Managing Canker Diseases in Grapevine

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**Bot Canker**

**Disease Cycle**
- Old pruning wounds
- Pruned debris on the ground
- Late fall - winter
- Fruiting bodies (Pycnidia)
- Spores (conidia)

**Blockage of vascular system**

Yield losses / Death of the plant
Inoculum sources for *Eutypa lata*

- More findings: Sacramento, San Joaquin, and Yolo Counties

- Apricot
- Cherry
- Grapevine
- Almond
Geographical distribution and host range of the perithecial stage of the pathogen *E. lata* in California.
Eutypa dieback Canker
Botryosphaeria pycnidia found in California grapevines.

- Pycnidia of *Lasiodiplodia theobromae* found in Coachella Valley grapevines.
Vaseline slides spore trapping results in Monterey County

Bot spores values = Total spores / 2 ml of H₂O
Volumetric spore trapping results in Monterey County from midnight October 26th to midnight October 27th, 2008
Fungal species were not re-isolated 1 inch below end of necrosis.
Cultural Control

- Cultural
  - Retraining from cordon or trunk
  - Late pruning
    - Mid to late February-early March
    - Wounds less susceptible
    - Inoculum decreased
    - Wound healing is faster
    - First pruning done with tractor mounted rotary saw
    - Second pruning done in late winter (Feb-early March)
    - Allows large acreage to be pruned late due to speed of second pruning
    - Excellent efficiency & economics
    - Should give at least 90-95% control
Double/Late Pruning
Canes are mechanically pruned (10-15 buds) late fall - early winter. Final pruning (2 buds) late February - early March.
Canes Collected
In March
1000 canes / vineyard
What are Effective Products Against Canker Pathogens?

- DMI’s - some have activity against Eutypa (Rally)
- Strobilurins - no activity
- Benzimidazole - Excellent activity against all pathogens (Topsin M)
- B - excellent activity against Eutypa (B-LOCK)
- Vitiseal with or w/o Rally + Topsin M
  - Paint
  - Spray (1:9 dilution)
- Biological’s - good activity if on wound 2 weeks before inoculation (Trichoderma, Cladosporium)
Control

- Double pruning or late pruning has been shown to be effective in significantly reducing infection by: Eutypa spp., Phaeo spp., and Botryosphaeriaceae spp.
- B-LOCK
- Vitiseal
- Currently Rally and Topsin M registered for tractor application
- Recommend Rally + Topsin in tank with non-ionic spreader i.e. Freeway/Pentra Bark
  - Application by machine is relatively fast and highly effective in control
  - Topsin M and Rally have been shown to be a good pruning wound protectants against Botryosphaeriaceae, Eutypa lata (Diatrypaceous), Pal and Pc infection
Safecoat VitiSeal™

- Natural waterborne co-polymer emulsion with other NOP (National Organic Program) approved ingredients.
- It is marketed not as a unique crop management tool that creates a protective resistant barrier against the typical point of entry for wood canker disease pathogens including Eutypa, Botryosphaeria and Phaeo group.
- VitiSeal™ is applied either through painting, daubing or spraying directly over pruning cuts onto vines, trunks, and tree bases.
- The proprietary formulation is water based, environmentally safe containing no hazardous materials or HAPs (hazardous air pollutants), has no re-entry wait restrictions after treatment, and has been proven effective through multiple years of university research center testing.
- California Certified Organic Farms has been approving materials request forms for VitiSeal use by organic and biodynamic growers.
Grape PM Trial 1 Disease Severity (Part 1)

- Timorex Gold, 0.86 qt, 10d
- Centurion II, 0.2% (v/v), 7d
- Kumulus (at budbreak), 5 lb/100 gal, then Fracture, 24.4 fl oz + Dyneamic, 0.25% (v/v), 14d
- Champ WG, 2 lb, 10d
- K-Phite 7LP, 3 qt, 14d
- Champ WG, 6 lb, 10d
- AG Copp 75, 1.33 lb, 10d

Disease Severity (%)
Grape PM Trial 1 Disease Severity (Part 2)

- Kumulus (at budbreak) then Fracture, 21 fl oz + Abound, 10 fl oz + Dyneamic, 0.25% (v/v) alt Procure, 8 fl oz + Dyneamic, 0.25% (v/v), 14 d

- Kumulus (at budbreak), 5 lb/100 gal then Abound + Dyneamic, 15.4 fl oz alt Fracture, 24.4 fl oz + Dyneamic, 0.25% (v/v), 14 d

- Kumulus (at budbreak), 5 lb/100 gal then Fracture, 24.4 fl oz + Dyneamic, 0.25% (v/v) alt Abound, 15.4 fl oz + Dyneamic, 0.25% (v/v), 14 d

- Kumulus (at budbreak) then Fracture, 21 fl oz + Abound, 10 fl oz + Dyneamic, 0.25% (v/v) alt Procure, 8 fl oz + Dyneamic, 0.25% (v/v), 14 d

- Chem Copp 50, 6 lb, 10 d
- Nordox 75 WG, 4 lb, 10 d
- AG Copp 75, 4 lb, 10 d
- Chem Copp 50, 2 lb, 10 d

Disease Severity (%)
Grape PM Trial 1 Disease Severity (Part 3)

- Untreated Control
- K-Phite 7LP, 3 qt + DKP XTRA, 2 gal, 21 d
- AG Copp 75 Organic, 4 lb, 20 d
- AG Copp 75, 4 lb, 20 d
- AG Copp 75 Organic, 1.33 lb, 10 d
- AG Copp 75 Organic, 4 lb, 10 d
- Nordox 75 WG, 1.33 lb, 10 d
- Centurion II, 0.2% (v/v), 14 d

Disease Severity (%)
Grape PM Trial 2 Disease Severity (Part 1)

Luna Experience, 6 fl oz alt Flint, 2 oz + Stylet oil, 1% (v/v), 14d

Pristine, 10.5 oz + Dynamic, 0.125% (v/v) alt Quintec, 6.6 fl oz + Dynamic, 0.125% (v/v), 21d

Inspire Super, 20 fl oz + Dynamic, 0.1% (v/v) alt Quintec, 4 fl oz + Dynamic, 0.1% (v/v), 14d

Luna Tranquility, 16 fl oz + Dynamic, 0.25% (v/v), 14d

Luna Experience, 6 fl oz + Dynamic, 0.25% (v/v), 21d

Merivon, 5 fl oz alt Vivando, 15.4 fl oz, 14-21d (RI)

Merivon, 5 fl oz + ORUS 009, 32 fl oz/100 gallon alt Vivando, 15.4 fl oz + ORUS 009, 32 fl oz/100 gallon, 14-21d (RI)

Luna Experience, 6 fl oz alt Sonata, 3 qt + Stylet oil, 1% (v/v), 14d

(Luna Experience, 6 fl oz alt Flint, 2 oz + Sonata, 2 qt) + Dyneamic 0.25% (v/v), 14d

(Luna Experience, 6 fl oz alt Flint, 3 oz) + Dyneamic, 0.25% (v/v), 14d
Grape PM Trial 2 Disease Severity (Part 2)

Inspire Super, 20 fl oz + Dyneamic, 0.1% (v/v) then Taegro 13 WP, 5.2 oz + Dyneamic, 0.1% (v/v) then Quintec, 4 fl oz + Dyneamic, 0.1% (v/v) then Inspire Super, 20 fl oz + Dyneamic, 0.1% (v/v) then Taegro 13 WP, 5.2 ...

Quintec, 6.6 fl oz, 21d, alt Flint, 2 oz, 14d (standard)

Sonata, 3 qt + Dyneamic, 0.25% (v/v), 14d

A15457, 10.3 fl oz + Dyneamic, 0.1% (v/v) alt Quintec, 4 fl oz + Dyneamic, 0.1% (v/v) (last spray A15457), 14d

Rhyme, 10 fl oz, 14d

Quintec, 6.6 fl oz + Dyneamic, 0.125% (v/v), 21d

Topguard, 10 fl oz, 14d

A19334, 13 fl oz + Dyneamic, 0.1% (v/v) alt Quintec, 4 fl oz + Dyneamic, 0.1% (v/v) (last spray A19334), 14d
Grape PM Trial 2 Disease Severity (Part 3)

- Untreated Control
- MCW-710 SC, 6 fl oz, 14d
- Torino, 3.4 fl oz + Dyneamic, 0.125% (v/v) alt Quintec, 6.6 fl oz + Dyneamic, 0.125% (v/v), 14d
- Rally, 5 oz + Dyneamic, 0.125% (v/v) alt Quintec, 4 fl oz + Dyneamic, 0.125% (v/v), 14d
- Rhyme, 5 fl oz, 14d
- Rhyme, 2.5 fl oz, 14d
- MCW-710 SC, 8.6 fl oz alt Quintec, 4 fl oz, 14d
- MCW-710 SC, 8.6 fl oz, 14d
- Luna Experience, 8 fl oz + Dyneamic, 0.125% (v/v) alt Quintec, 6.6 fl oz + Dyneamic, 0.125% (v/v), 21d

Disease Severity (%)
Grape PM Trial 3 Disease Severity (Part 1)

IKF-309, 5 fl oz, 7-14 d
Torino SC, 3.4 fl oz, 14-17 d (RI)
IKF-309, 4 fl oz, 7-14 d alt Rally, 5 oz, 14 d
IKF-309, 4 fl oz, (2x) 7-14 d alt Rally, 5 oz, (2x), 14 d
Phyton 27 AG, 25 fl oz/100 gal + HiWett, 0.1% (v/v), 10-14 d (RI)
IKF-309, 4 fl oz, 7-14 d alt Quintec, 6.5 fl oz, 14 d
Inspire, 5.25 fl oz, 10 d
Timorex Gold, 0.43 qt + Inspire, 5.25 fl oz, 10 d
Phyton 27 AG, 40 fl oz/100 gal + HiWett, 0.1% (v/v), 10-14 d (RI)
IKF-309, 4 fl oz (2x), 7-14 d alt Quintec, 6.5 fl oz (2x), 14 d
Grape PM Trial 3 Disease Severity (Part 2)
Grape PM Trial 4 Disease Severity

Untreated Control

Flint, 2 oz, 14d

Exp 4, 0.25% (v/v) + Flint, 1 oz, 14d

Exp 4, 0.25% (v/v), 7d, alt Flint, 2 oz, 14d

- Stylet oil, 0.5% (v/v) (2x), 7d, then Abound, 10 fl oz + Dynemic, 0.125% (v/v) (2x) then Rampart, 3 qt + Liberate, 0.125% (v/v) (2x) then Abound, 10 fl oz + Dynemic, 0.125% (v/v) (2x), 14d
- Stylet oil, 0.5% (v/v) (2x), 7d, then LI 6365, 10 fl oz + Franchise, 0.125% (v/v) (2x) then Rampart, 3 qt + Liberate, 0.125% (v/v) (2x) then LI 6265, 10 fl oz + Franchise (2x), 0.125% (v/v), 14d
- Stylet oil, 0.5% (v/v) (2x), 7d, then LI 6365, 10 fl oz + Liberate, 0.125% (2x) then Rampart, 3 qt + Liberate, 0.125% (v/v) (2x) then LI 6365, 10 fl oz + Liberate, 0.125% (v/v) (2x), 14d
- Stylet oil, 0.5% (v/v) (2x), 7d, then LI 6365, 10 fl oz (2x) then Rampart, 3 qt + Liberate, 0.125% (v/v) (2x) then LI 6265, 10 fl oz (2x), 14d

Disease Severity (%)
Grape PM Trial 2012: Treatments for comparison - Disease Severity

- **Untreated Control**
- **Quintec 6.6 fl oz alt Flint, 2 oz, 14-21 (RI)**
- **Kumulus (at budbreak), 5lb/100 gal, then Problad Plus, 21 fl oz + Abound, 10 fl oz, 14d + Silwet L-77, 0.0125% alt Elite, 4 oz + Silwet L-77, 0.125% (v/v), 14-21d (RI)**
- **Luna Exp, 6 fl oz alt Flint, 2 oz, 14 d**
- **Pristine, 10.5 oz + Silwet L-77, 0.125% alt Quintec, 6.6 fl oz + Silwet L-77, 0.125% 21 d**
- **Luna Exp, 6 fl oz + Silwet L-77, 0.125% (v/v) alt Quintec, 6.6 fl oz + Silwet L-77, 0.125% (v/v), 21 d**
- **Inspire Super, 20 fl oz + Dyneamic, 0.125%(v/v) alt Quintec, 4 fl oz + Dyneamic, 0.125% (v/v), 14 d**
### Grape PM Trial 2013: Treatments for comparison - Disease Severity

<table>
<thead>
<tr>
<th>Treatment Description</th>
<th>Disease Severity (%)</th>
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</thead>
<tbody>
<tr>
<td>Untreated Control</td>
<td>100</td>
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<tr>
<td>Luna Tranquility, 16 fl oz + Dyneamic, 0.25% (v/v), 14d</td>
<td></td>
</tr>
<tr>
<td>Quintec, 6.6 fl oz + Dyneamic, 0.125% (v/v), 21d</td>
<td></td>
</tr>
<tr>
<td>Luna Experience, 6 fl oz alt Flint, 2 oz + Stylet oil, 1% (v/v), 14d</td>
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<tr>
<td>Pristine, 10.5 oz + Dyneamic, 0.125% (v/v) alt Quintec, 6.6 fl oz + Dyneamic, 0.125% (v/v), 21d</td>
<td></td>
</tr>
<tr>
<td>Inspire Super, 20 fl oz + Dyneamic, 0.1% (v/v) alt Quintec, 4 fl oz + Dyneamic, 0.1% (v/v), 14d</td>
<td></td>
</tr>
<tr>
<td>Luna Experience, 6 fl oz alt Sonata, 3 qt + Stylet oil, 1% (v/v), 14d</td>
<td></td>
</tr>
<tr>
<td>(Luna Experience, 6 fl oz alt Flint, 2 oz + Sonata, 2 qt) + Dyneamic 0.25% (v/v), 14d</td>
<td></td>
</tr>
<tr>
<td>(Luna Experience, 6 fl oz alt Flint, 3 oz) + Dyneamic, 0.25% (v/v), 14d</td>
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</table>
Grape PM Trial 2012: Luna (with other treatments for comparison) Disease Incidence

- Untreated Control
- Quintec, 6.6 fl oz + Dyneamic, 0.125% (v/v), 21d
- Pristine, 10.5 oz + Dyneamic, 0.125% (v/v) alt
- Quintec, 6.6 fl oz + Dyneamic, 0.125% (v/v), 21d
- Luna Experience, 6 fl oz alt Flint, 2 oz + Stylet oil, 1% (v/v), 14d
- Inspire Super, 20 fl oz + Dyneamic, 0.1% (v/v) alt
- Quintec, 4 fl oz + Dyneamic, 0.1% (v/v), 14d
- Luna Tranquility, 16 fl oz + Dyneamic, 0.25% (v/v), 14d
- Luna Experience, 6 fl oz + Dyneamic, 0.25% (v/v), 21d
- Luna Experience, 6 fl oz alt Sonata, 3 qt + Stylet oil, 1% (v/v), 14d
- (Luna Experience, 6 fl oz alt Flint, 2 oz + Sonata, 2 qt) + Dyneamic 0.25% (v/v), 14d
- (Luna Experience, 6 fl oz alt Flint, 3 oz) + Dyneamic, 0.25% (v/v), 14d
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<tr>
<th>Product Name</th>
<th>Active Ingredients</th>
<th>Manufacturer</th>
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<tbody>
<tr>
<td>LI 6365</td>
<td>proprietary lecithin, methylesters of fatty acids, and alcohol ethoxylate (100%)</td>
<td>Loveland Products, Inc.</td>
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<tr>
<td>Liberate</td>
<td>proprietary flupyradyl (17.54%), tebuconazole (17.54%)</td>
<td>Bayer</td>
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<tr>
<td>Luna Experience</td>
<td>proprietary flupyradyl (11.3%), pyrimethanil (33.8%)</td>
<td>Bayer</td>
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<tr>
<td>Luna Tranquility</td>
<td>proprietary fluxabyroxad (21.26%), pyraclostrobin (21.26%)</td>
<td>BASF</td>
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<tr>
<td>MBI-10605</td>
<td>proprietary cuprous oxide (75% copper)</td>
<td>American Chemet Corporation</td>
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<tr>
<td>MCW-710 SC</td>
<td>proprietary copper sulfate pentahydrate (21.27%)</td>
<td>Phyton Corporation</td>
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<tr>
<td>Merivon</td>
<td>proprietary pyraclostrobin (12.8%), boscalid (25.2%)</td>
<td>BASF</td>
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<tr>
<td>Nordox 75 WG</td>
<td>proprietary triflumizole (42.14%)</td>
<td>Crompton Manufacturing Company</td>
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<td>ORUS 009</td>
<td>proprietary fluropyram (11.3%)</td>
<td>Dow AgroSciences LLP</td>
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<td>Phyton-27 AG</td>
<td>proprietary quinoxyfen (22.6%)</td>
<td>Dow AgroSciences LLP</td>
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<td>Pristine</td>
<td>proprietary myclobutanil (40%)</td>
<td>Loveland Products, Inc.</td>
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<td>Procure 480 SC</td>
<td>proprietary flutriafol (12%)</td>
<td>Syngenta Crop Protection, Inc</td>
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<tr>
<td>Quintec</td>
<td>proprietary Bacillus pumilus QST 2808 (1.38%)</td>
<td>Agraquest</td>
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<td>Rally 40 WSP</td>
<td>proprietary Bacillus subtilis Strain FZB24</td>
<td>Syngenta Crop Protection, Inc</td>
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<td>Rampart</td>
<td>proprietary Mono- and dipotassium salts of phosphorous Acid (53%), flutriafol (12%)</td>
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<td>Rhyme</td>
<td>proprietary flutriafol (12%)</td>
<td>Cheminova</td>
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<tr>
<td>Sonata</td>
<td>Bacillus pumilus QST 2808 (1.38%)</td>
<td>Agraquest</td>
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<tr>
<td>Taegro 13 WP</td>
<td>Bacillus subtilis Strain FZB24</td>
<td>Syngenta Crop Protection, Inc</td>
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<td>Timorex Gold</td>
<td>oil derived from the tea tree, Melaleuca alterniflora (23.8%)</td>
<td>Biomor Israel Ltd.</td>
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<tr>
<td>Topguard</td>
<td>proprietary flutriafol (12%)</td>
<td>Cheminova</td>
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<tr>
<td>Torino</td>
<td>proprietary cyflufenamid (10%)</td>
<td>Gowan Co.</td>
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<tr>
<td>Vivando</td>
<td>proprietary metrafenone (300g/L)</td>
<td>BASF</td>
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Adjuvants:
- DMI-triazole/N/A
- SDHI/AP
- SDHI + QoI
- QoI + carboxamide
- DMI
- quinoline
- biological
- oil
- benzophenone
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<tr>
<th>Product</th>
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<th>Description</th>
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<td>Merivon</td>
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<td>N/A + QoI</td>
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<td>NUP-12033</td>
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<td>other QoI + carboxamide</td>
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<td>QoI</td>
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<td>Problad Plus</td>
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<td>FMC Corporation</td>
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<td>DMI-triazole/QoI</td>
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<td>Crompton Manufacturing Company (Chemtura Corp.)</td>
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<td>Vivando</td>
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