

## Management of rind breakdown of mandarins

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Pre-harvest rind decay of mandarins in California generally occurs shortly after rain falls and is most severe on Satsuma mandarins. Although some researchers have associated the problem with fungi such as *Alternaria* species, our isolations from affected fruit were inconsistent. Re-inoculations with the isolated fungi (e.g., species of *Alternaria*, *Fusarium*, *Macrophomina*, *Ulocladium*, and *Cladosporium*) only sometimes reproduced disease symptoms and only on water-soaked fruit. Furthermore, in preliminary field trials that were conducted in Butte Co. in the fall of 2002 and 2003, fungicide treatments that included Topsin-M®, Pristine®, and Abound® only reduced the incidence of disease from 99% in the control to approximately 90%. These data suggested that mandarin rind breakdown is a physiological, abiotic disorder of fruit rather than a pathological problem and the fungi isolated are rather secondary causes of rind decay than primary pathogens.

Rind breakdown of citrus was previously reported by Fawcett and others in the 1930s. Wet weather combined with a sudden decrease in temperature

was shown to result in liberation of rind oil and collapse of cells just under the cuticle. In our laboratory studies with Satsuma mandarins, symptoms could be reproduced by water soaking of the fruit. In laboratory and preliminary field trials in 2003 fruit treatments with water repellants (e.g., postharvest fruit coatings, an agricultural anti-transpirant, or a summer oil) reduced the incidence of rind breakdown to very low levels. Field trials were again conducted in the fall of 2004 in Butte County. Fungicide treatments were ineffective in the Butte Co. trial and in all trials, applications of Vapor-Gard or Omni oil significantly reduced the disorder (Table 1). In all programs with Vapor-Gard and Omni Oil, a first application was made at the end of October and there was no significant difference in efficacy when additional applications were done. When trees were protected from rainfall using a tent, in both 2003 and 2004 (Table 1), the disorder could not be detected indicating the rind breakdown is correlated to rainfall.

In summary, results from our trials support previous findings by Fawcett and others that mandarin rind disorder is an abiotic, weather-related problem of mature fruit that has undergone a green to orange color change. Furthermore, we developed economical treatments that can significantly reduce the disorder.

Table 1. Effect of fungicides and rain protecting materials on mandarin rind disorder in Butte Co. 2004

No.	Treatment*	Product Rates (/200gals/A)	Application Dates				Incidence of MRD (%) & LSD
			Oct. 22	Nov. 9	Nov. 19	Nov. 26	
1	Check	---	---	---	---	---	33.67 A
2	Abound	12.8oz	@	---	@	---	31.25 A
4	Vapor Gard	1gal	@	@	---	@	5.85 B
5	Vapor Gard	1gal	@	---	---	---	4.00 B
7	Omni Oil	6qt-0.75%	@	@	---	@	1.25 BC
8	Omni Oil	6qt-0.75%	@	---	---	---	1.96 BC
9	Vapor Gard/Nordox	1 gal/6 lb	@	---	---	---	5.80 B
10	Tent Protected	---	---	---	---	---	0 C

\* - Treatments were applied using an air-blast sprayer calibrated to 200 gal/A.

\*\* - Incidence of mandarin rind disorder (MRD) is based on the evaluation of 100 fruit per tree.

