# Fungicide control of Apple Scab
# 2016 field trial

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# Summary

Apple scab, caused by the fungal pathogen *Venturia inaequalis*, is a significant fruit and foliar disease worldwide (Jones and Sundin 2006). Apples grown in regions of California characterized by spring precipitation or damp microclimates are subject to infection. Initial pathogen colonization of green tissue occurs when water stimulates ascospore release from pseuodothecia located in overwintering leaf litter, followed by dispersal to leaves, flowers or fruit. Asexually-produced conidia from the primary sites of infection on the host can also colonize new tissue if spores are transported in the air or by water splash (Jones and Sundin 2006). In California, periodic applications of synthetic or organic fungicides from approximately March to June are required to control apple scab; the timing of fungicide applications is dependent on season to season patterns in precipitation (Gubler 2006). Based on research in other apple producing regions, additional control measures such as post-harvest fungicide applications at the time of leaf fall to reduce inoculum for the following growing season (Beresford et al. 2008), leaf litter removal (Gomez et al. 2007) or use of cultivar mixtures in an orchard (Didelot et al. 2007) may effectively reduce disease impacts.

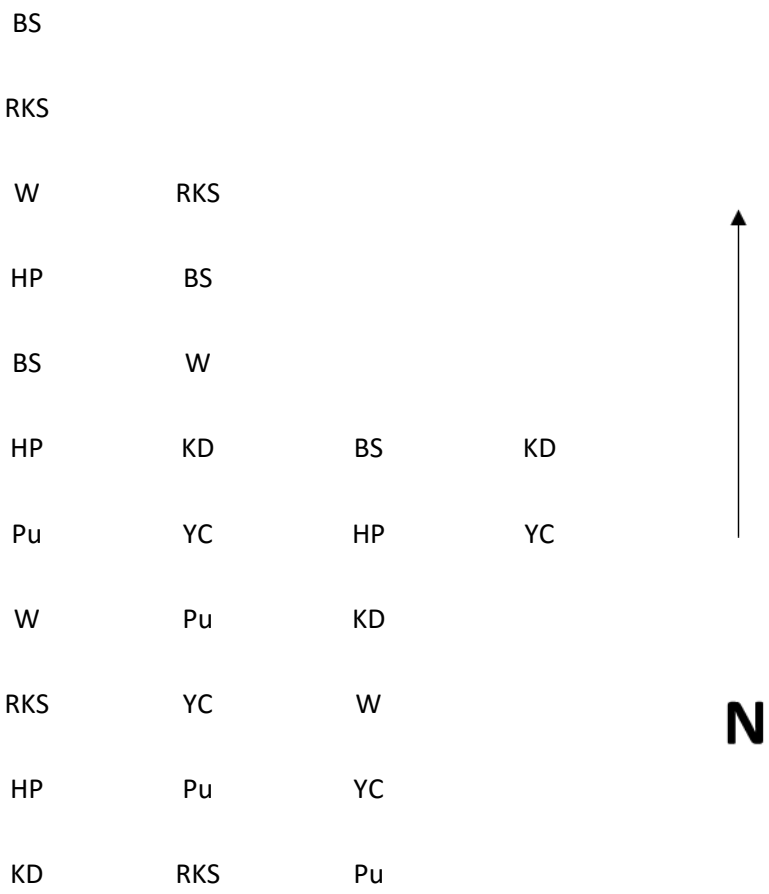
We conducted a field experiment near Placerville, El Dorado County, California to test the effects of registered and experimental fungicides on control of apple scab in mature Gala Trees. Five applications were made from early March (green tip) to late April 2016 (cover spray after petal fall). We evaluated the trial on June 27 then compared disease levels obtained on foliage and fruit in untreated trees with disease control exhibited by various products.

# Materials and Methods

## A. Trial layout

| | | | | |
|---|---|---|---|---|
| Experimental unit | 1 tree = 1 plot | | | |
| Row and tree spacing | 16 ft (row) and 10 ft (tree) | | Plot unit area | 160 $ft^2$ |
| Area/treatment | 640 $ft^2$ or 0.0147 acre/treatment (4 replicate trees = 1 treatment) | | | |
| Fungicide applications | A | green tip | 2 Mar | 100 gallons/acre | 1.5 gallons/4 replicates |
| | B | early bloom | 16 Mar | 100 gallons/acre | 1.5 gallons/4 replicates |
| | C | full bloom | 30 Mar | 100 gallons/acre | 1.5 gallons/4 replicates |
| | D | petal fall | 8 Apr | 100 gallons/acre | 1.5 gallons/4 replicates |
| | E | cover spray | 21 Apr | 125 gallons/acre | 1.8 gallons/4 replicates |

## B. Trial Map


BS
RKS
W RKS
HP BS
BS W
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Pu YC HP YC
W Pu KD
RKS YC W
HP Pu YC
KD RKS Pu
N

## C. Experimental Treatments

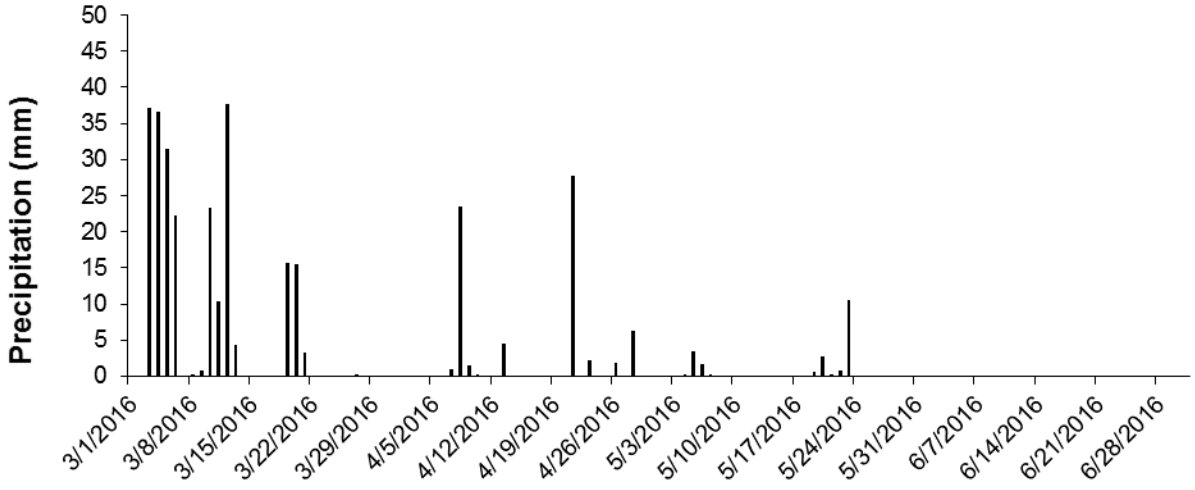
| No. | Flag | Product(s) | FP/Acre | FP/Treatment |
|---|---|---|---|---|
| 1 | W | Unsprayed control | none | none |
| 2 | Pu | WFX-16001 | 0.35% (v/v) | 19.9 ml |
| 3 | RKS | WFX-16002 | 1% (v/v) | 56.8 ml |
| 4 | YC | Howler + Capsil | 7.5 g/L + 6 oz/100 gal | 42.8 g + 2.7 ml |
| 5 | KD | Howler + Sovran + Capsil | 7.5 g/L + 3.2 oz + 6 oz/100 gal | 42.8 g + 1.3 g + 2.7 ml |
| 6 | BS | Sovran (standard) | 6.4 oz | 2.7 g |
| 7 | HP | Serenade Optimum | 20 oz | 8.3 g |

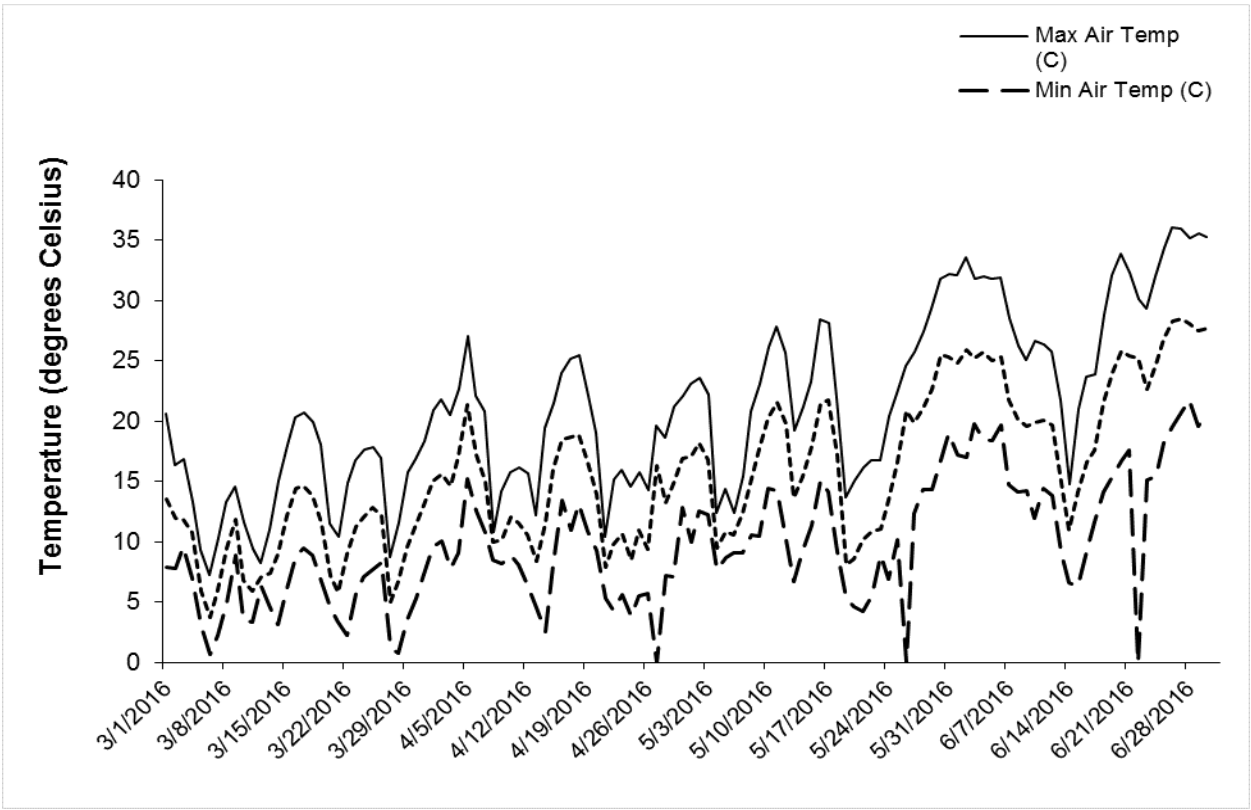
## C. Disease and statistical analysis

Disease was assessed on Jun 27 2016 when fruits were large enough to observe diseases.

## D. Weather and Disease

Weather from CIMIS weather station in Camino, California. Precipitation data from Mar 1 to Jul 1 ranged from 0 to 37.7 mm.



# Results

**Table 1.** Apple scab leaf severity and incidence (means). Product names are followed by rate (per acre). Treatment means followed by the same letter are not significantly different according to Fisher's LSD at α=0.05.

| Treatment | Leaf | |
|---|---|---|
| | Mean Severity (%) | Mean Incidence (%) |
| Howler 7.5 g/L + Sovran 3.2 oz + Capsil 6 oz/100 gal | 0.00 B | 0.83 C |
| Sovran 6.4 oz (Standard) | 0.00 B | 0.83 C |
| Serenade Optimum 20 oz | 0.03 B | 3.33 BC |
| WFX-16002 1% (v/v) | 0.08 B | 5.83 BC |
| WFX-16001 0.35% (v/v) | 0.13 AB | 6.68 ABC |
| Howler 7.5 g/L + Capsil 6 oz/100 gal | 0.33 A | 10.83 AB |
| Untreated Control | 0.30 A | 14.10 A |

**Table 2.** Apple scab fruit severity and incidence (means). Product names are followed by rate (per acre). Treatment means followed by the same letter are not significantly different according to Fisher's LSD at α=0.05.

| Treatment | Fruit | |
|---|---|---|
| | Mean Severity (%) | Mean Incidence (%) |
| Sovran 6.4 oz (Standard) | 0.03 C | 1.83 A |
| Howler 7.5 g/L + Sovran 3.2 oz + Capsil 6 oz/100 gal | 0.10 C | 6.68 A |
| Serenade Optimum 20 oz | 0.13 C | 9.15 A |
| WFX-16002 1% (v/v) | 0.20 BC | 10.00 A |
| Untreated Control | 0.33 ABC | 18.25 A |
| WFX-16001 0.35% (v/v) | 0.60 AB | 22.43 A |
| Howler 7.5 g/L + Capsil 6 oz/100 gal | 0.63 A | 24.25 A |

# Acknowledgements

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# References


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# Appendix: Products tested

| Product | Active ingredient(s) and concentration | Class | Manufacturer |
|---|---|---|---|
| Capsil | polyether-polymethylsiloxane-copolymer and nonionic surfactant (100%) | Adjuvant | Aquatrols |
| Howler | Proprietary | N/A | Proprietary |
| Serenade Optimum | QST 713 strain of Bacillus subtilis (26.2%) | Biological | Bayer CropScience |
| Sovran | kresoxim-methyl (50%) | QoI | FMC |
| WFX-16001 | Proprietary | N/A | Proprietary |
| WFX-16002 | Proprietary | N/A | Proprietary |

*Appendix references:* (1) Adaskaveg, et al. 2012. Efficacy and timing of fungicides, bactericides and biologicals for deciduous tree fruit, nut, strawberry, and vine crops 2012, available at http://www.ipm.ucdavis.edu/PDF/PMG/fungicideefficacytiming.pdf.
(2) Gubler Lab fungicide efficacy field trials, available at http://plantpathology.ucdavis.edu/Cooperative_Extension/.
(3) Various sources including product labels and/or MSDS, product websites, and personal communications.