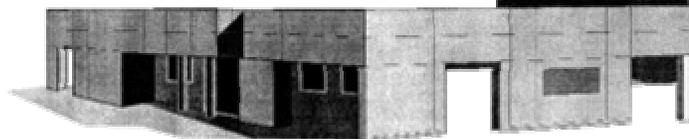




Central Valley **POSTHARVEST**



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DECAY OUTBREAKS – SOUR ROT

J. E. Adaskaveg
and
C. H. Crisosto

Sour rot caused by the fungus *Geotrichum candidum* occasionally causes fruit decay and crop losses during transport and market display. Symptoms include a watery, soft decay with a thin layer of white mycelial growth on the fruit surface. Rotted fruit have a characteristic yeasty to vinegary odor (other odors may develop with bacterial contamination that commonly develops in the watery decay). The

fungus is a wound pathogen that decays fruit after spores are deposited into injuries. The organism is commonly found in soil and is carried on dust or dirt onto the fruit surface.

Epidemiology and Control Measures – The fungus is widespread on organic material in the soil. Spores of the fungus may be spread by vinegar flies from decayed fruits to cracks or bruises in healthy fruit. The spores may also be spread in picking boxes and handling equipment. During harvest micro-wounds occur on the fruit and these injuries may function as infection sites. When the fruit is washed, the wash water may carry the spores of

the fungus into the wounds. Thus, proper sanitation practices are critical for effective decay control. Fruit should not be harvested from the orchard floor, and should be carefully sorted at the packingline. Care in handling should be taken to prevent injuries and fruit should be washed using a disinfectant such as chlorinated water. To be effective, chlorinated washes need to be monitored and maintained at 50-100 ppm free chlorine (hypochlorous acid) at a pH of 7.5-8. Furthermore, the decay can be managed with proper temperature management.

The minimum temperature for spore germination, growth of the fungus, and infection is about 36°F (2°C), the optimum 77-80°F (25-27°C), and the maximum 101°F (38°C). At above 60°F (15.5°C), the rot spreads very rapidly in ripe peaches. Decay will essentially stop developing if fruit is maintained below 41°F (5°C); however, if the fruit was inoculated the decay develops quickly once the fruit are stored at higher temperatures. Rapid cooling of the fruit and refrigeration at low temperature will reduce losses from sour rot.

Previously, registered pre- and postharvest fungicides were not effective against this decay pathogen. The new fungicides tebuconazole (Elite 45WP) and propiconazole (Break 3.6EC) are effective against this fungus and they are registered for preharvest but not for postharvest use on stone fruit crops. Preharvest applications of these fungicides should probably be effective in reducing the incidence of decay, although specific usage of these fungicides for management of this decay on stone fruit has not been well studied.

Three aspects of sour rot make it potentially a serious decay problem:

- Incipient infections cannot be easily observed by graders and infected fruit become packed along with healthy fruit.

- Sour rot spreads rapidly at temperatures above 41°F (5°C); and
- The disease is not controlled by any postharvest fungicide treatment and requires proper harvesting and handling to minimize wounds and soil contamination. Additionally, sanitation rinses that prevent additional spread of inoculum and inoculation of fruit during postharvest cleaning and low-temperature storage (<41°F or 5°C) are required for effective control.

STONE FRUIT DECAY CHALLENGES IN THE SPRING SEASON OF 2003

The Top Ten Tips For Decay Control

J. E. Adaskaveg, H. C. Förster,
and
C. H. Crisosto

The 2003 stone fruit packing season has started with major challenges in the management of decays. The unusually high rainfall has created ideal conditions for decay fungi. These fungi thrive in wet environments at moderate temperatures with spore formation, germination, and growth at their optimum. Spores of *Monilinia* species (brown rot) are produced on infected blossom parts and previous year's fruit mummies. These spores are wind- and rain-disseminated, and can infect fruit through the intact cuticle and epidermis. On mature fruit, decays develop either in the field or soon after harvest. On immature fruit, quiescent infections are established that can develop into active decay at fruit ripening later in the season. Thus, the spring rains will also affect decay incidence of fruit that is maturing later in the season. Rain cracks and split pits are direct entry points for *Monilinia* species and *Botrytis cinerea* (gray mold), as well as for fungi that are usually of minor importance such as *Alternaria*, *Cladosporium*, and *Penicillium* species.

Decay management in this current situation cannot depend on any postharvest fungicide alone. Fludioxonil (Scholar) that is now fully registered on all stone fruits in California is the most active postharvest fungicide ever developed. It is a wound-protection treatment that effectively inhibits brown rot, gray mold, *Rhizopus* decay, and other fruit rots when applied up to 18 hours after inoculation. Any established infections especially those in split pits, however, cannot be eradicated or managed effectively with any postharvest treatment except by strict sorting practices. Thus, an integrated decay management approach is the only option to get high-quality fruit to the consumer in a high-risk disease year like this. This includes preharvest fungicide treatments to inhibit new infections on the highly susceptible maturing fruit, careful sorting to remove any injured fruit, and then a postharvest fungicide treatment. In our research we have identified preharvest fungicide treatments that effectively reduce postharvest brown rot and gray mold decays even after fruit is washed and sanitized in the postharvest handling process. The most effective treatments include mixtures of SBI fungicides such as Elite (tebuconazole), Orbit (propiconazole), and Indar (fenbuconazole) with either Elevate (fenhexamid) or Vanguard (cyprodinil). In the mixtures, the SBI fungicide was used at the low label rate (4 oz/100 gal/A). Elevate was used at the only rate registered (1.5 lb/100 gal/A) and Vanguard at the 5 to 10 oz/100 gal/A rate. For best efficacy, two treatments should be applied between 14 days and 1 day before harvest in a 7-day interval (e.g., 14 and 7, or 7 and 1 days before harvest). Treatments with Elite or other SBI fungicides alone are also very effective against brown rot, but control against gray mold is reduced.

For postharvest treatments with Scholar at labeled rates of 8 to 16 oz/200,000 lb of fruit, good fruit coverage by the fungicide is even more important in high-disease years. Thus, low-volume spray application systems need to be accurately calibrated and should be used on

a brush bed. Alternatively, high-volume applications can be used to improve fruit coverage. With a CDA system, use higher recommended volumes of 20 to 25 gal/200,000 lb. One of the most difficult areas of stone fruit crops to reach is the concaved stem end. Water may accumulate in this area of the fruit and allow spores of the brown rot pathogens to germinate and infect the fruit in both pre- and postharvest environments. Thus, be sure that the fungicide covers the stem end well by checking treated fruit immediately after application.

The following 10 guidelines are suggested for this season:

1. Identify orchards with a history of brown rot. They will be at greater risk in a wet year such as this year.
2. Monitor orchards for any fruit with brown rot during fruit development. Decayed fruit on the tree is an indication of high inoculum levels in the orchard.
3. Use preharvest treatments within 14 days of harvest as described in the text above.
4. Use SBI fungicides (e.g., Elite, Orbit, Indar) for best results against brown rot.
5. Minimize injuries during harvest and transportation to the packinghouse.
6. Hydro-cool fruit with chlorinated water. Be sure to change the water in the hydro-coolers daily to prevent build up of organic load (organic material and soil directly inhibit the activity of active chlorine on microbial populations including fruit pathogens such as *Monilinia* species).
7. Be sure to use chlorinated water (and possibly detergents) on the brush beds to minimize contamination of equipment and subsequent inoculation of fruit.

8. Treat fruit with postharvest fungicides (e.g., Scholar) at **registered rates** within 18 hours of harvest. Lower rates than 8 oz/200,000 lb are ineffective on peaches, plums, and nectarines to maintain commercial decay management standards for all major decays and may result in the development of resistant populations of postharvest pathogens.
9. Sort fruit to remove off-grades and fruit with obvious injuries.
10. Carefully use temperature management practices throughout packing and transportation of fruit to market.

HANDLING PRECONDITIONED TREE FRUIT AT THE RETAIL DISTRIBUTION CENTERS

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and
David Parker

Temperature Management – While the precise temperature management regime will depend on a particular company's anticipated sales/consumption schedule (fruit turning schedule), generally all tree fruit should be kept out of the "killing zone" temperature range of 36-50°F. The ideal storage temperature range will be within 32-35°F. This pulp temperature will reduce the incidence of internal breakdown or mealy fruit, fast softening, shriveling, and decay outbreak. The exact temperature management will be part of a broader fruit ripening protocol that takes into account the firmness on arrival of fruit and the fruit turning schedule coordinated with the store level demand.

Fruit Firmness – Fruit firmness reduction is only one component of the tree fruit preconditioning/preripening process and it does not accurately reflect the quality of the preconditioning execution. Cheek firmness is a

good tool to determine ripening stage ("Transfer Point", "Ready to Buy", "Ready to Eat", etc.), while firmness measured at the weakest position (shoulder, tips, or suture) is well related to potential impact and transportation damages. Fruit firmness does not accurately certify the quality of the preconditioning execution.

Preconditioned peaches and nectarines should be arriving at the supermarket distribution center at ~5-8 pounds firmness measured at the weakest point or ~6-8 pounds measured on the cheeks. For preconditioned plums, ~3-8 pounds firmness measured at any position on the fruit are suggested.

When kept at 36°F or below, this product should be shipped out of the distribution center no later than within 4-5 days and ideally within 2-3 days. To the extent that the distribution center does not have rooms that can maintain temperatures at this 36°F and below range, it might make more sense to set up two shipments per week from the shipper to assure better temperature control and extend the market life of the product.

In general, soft fruit are more susceptible to bruising than hard fruit. To reduce potential physical damage occurring during transportation from the distribution centers to retail stores and handling at the retail stores, we suggest transferring fruit to the retail store before fruit reaches no lower than 4-5 pounds measured on the weakest position for tray packed peaches and nectarines. In general, the shoulder position is the weakest point on the mid or late season fruit. For plums, transfer should be done before they reach 3 pounds firmness measured at any position on the fruit.

Temperature conditions for tree fruit during and after ripening should be adjusted according to the desired sales/consumption schedule. We encourage that further fruit ripening, if necessary, be done at the distribution level. The rate of fruit softening (pounds lost per day)

varies among peach, nectarine and plum cultivars, and can be controlled by the storage temperature used. In general, fruit at 68°F loses 2.0 pounds per day and it loses less than 1.0 pound per day when stored at less than 36°F. When the fruit reaches the transfer firmness mentioned above, the rate of softening slows. However, rate of softening also varies according to orchard and season so firmness measurements should be taken to protect fruit integrity during the ripening process. These fruit will reach their “Ready to Eat” firmness of 2-4 pounds (cheek) after 2-3 days at room temperature (68°F dry retail display).

As bruising incidence varies among cultivars, and bruising potential is related to each specific operation, you should fine-tune your own transfer points for your handling situation. Correctly preconditioned fruit will have a longer shelf life even at lower firmness than conventionally packed product; and as such, retailers need to gain confidence in handling preconditioned product with lower firmness than historical experience suggests.

SSC – We do not recommend using SSC as an exclusive measurement for evaluating preconditioned fruit quality at the distribution center. SSC can be used to set a minimum quality index but it varies according to cultivar, season, etc. However, based on our experience, we feel that the appropriate harvest maturity and ground color followed by correct preconditioning predict much better eating quality than SSC and/or firmness alone. A mealy piece of fruit can be within an acceptable range of firmness and have a high SSC reading but still be entirely unsatisfactory to the consumer.

Please understand that these are general handling guidelines but they need to be modified and assessed in light of your particular company’s facilities, logistics and customer requirements.

HANDLING PRECONDITIONED TREE FRUIT AT RETAIL STORES

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and
David Parker

What is Preconditioned Fruit?

When you sell preconditioned tree fruit in your store, you are offering consumers peaches, nectarines, and plums that have been preconditioned/ preripened to delay mealiness and assure the consumer the peach, nectarine or plum is juicy and tasty. This product will be at a higher stage of ripeness than conventionally packed product and needs to be handled carefully at the retail store level. The preconditioning process does not prevent mealiness, it only delays its development, and, therefore, this product needs to be moved quickly from the distribution center to retail stores in order to assure a satisfactory eating experience for your customers.

Temperature Management

Ideally, preconditioned tree fruit should be transported at 32-35°F from the distribution center and kept at 32-35°F prior to transfer to dry/warm table for display. We refer to the temperature range of 36-50°F as the “killing temperature zone” which increases fruit flesh browning, mealiness, and “off flavors”. To the extent the fruit temperature cannot be maintained below this “killing zone”, it would be preferable to move fruit fast. Firmness measurements need to be considered in the decision-making process.

Fruit Firmness

Preconditioned peaches and nectarines should ideally be arriving from the distribution center to the retail stores with firmness in the 4-6 pound range (weakest position) or 6-8 pound range (cheeks). Preconditioned plum firmness should be in the 3-5 pound range (at any

position on the fruit). This fruit is at the “Ready to Buy” or “transfer point” stage of ripening and within ~48-72 hours at 68°F should be “ready to eat” in the 2-4 pound firmness range. This is the firmness range at which most consumers claim the highest satisfaction when eating tree fruit.

Display Suggestions

- Produce managers need to be educated about this new “Ready to Buy” type of fruit (preconditioned).
- Minimize mechanical damage and expedite an effective rotation (first in, first out).
- The dry tables should be labeled as preconditioned or “Ready to Buy/Eat” and consumers should understand that this fruit is riper than conventionally packed tree fruit.
- In order to protect preconditioned fruit, the display should be no more than two layers deep. In box display should be attempted.
- As tree fruit will continue to ripen on the display warm/dry table, they should be checked often and the softest fruit be placed at the front of the display.
- Fruit that reaches the “Ready to Eat” ripeness of 2 to 3 pounds cheek firmness need to be sold quickly or placed in refrigeration to extend their shelf life.
- Consumers should be instructed that this type of fruit should be refrigerated if fruit are not going to be consumed within 3 days of purchase.

DEVELOPING CRITICAL PITTER THRESHOLDS FOR CANNING PEACHES USING THE NONDESTRUCTIVE SINCLAIR FIRMNESS SENSOR

**Carlos H. Crisosto, Paul Metheney,
Constantino Valero,
and
Earl Bowerman**

The relationship between mechanical pitting damage using the Atlas pitter (Atlas Pacific Engineering Co., Inc., Pueblo, Colorado) over a range of nondestructive and destructive firmness measurements for ‘Andross’, ‘Carson’, and ‘Ross’ clingstone peaches was studied. During the two years of work, the percentage of ‘Andross’, ‘Carson’, and ‘Ross’ fruit with pitting damage increased sharply as nondestructive firmness sensor Sinclair firmness index values fell below 7.0 (SFI) and when destructive penetrometer readings fell below 3.8 pounds (17 N). Even though there was a low correlation between nondestructive and destructive firmness measurements, nondestructive measurements appear to be well related to the pitting damage. These preliminary results encourage that further research to improve the relationship between an automatic nondestructive system could give processors the option to segregate peaches susceptible to pitting prior to processing.

This information measured at the receiving area could be useful for subjective grading and/or predicting potential pitter problems during processing.

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present

**2003
VARIETY DISPLAY AND RESEARCH UPDATE
SEMINARS**

at the

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9240 S. Riverbend Avenue
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Mark your calendars for these dates:

Friday, June 20

Friday, July 25

Friday, September 12

8:00 – 9:00 a.m. Variety display by stone fruit nurseries, breeders,
and the USDA.

9:00 – 10:00 a.m. Research Update Topics:

- Nutrient deficiencies
- Dwarfing & semi-dwarfing rootstocks
- Keeping trees short
- IPM updates
- Irrigation management and water stress

For more information call:

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