



University of California Cooperative Extension

Kern Citrus and Subtropical Fruit



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Rind Breakdown in W. Murcott Mandarins

Several growers have brought in W. Murcott mandarin fruit with what appears, at least in part, to be rind breakdown. Earlier than normal rind breakdown was also a problem in Satsuma mandarins earlier this season in Kern County. We don't have a lot of experience with W. Murcott mandarin in Kern County, as most of the oldest blocks are only about a decade old. Tango, widely planted in the southern San Joaquin Valley of late, is a low-seeded version of W. Murcott. Rind breakdown is almost guaranteed to show up on most citrus fruit if it is held on the tree long enough. However, its early appearance in January on W. Murcott is unusual. Rind breakdown this year may be related to the freezing temperatures we had the third week in November and the heavier than normal late-fall rain. In recent years, outbreaks of this disorder have caused serious crop losses in several citrus-growing counties of California, especially in areas of higher rainfall than usually occurs in Kern County. The damage occurs after color break in the fall, shortly following rainfall. Symptoms initially appear as irregular, water-soaked areas that are more frequently observed on the exposed side of the fruit on the outer perimeter of the tree. These areas develop into irregular, dark-brown, necrotic lesions that frequently cover large portions of the fruit surface. Affected fruit often rapidly decay after harvest.

The following information was adapted from information in an article authored by Dr. Jim Adaskaveg, Plant Pathologist, UC Riverside and Joe Connell, UC Farm Advisor in Butte County:

"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 antitranspirant, or 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. In all trials, applications of Vapor-Gard® or Omni oil® significantly reduced the disorder. 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, 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."

Septoria Risk High for Fruit Headed to Korea

The following letter is to interested growers from Jim Cranney, of the California Citrus Quality Council:

Korea Exporters:

*The combination of cold temperatures and high rainfall this season has contributed to near perfect conditions for the development of *Septoria citri*. UC Riverside's Jim Adaskaveg has reported that his predictive model shows that there is a very high risk for *Septoria* infection. Additionally, the level of detections for voluntary testing in the NAVEK program are at high levels. The California Citrus Quality Council (CCQC) strongly advises all Korea exporters to ensure that copper treatments are in place by Jan. 20 to avoid interceptions in Korea. As indicated in workshops earlier this season, copper applications are the only preventative treatment.*

Even with the reduced risk of detections in Korea based on actual sporulation of the pathogen, if high levels of disease are detected here in March, there is a risk that infected, sporulating fruit could be detected in Korea.

Based on rainfall and temperatures to date, it is highly likely that a third application of copper will be required this season. Exporters should expect to treat with copper again sometime in mid to late February. A deadline will be fixed at a later date. Dr. Adaskaveg has also suggested possible use of Abound® (azoxystrobin) along with copper-zinc-lime treatments, because there is some penetration into the peel, which would suppress existing non-visible infections. Unfortunately, this fungicide does not persist more than a week or two. Preliminary data also indicates Abound® suppresses sporulation.

He also suggests that houses consider use of Graduate A+® (fludioxonil and azoxystrobin) as postharvest treatments to suppress sporulation. CCQC plans to hold a conference call to discuss the implications of using Abound® or Graduate A+® because the MRLs for both of these fungicides are only 1 ppm in Korea. Houses will need to evaluate their unique situation for application, harvest, treatment and shipment if these two fungicides are used to avoid MRL violations.

Since this strategy will be complex to implement we plan to hold a conference call within a couple of weeks to discuss its benefits and risks.

Please contact me by telephone at (530) 885-1894 or via e-mail at jcranney@calcitrusquality.org if you have questions or need additional information.

Disclaimer: Discussion of research findings necessitates using trade names. This does not constitute product endorsement, nor does it suggest products not listed would not be suitable for use. Some research results included involve use of chemicals which are not currently registered for use, or may involve use which would be considered out of label. These results are reported but are not a recommendation from the University of California for use. Consult the label and use it as the basis of all recommendations.

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Orchard Floor Management in Citrus

The objective of an orchard floor maintenance program is to provide conditions for the crop that reduces competition by weeds, reduces danger from frost, allows grower access to the trees for cultural and harvest activities and prevents environmental degradation of agricultural resources like soil and water. Orchard floor management options are varied and include: doing nothing (usually resulting in a much more expensive weed removal effort later usually involving hoes), planting a fall cover crop in the middles between tree rows with the possible use of pre-emergent or post-emergent herbicides in the tree row, disking the middles and using pre-emergent and/or post-emergent herbicides in the tree row, or treating the entire orchard floor with post-emergent and/or pre-emergent herbicides.

Most citrus growers in the San Joaquin Valley maintain orchard floors relatively free of weeds. Research shows that vegetation on the orchard floor will result in cooler temperatures, and these cooler temperatures may mean the difference between saving and losing the crop. Disked soils have been shown to be cooler than untilled soil, since they conduct heat less efficiently. Firmly-packed bare earth in the middles between rows, wet to a minimum depth of 6 inches, is an efficient absorber of heat during the day and re-radiator of heat to the trees at night. The orchard-floor management system used by most growers consists of applying pre-emergent and post-emergent herbicides tree trunk to tree trunk.

Cover crops are being planted in citrus in areas of the San Joaquin Valley where temperatures do not usually fall much below 30 degrees Fahrenheit, where fruit are picked early before major frost events are likely, or where other concerns outweigh frost danger. Cover crops often have a positive effect on the environment by reducing erosion, reducing runoff through improving rates of water infiltration into the soil, and by reducing the potential of contamination of surface or ground waters that comes from herbicide use. Herbicide carried in runoff from citrus groves has been shown to be damaging to crops, such as pistachio and grape, located downhill. Research work has shown that swales or drainage areas planted to certain annual crops can provide a buffer reducing runoff from herbicide treated fields. Fall-planted cover crops minimize the amount of vegetation present during the coldest part of the winter. Less vegetation means less frost hazard, but timing planting so that rainfall germinates the seed in the fall can be tricky, especially in the southern San Joaquin Valley. The first rains may not come until temperatures are too low to germinate seed and supplementary water is not usually available since most groves in this area only have low-volume irrigation systems which do not wet areas outside of the tree row. In Kern County most cover crops generally succumb to drought in unirrigated areas of the orchard floor in June. Mowing is used to manage cover crop height in the spring.

Citrus groves may be kept relatively weed free by only using post-emergent herbicides or by disking or a combination of the two. However, if a needed post-emergent application is missed or is late, weed control may quickly be lost. For example, the ability of a weed like puncture vine (*Tribulus terrestris* L.) to begin producing its 'goat head' seeds shortly after germination remains impressive.

Most orchard floor management systems in the southern San Joaquin Valley depend heavily on pre-emergent herbicide applications in the fall and/or spring, with 'touchup' applications of post-emergent herbicide applications during the spring and summer. Herbicides should always be selected based on their efficacy in controlling the weed species that exist in the field to be treated and pre-emergent applications should be timed to ensure that they are applied before the weeds germinate. Resistances of some weed species to some herbicides have been documented, so herbicides that worked 10 years ago, may not work as well today. For example, the fleabanes can be difficult to control and exhibit resistance in many areas. In the southern San Joaquin Valley, fleabane may germinate as early as late October and overwinter as a large rosette that will be difficult to kill in late winter or spring. Citrus growers are fortunate that a relatively wide selection of effective herbicides have been registered for use to assist them with weed problems.

Generally, pre-emergent herbicides are applied in the fall and/or spring before anticipated rainfall and prior to the germination of the winter and summer weeds, respectively. However, some herbicides have been found in ground water in the San Joaquin Valley beneath areas that have a long-history of citriculture and special use regulations apply to some materials in many counties of the San Joaquin Valley, particularly in areas with shallow groundwater. Persons using or recommending the use of herbicides in California

should contact their county agricultural commissioner for current groundwater protection training and restrictions. Fall pre-emergent herbicide applications are especially susceptible to leaching by winter rainfall and irrigation water run for frost protection purposes. The use of the post-emergent, broad-leaf phenoxy herbicides, such as 2-4, D and dicamba are strictly limited in the southern San Joaquin Valley because of the damage they can do to neighboring crops. The local County Agricultural Commissioner's office will have information governing the use of phenoxy herbicides in their respective areas which includes information of where, when and how they may be applied. Growers and PCAs should also monitor application rates and methods carefully. Spraying the tree and fruit can result in phytotoxicity and may contaminate the fruit. Maximum residue tolerances (MRLs) exist for some herbicides in some countries as they do for other pesticides.


Care should be taken and label directions followed very closely in applying pre-emergent herbicides to young trees. Some pre-emergent herbicides cannot be used until trees are three years old. Replants in a mature orchard are at risk from use of some pre-emergent herbicides. Pre-emergent herbicides are available for non-bearing trees that are not available to bearing trees. Read label directions carefully.

Often, improving water distribution uniformity, fixing leaky irrigation systems and addressing drainage problems possibly with soil amendments, can provide better weed-control in some areas of the field than any other strategy. Many grassy and some broad-leafed waterweeds disappear once water is prevented from ponding.

Having an orchard floor management strategy in place and specifically tailored to the conditions and past experiences in a particular orchard, is a great way to get another season off to a great start.

*Craig Kallsen
Citrus, Subtropical Horticulture, Pistachios Advisor*

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