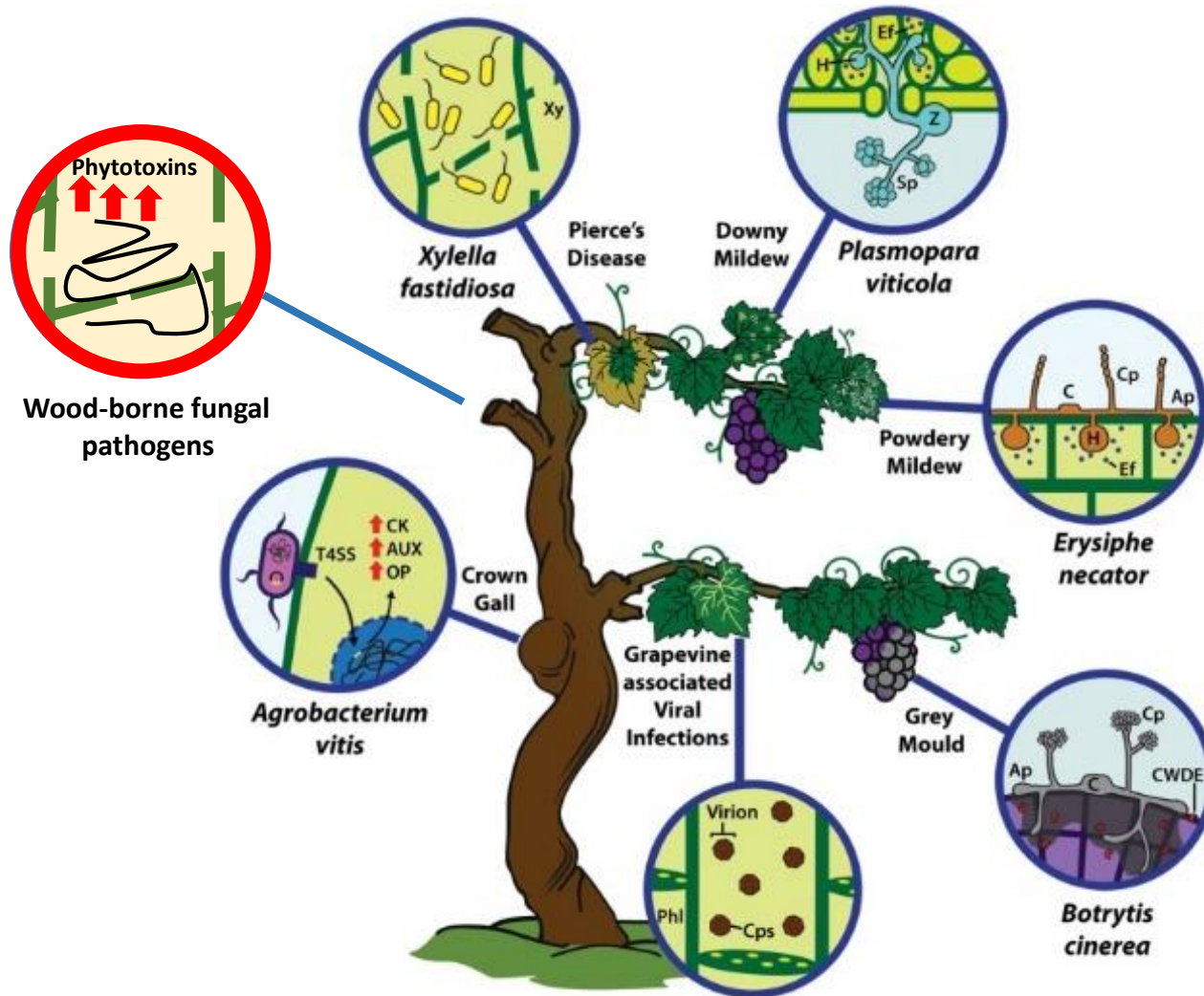
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Phone: (919) 352-8006





Armijo et al. (2016): Grapevine Pathogenic Microorganisms: Understanding Infection Strategies and Host Response Scenarios. Front. Plant Sci. 2016, 7:382.

## **Grapevine Trunk Diseases (GTDs)**

Biology and Complexity of GTDs.

Identification of GTDs.

Damage Potential of GTDs.

Prevention and Management of GTDs.



# SCALE: 1 (most important) - 5 (not important): How important are trunk diseases to you?

1

2

3

4

5

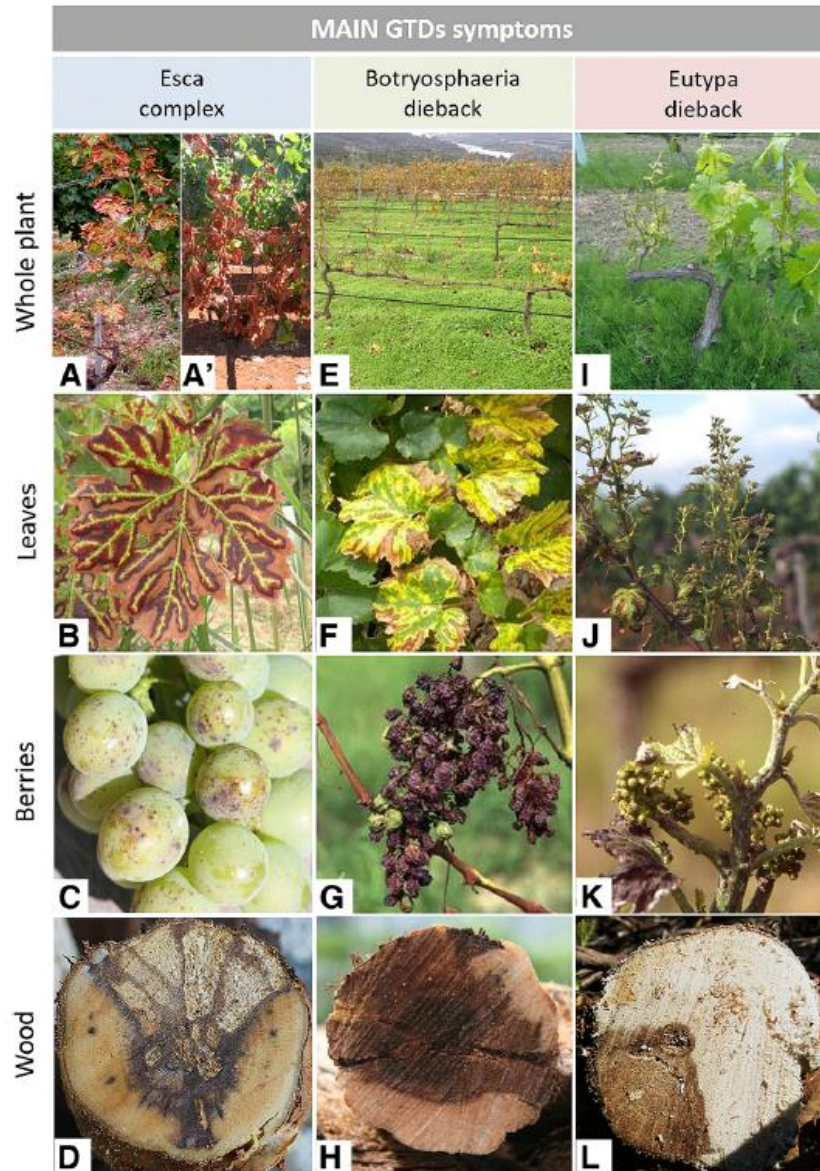


|                                     | Trunk Diseases                   |
|-------------------------------------|----------------------------------|
| <i>Type of Pathogen</i>             | Fungal                           |
| <i>Lethal to vine</i>               | Yes                              |
| <i>Plant Age</i>                    | Mature; young (ESCA)             |
| <i>Resistance/Tolerance</i>         | Not found                        |
| <i>Can come with nursery stock?</i> | Yes                              |
| <i>Transmitted?</i>                 | Open wounds, Rain, Pruning Tools |
| <i>Systemic</i>                     | No                               |
| <i>Severity in NC</i>               | ?                                |



# GTDs = Complex Diseases

- Eutypa Dieback
- Esca Disease Complex ('Petri Disease')
- Botryosphaeria Dieback



Mondello et al. (2018): Grapevine trunk diseases: A review of fifteen years of trials for their control with chemicals and biocontrol agents. *Plant Disease* 102:1189-1217.



# Grapevine Trunk Diseases

## Eutypa Dieback

- Main organism: *Eutypa lata*
- *Other organisms described in association with Eutypa Dieback*
- Common in areas with more than **10 Inches of rainfall/year** (Yadkinville: **45 Inches/year**; Hendersonville: **55 Inches/year**)
- Often associated with stunted growth and dead arms





# Grapevine Trunk Diseases

## *Bortyosphaeria* Dieback

- 21 different species of *Bortyosphaeria*

*Many other fungi as well.*

- Wood Symptoms
- Sudden death
- Apoplexy!





# Grapevine Trunk Diseases

## ESCA Disease Complex

- Main organisms: *Phaeomoniella chlamydospora* (PC);  
*Phaeoacromonium aleophilum* (PA);
- *Many other fungi are described in association ESCA*
- PC spore liberation → linked to rainfall; PA spore liberation → not linked to rainfall



# Grapevine Trunk Diseases

## ESCA Disease Complex

- *Brown Wood Streaking*
  - *Petri Disease*
  - *Young Esca*
  - *Esca (Leafstipe)*
  - *Esca Proper*
- 
- Wood Symptoms
  - Sudden death
  - Stunned growth, leaf chlorosis
  - Black Measels
  - Tiger Stripes
  - Apoplexy!



# Grapevine Trunk Diseases

## ESCA Disease Complex

| The Esca Complex                                                                  |                                                                                                           |                                                                                        |                                                                                     |                                                                                                          |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| 1-7 year old <                                                                    |                                                                                                           | vine age                                                                               | >8 year old                                                                         |                                                                                                          |
| <b>Dark wood streaking</b><br><i>Pa. chlamydospora</i><br><i>Pm. minimum</i>      | <b>Petri Disease</b><br><i>Pa. chlamydospora</i><br><i>Pm. minimum</i><br><i>Cadophora luteo-olivacea</i> | <b>Grapevine Leaf Stripe Disease</b><br><i>Pa. chlamydospora</i><br><i>Pm. minimum</i> | <b>White rot</b><br><i>Fomitiporia</i> spp.<br>other Basidiomycota                  | <b>Esca proper</b><br><i>Pa. chlamydospora</i><br><i>Phaeoacremonium</i> spp.<br><i>Fomitiporia</i> spp. |
|  |                          |      |  |                       |

Mondello et al. (2018): Grapevine trunk diseases: A review of fifteen years of trials for their control with chemicals and biocontrol agents. *Plant Disease* 102:1189-1217.







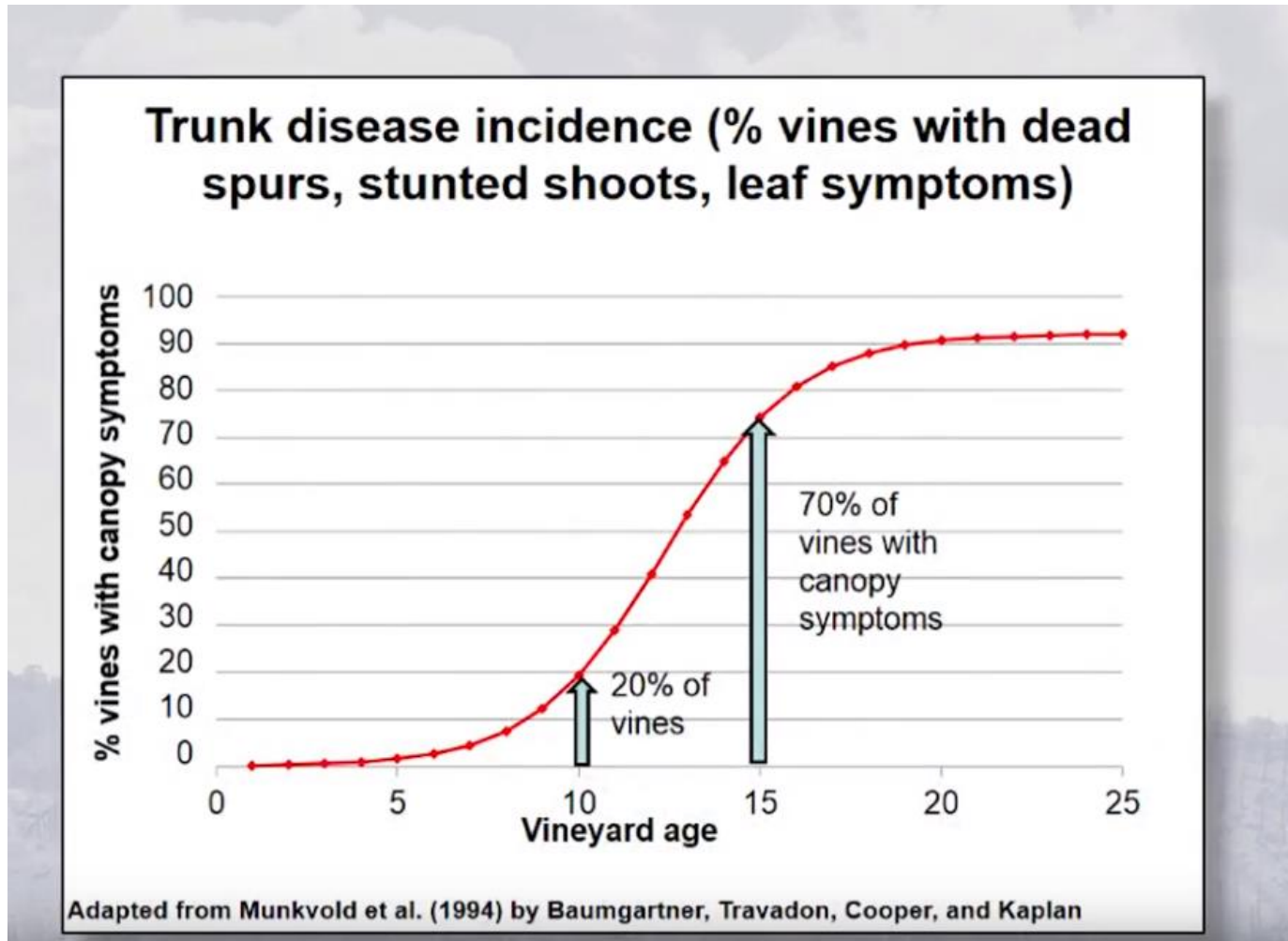
Bertsch et al. (2013): Grapevine trunk diseases: complex and still poorly understood. *Plant Pathology* 62,243-265.

# Grapevine Trunk Diseases

## Effects

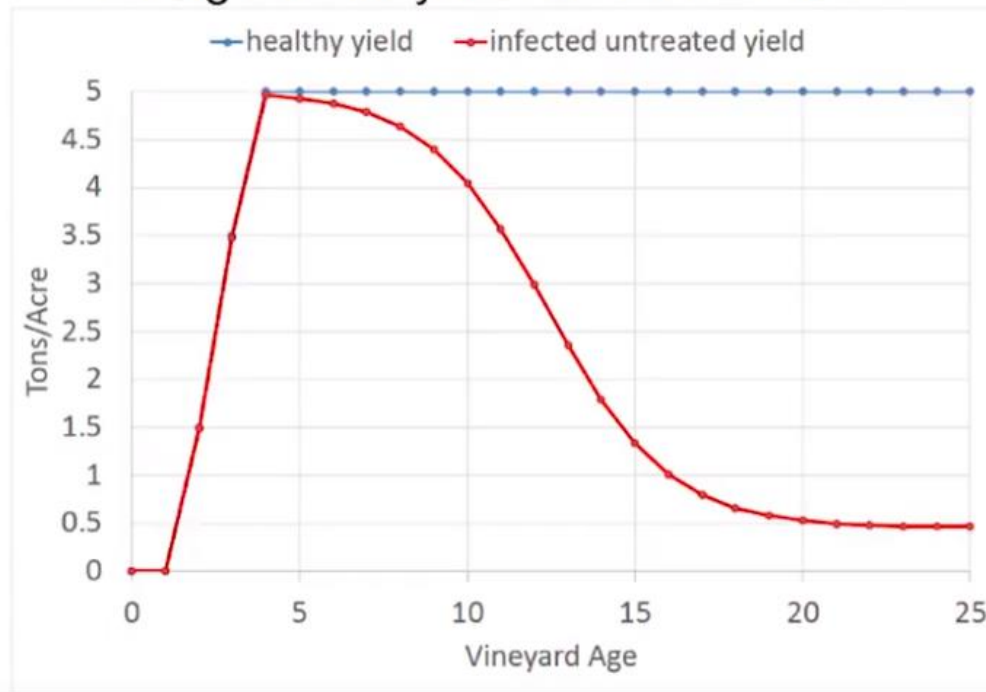
- Reduced Growth
- *Dieback / Death of Vine*
- **Reduces time span of a vineyard**
- **Dead Arm**
- **Reduced Yield**

# Often Dead Arm Disease Management starts too late!



# Often Dead Arm Disease Management starts too late!

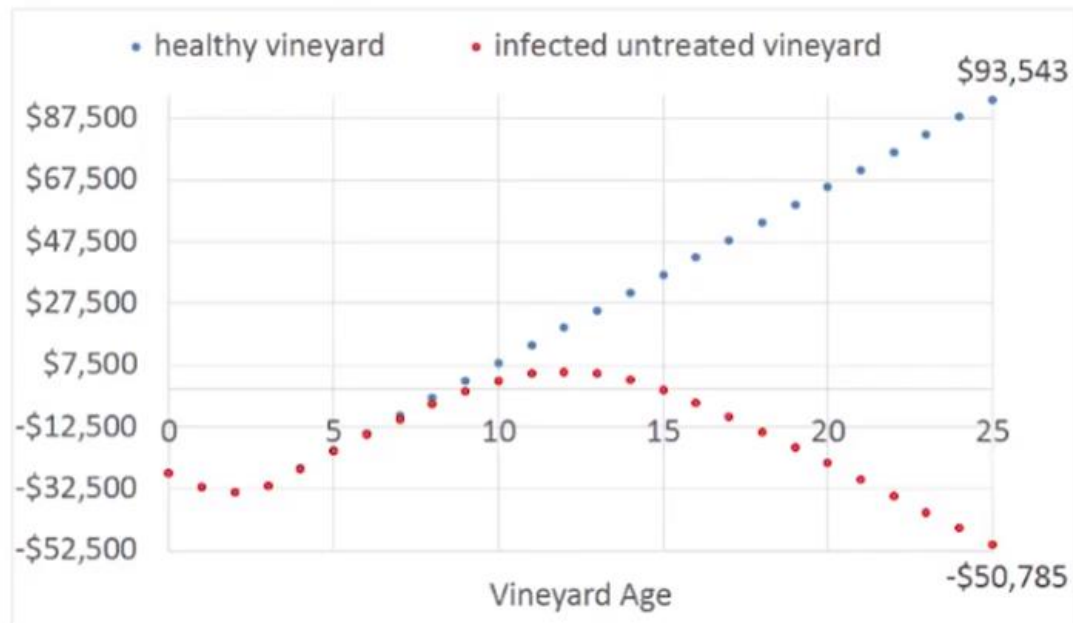
Annual yields for healthy vs. infected Cabernet Sauvignon vineyards in crush district 3



Baumgartner, Travadon, Cooper, Kaplan

# Often Dead Arm Disease Management starts too late!

Cumulative Net Returns (Total Revenue – Total Cost) per acre for healthy versus infected Cabernet Sauvignon vineyards in crush district 3



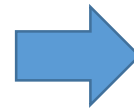
Baumgartner, Travadon, Cooper, Kaplan

# Grapevine Trunk Diseases

## Latency is a problem

vineyard:

High latency period  
Symptoms not always evident  
Cultural methods and climate  
GTD pathogens presence in other hosts



Unaware of GTD spread  
Loss of yield quality and quantity  
Death/Dieback

nursery:

High latency period  
Asymptomatic plants in production  
process;  
High contamination risk;



Economic loss (unsellable material)  
GTD asymptomatic plants

In North Carolina specific: No access to detection and assessment services

## MOTHER FIELD

Rootstock



Scion



- Pruning wound protection: chemicals and/or BCA\*
- Cultural practices: irrigation & trellising
- Weed control
- Sanitation: removal of trimming debris
- Correct treatment and handling of harvested cuttings

## NURSERY PROCESS

Hydration



- Cleaning of hydration tanks: frequently during the season, and at the start and end of the season.
- Reduction of the cutting hydration period
- Application of chemicals and/or BCA

Cold storage



- Cleaning of bins, boxes or crates before use in this phase
- Cleaning of cold storage room/s
- Application of chemicals and/or BCA: as a dip for cuttings before storage

Disbudding



- Disinfect pruning shears regularly
- Application of chemicals and/or BCA: as a dip for cuttings after disbudding

Grafting



- HWT\* prior to grafting
- Disinfect grafting machines regularly
- Application of chemicals and/or BCA: as a dip for vines after grafting

Callusing



- Use moderate temperature for callusing and rooting
- Disinfect callusing rooms regularly
- Application of chemicals and/or BCA

## NURSERY FIELD

Root and shoot development



- Application of BCA directly to soil
- Weed control

Uprooting and distribution



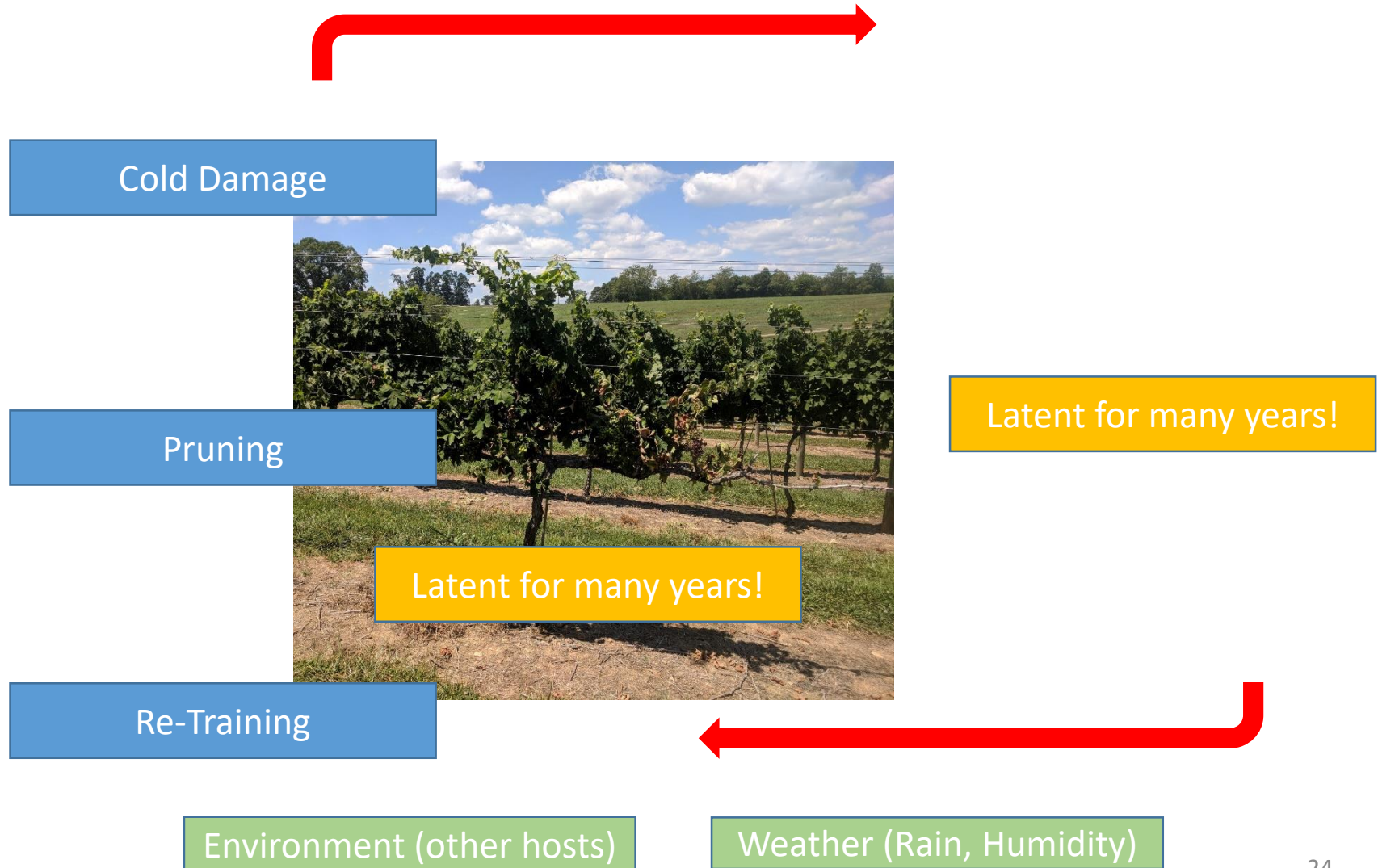
- Application of chemicals and/or BCA: as a dip for one-year-old vines before storage as well as before dispatch
- HWT of dormant nursery plants prior to dispatch

Gramaje et al. (2018): Managing Grapevine Trunk Diseases With Respect to Etiology and Epidemiology: Current Strategies and Future Prospects: Plant Disease 102:12-39.

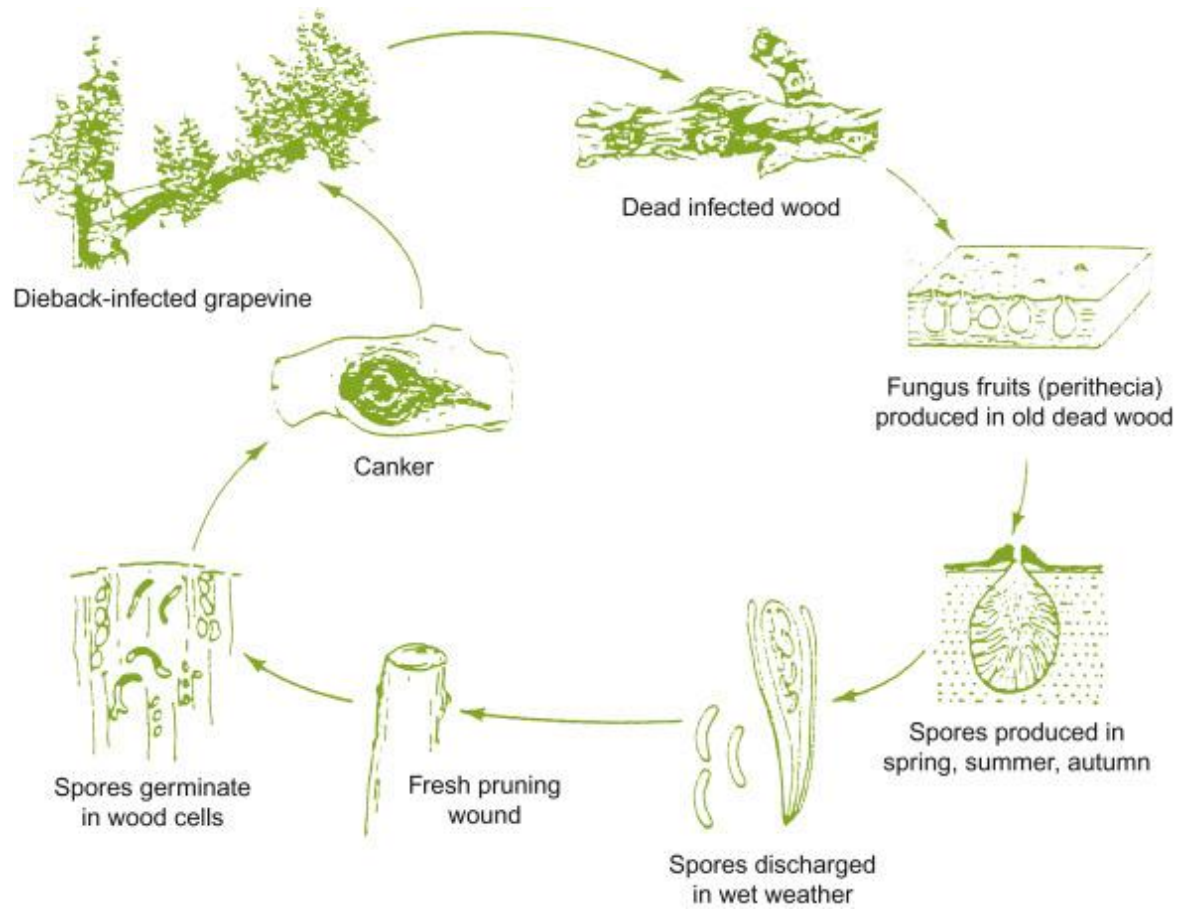
\*BCA: Biological Control Agent; HWT: Hot-Water Treatment

# Grapevine Trunk Diseases

## Problems: understand your enemy!







Jackson 2014. Vineyard Practice, Wine Science (Fourth Edition).

# **Grapevine Trunk Diseases Prevention and Management**

General rules:

- (1) Start Early
- (2) Stay on top of things
- (3) Plan ahead

# Grapevine Trunk Diseases Prevention and Management

## Start Early:

- Don't accept nursery material with bad grafting units!!!
- Establish a personal Relationship with your nursery!!
- Ask questions about trunk disease management in nursery

# Grapevine Trunk Diseases Prevention and Management

Stay on top of things

- Monitor vines from the very beginning
- Especially after Cold Damage!!!
- Retrain rather than leave old wood
- Don't allow cordons to establish dead areas
- Use Topsin, VitiSeal, B-Lock

# Grapevine Trunk Diseases Prevention and Management

## Plan ahead

- Retraining can be planned!
- Order plants early!!!
- Train your crew
- Talk to Extension!!! We help!

# Grapevine Trunk Diseases Prevention and Management

## Integrated Management Practices:

Prevention

Sanitation

Pruning (Cane vs. Spur)

Control (Chemical)

# Grapevine Trunk Diseases Prevention and Management

- Having good soil drainage
  - **Double Pruning**
- **Sanitize, remove infected wood after pruning**
  - **Pruning wound protectants**

# Grapevine Trunk Diseases Prevention and Management

## Pruning!

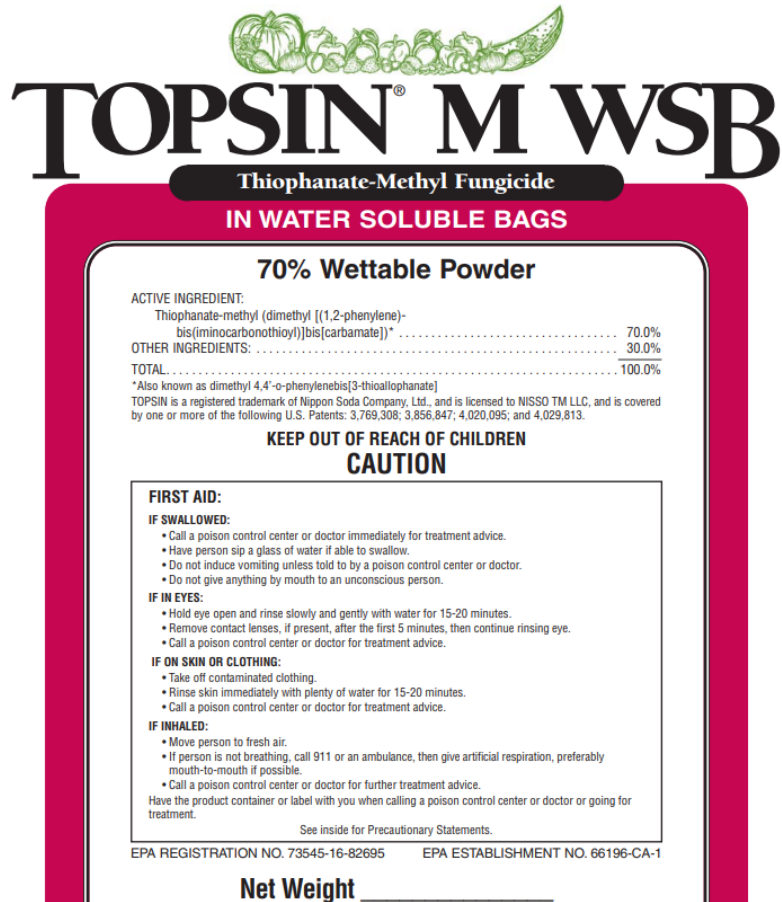
- Double Prune: Leave a long spure/cane and come back shortly before bud break and prune again.
- Think about cane vs. spur pruning systems



# Grapevine Trunk Diseases Prevention and Management

## Pruning Wound Protectants!

- 0.75-1.5 lbs/A



The image shows the front of a white plastic bag for Topsin M WSB. At the top, there is a green illustration of various fruits including a pumpkin, grapes, and a cucumber. Below this, the brand name 'TOPSIN® M WSB' is printed in large, bold, black letters. Underneath the brand name, 'Thiophanate-Methyl Fungicide' is written in white on a black background, followed by 'IN WATER SOLUBLE BAGS' in red. The main body of the bag is white with black text. It specifies '70% Wettable Powder' and lists the active ingredient as Thiophanate-methyl (dimethyl [(1,2-phenylene)-bis(iminocarbonothioyl)]bis(carbamate))\* at 70.0%. Other ingredients account for 30.0%, and the total is 100.0%. A small note states that the product is also known as dimethyl 4,4'-o-phenylenebis[3-thioallophanate] and is a registered trademark of Nippon Soda Company, Ltd. The label includes a 'KEEP OUT OF REACH OF CHILDREN CAUTION' warning and a 'FIRST AID' section with instructions for swallowing, eye contact, skin contact, and inhalation. At the bottom, it provides EPA registration and establishment numbers and a line for the net weight.

**TOPSIN® M WSB**  
Thiophanate-Methyl Fungicide  
IN WATER SOLUBLE BAGS

**70% Wettable Powder**

ACTIVE INGREDIENT:  
Thiophanate-methyl (dimethyl [(1,2-phenylene)-bis(iminocarbonothioyl)]bis(carbamate))\* ..... 70.0%

OTHER INGREDIENTS: ..... 30.0%

TOTAL ..... 100.0%

\*Also known as dimethyl 4,4'-o-phenylenebis[3-thioallophanate]  
TOPSIN is a registered trademark of Nippon Soda Company, Ltd., and is licensed to NISSO TM LLC, and is covered by one or more of the following U.S. Patents: 3,769,308; 3,856,847; 4,020,095; and 4,029,813.

**KEEP OUT OF REACH OF CHILDREN  
CAUTION**

**FIRST AID:**

**IF SWALLOWED:**

- Call a poison control center or doctor immediately for treatment advice.
- Have person sip a glass of water if able to swallow.
- Do not induce vomiting unless told to by a poison control center or doctor.
- Do not give anything by mouth to an unconscious person.

**IF IN EYES:**

- Hold eye open and rinse slowly and gently with water for 15-20 minutes.
- Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
- Call a poison control center or doctor for treatment advice.

**IF ON SKIN OR CLOTHING:**

- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 minutes.
- Call a poison control center or doctor for treatment advice.

**IF INHALED:**

- Move person to fresh air.
- If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.
- Call a poison control center or doctor for further treatment advice.

Have the product container or label with you when calling a poison control center or doctor or going for treatment.

See inside for Precautionary Statements.

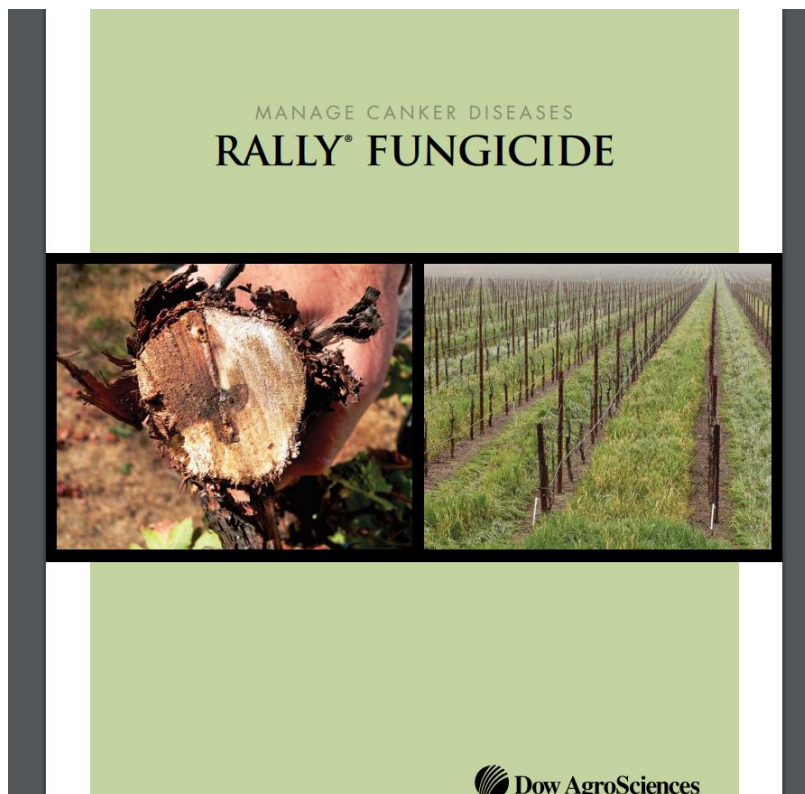
EPA REGISTRATION NO. 73545-16-82695      EPA ESTABLISHMENT NO. 66196-CA-1

**Net Weight** \_\_\_\_\_

# Grapevine Trunk Diseases Prevention and Management

## Pruning Wound Protectants!

- **4 oz/A in 33 gpa**
- **5 oz/A in 42 gpa**
- **6 oz/A in 50 gpa**
  
- Spray soon after pruning.
- 1-2 weeks of protection (if it doesn't rain!!!)
- REI 24hrs.
- Can be sprayed with standard vineyard sprayer



# Grapevine Trunk Diseases Prevention and Management

## Pruning Wound Protectants!

- **B-Lock**
- Paint!
- 5% Boric Acid
- Apply on fresh pruning wounds
- NOT a Fungicide!
- Physical Barrier



# Grapevine Trunk Diseases Prevention and Management

## Pruning Wound Protectants!



- **VitiSeal**
- Is also a barrier
- Is organic
- **Can be Tank mixed**

Contact Viti Seal Corporate  
3251 Third Street  
San Diego, CA 92103  
619-239-0321,  
[info@vitiseal.com](mailto:info@vitiseal.com)

# Grapevine Trunk Diseases Prevention and Management

Prevention! Retrain a trunk!



- Cut back the healthy looking wood as well
- **NO COSMETIC SURGERY!**
- **Train your crew!**
- ONLY cut in dormant season!
- Take the wood out of the vineyard

# Grapevine Trunk Diseases Prevention and Management

Prevention! Retrain the whole vine (scion)!



- Retrain a sucker (1-2 years)
- **NO COSMETIC SURGERY!**
- **Cut out the old vine until you don't see the pie canker**
- Make sure you use plenty wound protectant and often



# **Grapevine Trunk Diseases**

## **Conclusions**

### **GOOD DEADARM MANAGEMENT:**

**Vineyard Economic Sustainability**

**Guarantees the longevity of a vineyard**

Lower Labor Costs eventually



On a scale from 1 (very) - 5 (not), how important are trunk diseases for you?

1

2

3

4

5

# Thank you!

**NC STATE**  
UNIVERSITY

## Thank you for your attention

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