Management Strategies for Sour Rot of Stone Fruit

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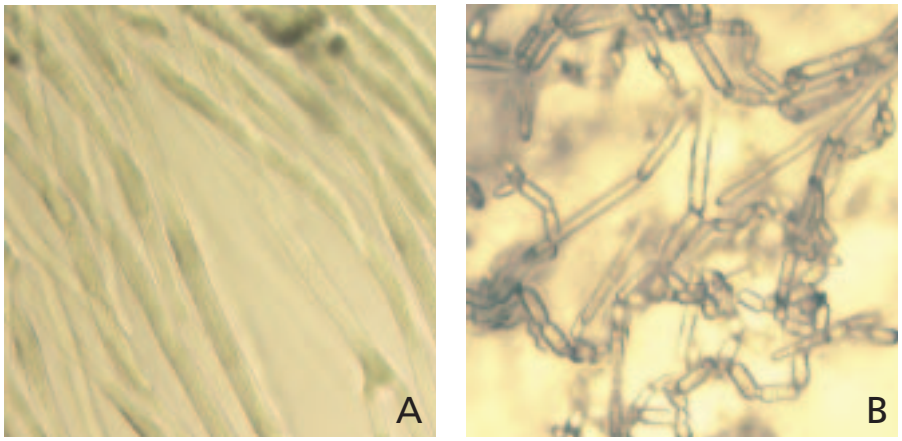
Sour rot is a postharvest decay disease of stone fruit caused by the yeast-like fungal pathogen *Geotrichum candidum*. This fungus exists as a saprophyte on dying and dead plant surfaces (e.g. hay) or in orchard soils, but it can also be pathogenic on stone fruit. Immature, healthy fruit are not affected by this fungus. However, spores of *Geotrichum* can be spread with contaminated dust particles during orchard maintenance operations, during harvest or by wind. Thus, spores may land on mature fruit at harvest. *Geotrichum* is not an aggressive wound pathogen; it infects only ripe fruit and requires a relative humidity of ≥ 95% and a temperature of > 36° F for decay to develop.

Figure 1.

(A) Bifurcate hyphae of *Geotrichum candidum* grown in culture.

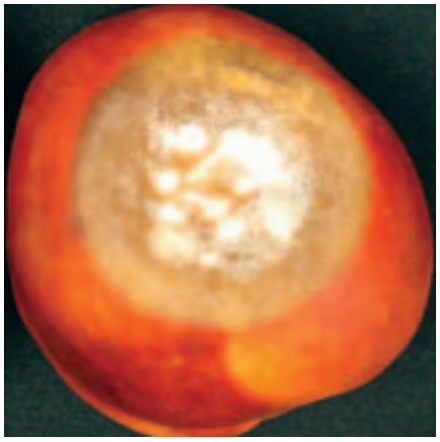
(B) Fragmenting hyphae forming spores. Spores can be spread to mature susceptible fruit by dust or wind.



Source: Dr. Jim Adaskaveg, University of California, Riverside.

What are the Symptoms of Sour Rot Decay?

Symptoms of sour rot include a watery, soft decay with a thin layer of white mycelial growth on the fruit surface. Discolorations on the fruit quickly develop into a wet, mushy decay of the entire fruit. Rotted fruit have a characteristic yeasty to vinegary odor. Sour rot spreads rapidly at temperatures above 41° F.



Source: Dr. Jim Adaskaveg, University of California, Riverside.

Why Has the Incidence of Sour Rot Increased Over Recent Years?

There are many factors that could have contributed to this. First, the market demand for fruit that are ripe and ready to eat has increased drastically. More of today's packers pre-condition fruit to ripen it prior to shipment, and ripe fruit are more susceptible to sour rot infections. Second, no adjustments have been made in handling practices (e.g. additional use of sanitizers) for pre-conditioned fruit. In fact, many packing houses have actually decreased chlorine rates to minimize worker respiratory issues. Proper sanitation is highly effective in reducing sour rot. Third, no fungicides are currently registered for sour rot control. Finally, uneven ripening of fruit has forced many growers to pick orchards a second or third time, and this process disseminates spore-bearing dust and increases the incidence of decay in the latter harvests.

Management Strategies Must be Integrated

Management strategies for sour rot control must include:

A. Orchard Practices
B. Sanitation of Fruit
C. Sanitation of Equipment
D. Preharvest & Postharvest Fungicides

A. Orchard Practices

Dust control – *Geotrichum candidum* is a common soil inhabitant and is disseminated by contaminated soil particles.

- It is essential to minimize dust movement in the orchard.
- Never cultivate soil at harvest time.

Harvest time –Tree-ripened fruit are more susceptible to sour rot infections.

- **Never pick fruit from the orchard floor**; this fruit is likely to be contaminated.

Fruit handling

- Handle fruit with care to avoid injuries.
- *G. candidum* is a wound pathogen, so minimizing wounding decreases infections.

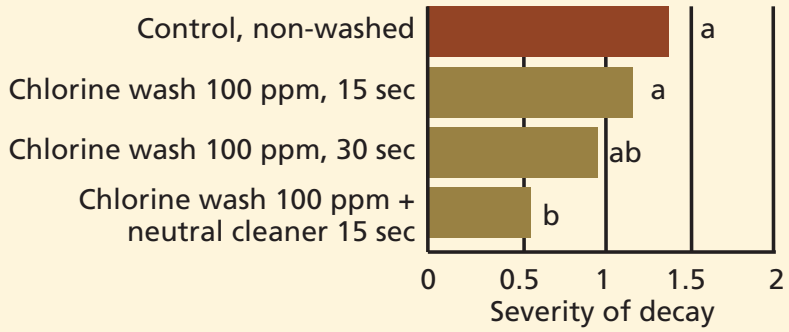
B. Sanitation of Fruit

Good sanitization of fruit can greatly reduce the incidence of sour rot in the packinghouse.

- Results from a fruit contamination study illustrated that the surfaces of organically grown fruit had higher levels of sour rot spore contamination than did the surfaces of non-organically grown fruit. This is most likely due to increased mechanical soil cultivation needed to provide adequate weed control in organic orchards.
- Postharvest sanitation washes with chlorine and neutral cleaners reduced fruit surface contamination with *G. candidum* and reduced sour rot incidence and severity (Figure 2).

Figure 2. Results from a study to evaluate the effects of fruit sanitizing treatments with chlorine and neutral cleaners.

Evaluation of Fruit Sanitizing Treatments for Management of Sour Rot



Fruit were drop-inoculated with *G.candidum* (10^6 spores/ml), incubated for 11h, postharvest washed and wounded at the inoculation site.

- Postharvest sanitation washes with chlorine and neutral cleaner reduced fruit surface contamination with *G. candidum* and incidence and severity of sour rot.
- Longer wash times (30 sec) were sometimes more effective.
- Ozonated water treatments were ineffective.

Sanitation washes of fruit reduce the amount of inoculum on fruit surfaces, but do not completely eliminate the contamination.

Source: Dr. Jim Adaskaveg, 2004. University of California, Riverside.

C. Sanitation of Equipment

Sanitization of the pack line equipment is also important to remove *G. candidum* spores from the brushes, belts and other surfaces that fruit contact.

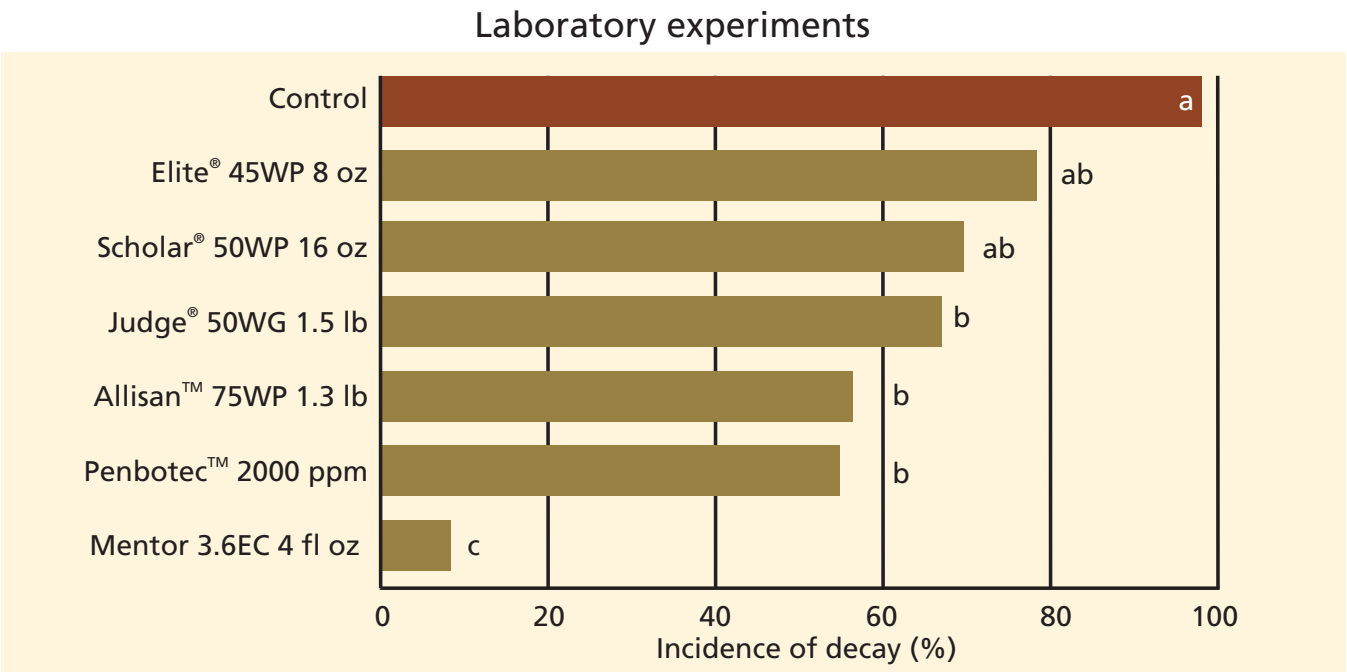
- Chlorine and quaternary ammonia compounds are very effective sanitizers that kill spores of *G. candidum* during short exposures.
- Organically grown fruit commonly have a higher surface contamination with fungal spores adhering to dirt particles.
- Thus, packinghouse equipment should be thoroughly cleaned before processing conventionally grown fruit.
- To optimize fruit sanitation, a packingline may have to be modified to provide a longer wash bed to increase the length of exposure time that fruit are in the wash.

D. Preharvest & Postharvest Fungicides

Although there are many fungicides that provide disease control on stone fruit, most of them are not efficacious against *G. candidum*. Only the preharvest fungicide Orbit® and the postharvest fungicide Mentor™ provided sour rot control (Adaskaveg, J.E., H. Förster, G. Driever, D. Thompson, K. Day, H. Andris, B. Beede and B. Holtz. 2005. Epidemiology and management of pre- and postharvest diseases of fresh market stone fruits. California Tree Fruit Agreement Annual Report 2005. 27 pp.).

Dr. Jim Adaskaveg's team conducted a study to evaluate the efficacy of various products against sour rot on Ryan Sun peaches. In this study, fruit were wound-inoculated with *G. candidum*, incubated for 14 hours and treated with postharvest fungicides. The only postharvest fungicide that controlled sour rot was Mentor (Figure 3).

Figure 3. Efficacy of various fungicides for control of sour rot on 'Ryan Sun' peaches.



Fruit were wound-inoculated with spores of *G. candidum* (20 ul of 10^8 spores/ml), incubated for 14 hr, and treated using an air-nozzle sprayer. Fruit were then incubated for 6 days at 20° C.

Source: Dr. Jim Adaskaveg, 2004. University of California, Riverside.

Conclusions

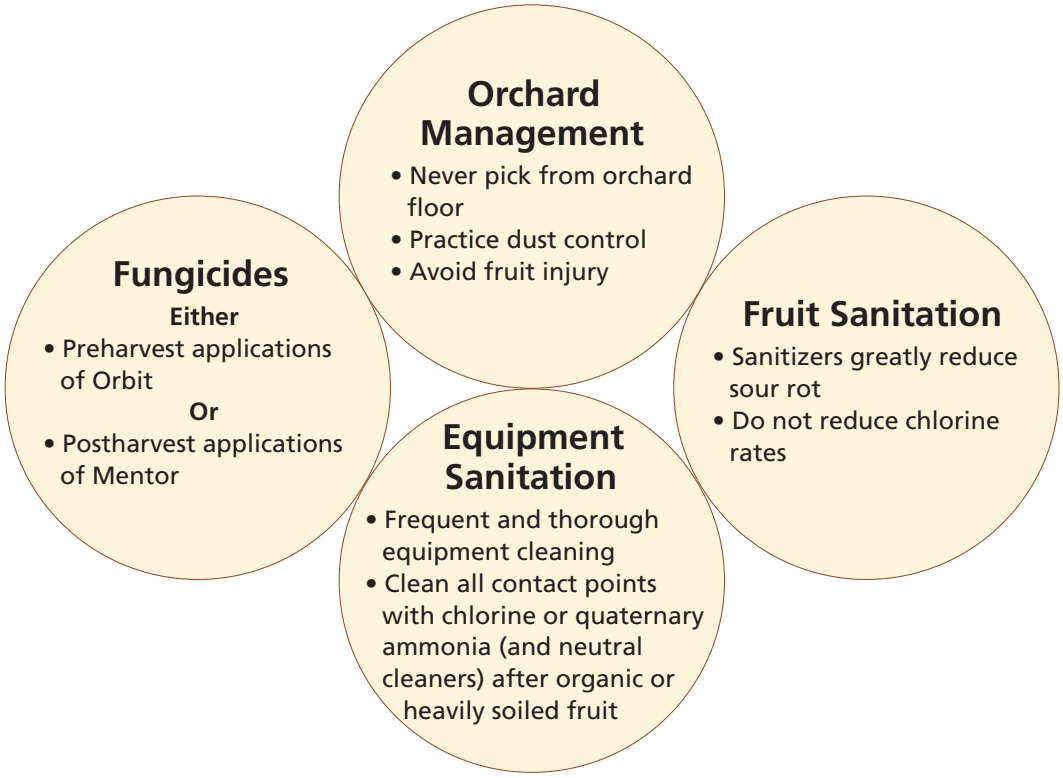
Sour rot management with fungicides:

- Of the fungicides evaluated, only propiconazole (the active ingredient in Mentor) was effective against sour rot.

Summary

The best sour rot control requires an integration of cultural practices and use of efficacious fungicides (Figure 4). Management must begin in the orchard with strategies that will minimize the development and spread of sour rot. It must continue into the packing operation with sanitary practices to clean fruit, as well as equipment that can spread the pathogen. Finally, harvested fruit can be protected from sour rot that develops from wound infections by using a postharvest application of Mentor fungicide.

Figure 4. Summary of the key management strategies for sour rot control of stone fruit.



Acknowledgements

Syngenta would like to acknowledge Dr. James E. Adaskaveg, Dr. Helga Förster and Dr. George Driever for research on sour rot and for their support of the stone fruit industry at large.

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GS: 406.60607

SCP: 715-00037-A (11/06)