CENTRAL VALLEY POSTHARVEST NEWSLETTER

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UPDATE ON MENTOR 45WP – A "NEW TOOL" FOR POSTHARVEST MANAGEMENT OF SOUR ROT OF STONE FRUIT IN THE 2007 SEASON

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The new postharvest fungicide Mentor 45WP from Syngenta Crop Protection will receive a Section 18 Emergency registration in California for postharvest management of sour rot of peaches and nectarines in the 2007 season. This is a statewide renewal of the crisis exemption obtained in August 2006 and the first year of the federally approved postharvest registration of this fungicide on any crop. The California Grape and Tree Fruit League made the request on behalf of the summer stone fruit industry and led the industry through the new regulatory requirements that were initiated in April 2006 for obtaining an emergency registration. The fungicide, propiconazole, is highly active against the fungal pathogen *Geotrichum candidum* and should be integrated into cultural and sanitation programs for managing sour rot. The disease has caused extensive problems for growers, packers, and shippers that have been facing an increased occurrence in the last several years.

The pathogen *G. candidum* is causing both pre- and postharvest sour rot of ripening fruit. Symptoms include a watery, soft decay with often a thin layer of white mycelial growth on the fruit surface. Rotted fruit have a characteristic yeasty to vinegary odor, but 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 fruit surfaces. Other yeasts have also been reported to cause decays of ripe fruit similar to sour rot. These decays (i.e., yeast rots) are generally of minor importance and should not be confused with sour rot. Propiconazole is not effective against these yeasts, however, a sound postharvest sanitation program of equipment and fruit should eliminate these problems.

Sour rot has become a major decay problem in the production of fresh market peaches and nectarines in California. With higher fruit quality demands by consumers, buyers around the world request riper and better tasting fruit that are ready to consume. Ripe fruit, however, promotes decay problems like sour rot in addition to the usual set of decays, namely brown rot, gray mold, and Rhizopus rot. Generally, first harvests of an orchard block are not a problem but by the second and third harvest, an increase in sour rot incidence occurs. This is associated with higher levels of dust in the orchard carrying spores of the soil-borne pathogen. In second harvests of a white peach and a nectarine variety in 2006, 3% and 5%, respectively, of the fruit had sour rot upon arrival at the packinghouse after a morning harvest despite a preharvest fungicide program. Still, crop losses are generally low when the disease develops prior to harvest, but losses can be very high during storage, transport, and market display. Thus, the pathogen is being brought in on decayed or injured fruit and then the packingline is being contaminated. This results in the inoculation of healthy fruit bound for packaging and further handling, transportation, and final market display.

The California Tree Fruit Agreement (CTFA) has supported research of two labs (Adaskaveg and Michailides) at the University of California to improve our understanding of the pathogen and the disease, as well as to develop new management programs for reducing sour rot. Our research identified a series of strategies to combat the disease that include identification of susceptible varieties, sources of inoculum (soil populations, orchard sanitation, dust control, and fruit flies), fruit firmness (fruit with ≤7 lb pressure are highly susceptible to injury) and maturity levels, as well as postharvest sanitation methods for fruit and equipment using sodium hypochlorite/neutral cleaners and quaternary ammonium, respectively. Stone fruit varieties vary widely in their susceptibility to sour rot and thus, management programs should be developed specifically for each variety.

Mentor 45WP is specifically formulated for postharvest use and is highly effective against sour rot. The mixture of Mentor 45WP with Scholar 50WP (fludioxonil) will provide the broadest activity spectrum against decays of stone fruit ever developed. Both materials can be used in 2-4 oz/6 oz (low disease pressure) or 4 oz/8 oz (high disease pressure) ratios (Mentor/Scholar) per 200,000 lb of fruit. These rates may appear low but both fungicides are extremely active at low rates and low residues on fruit. The label for Mentor will include the same low- and high-volume application methods as Scholar including controlled droplet (CDA; 8-25 gals/200,000 lb of fruit) and high volume (e.g., drenches, or T-Jet nozzles set for 100 gals/200,000 lb of fruit) applications. The fungicide with the final approved label will be available by mid-May and will be sold in 8-oz packages. The Section 18 will be valid until September 30, 2007 and any unused material will need to be returned to the registrant. Four counties, Fresno, Tulare, Kings, and Kern, are included in the emergency registration.

The temporary tolerance in the United States is set at 2 ppm (2 mg propiconazole per 1 Kg of fruit) for peaches and nectarines. Thus, postharvest treatments with Mentor 45WP can be made on fruit treated with preharvest cover sprays with Orbit 3.6EC. A residue of 1 ppm should not be exceeded even with both pre- and postharvest use of propiconazole and fruit with a 1-ppm residue should be in compliance with international markets that have this level as a maximum residue limit (MRL). Preharvest fruit applications with other fungicides are also acceptable following their labels. For plums, postharvest treatments with propiconazole have not been approved but the fungicide is registered as a preharvest treatment (e.g., Orbit) and the tolerance is 1 ppm. Thus, contamination of plum fruit with propiconazole using the same postharvest handling equipment should not be an issue. To prevent fungicide-resistant pathogen populations from developing to propiconazole, mixing Mentor with Scholar will minimize the risk for *Monilinia* spp. to become insensitive to propiconazole. Scholar is not registered for preharvest use and belongs to a different class with a different mode of action. As a general anti-resistance strategy against *G. candidum* and other pathogens, fungicide-treated fruit should not be disposed of into stone fruit orchards. The Scholar-Mentor mixture provides complementary high activity against brown rot. Mentor is effective against brown rot, sour rot, and partially effective against Rhizopus rot, whereas Scholar is highly effective against brown rot, gray mold, and Rhizopus rot.

Preharvest strategies for sour rot and brown rot management. With the exception of propiconazole, registered pre- and postharvest fungicides are not highly effective against sour rot. Preharvest applications of propiconazole (Orbit 3.6EC) can help but are not stand-alone treatments in reducing the incidence of sour rot. If two preharvest applications are being used then one application of Orbit 3.6EC should be used in rotation with another fungicide of a different class if sour rot is a problem.

For brown rot management, two to three applications of a demethylation inhibitor (DMI) fungicide (e.g., Elite, Indar, Orbit), an anilinopyrimidine (e.g., Scala or Vangard), a phthalimide (e.g., Captan), or a strobilurin/carboxyanilide (i.e., Pristine) are suggested for application within two to three weeks of harvest and ideally at 7- and 1-day preharvest intervals (PHI). As an example, Captan followed by Pristine for the first harvest of a block and then a rotation to a DMI fungicide for the second harvest of that same block would be an excellent program. Use of the anilinopyrimidine fungicides (e.g., Vangard, Scala) as rotational materials instead of Pristine would also be very good, provided temperatures and humidity are at moderate levels. As always, follow label directions and limitations of all these fungicides.

Epidemiology of sour rot and integrated management practices. The sour rot pathogen is widespread in soil and on organic material in the soil. In the field, spores of the fungus may be spread by vinegar flies and dust deposited in 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 may function as infection sites. Fruit should not be picked up from the orchard floor, and dust control of orchard floors and roadways is an important practice and should start with the first color pick and continue as fruit mature. Fruit handling methods that minimize injuries are critical. Highly susceptible varieties should be picked and transported in small containers to minimize rubbing and bruising injuries that may occur in bins. All fruit should be carefully sorted at the packingline. Care in handling should be taken to prevent injuries and soft fruit should not be harvested. When the fruit are washed, the wash water may carry spores of the fungus into fruit wounds. Thus, fruit should be washed using a disinfectant with a surfactant such as chlorinated water mixed with neutral cleaner starting immediately at the dump bin. 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. Equipment should be surface disinfested with chlorinated water or quaternary ammonium products at recommended dilutions and then rinsed with potable water after every fruit lot.

Furthermore, the decay can be managed with proper temperature management guidelines of maintaining fruit at 32-35ºF. The minimum temperature for spore germination, growth, and infection by *G. candidum* is about 36ºF (2ºC), the optimum is 77-80ºF (25-27ºC), and the maximum is 101ºF (38ºC). At above 60ºF (15.5ºC), the rot spreads very rapidly in ripe peaches. Decay will essentially stop developing if fruit is maintained below 41ºF (5ºC); however, if the fruit was already inoculated, decay develops quickly once the fruit moved to higher temperatures. Thus, rapid cooling of the fruit and low temperature refrigeration will reduce losses from sour rot.

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

- Incipient or early infections cannot be easily observed and infected fruit may become packed with healthy fruit into the same box.
- Sour rot may be misidentified resulting in claims concerning the ineffectiveness of postharvest treatments with Scholar.
- Sour rot spreads rapidly at temperatures above 41ºF (5ºC).
- Only a single currently registered fungicide (i.e., propiconazole) is very active against sour rot. Preharvest applications with Orbit 3.6EC will reduce the incidence of sour rot, but postharvest treatments with Mentor 45WP will be much more effective if 100% coverage and uniform dosage is provided.
- Preharvest integrated management programs have to be followed that include proper harvesting and handling of fruit to minimize wounds and soil contamination.
- Postharvest integrated management programs that include sanitation rinses (such as oxidizing treatments such as sodium hypochlorite) of fruit and equipment that prevent spread of inoculum and new inoculations of fruit during postharvest cleaning have to be followed. Equipment should also routinely be disinfested using sanitizing treatments such as quaternary ammonium.
- Consistent low-temperature storage (<41ºF or 5ºC) is still a cornerstone for decay management and is highly recommended for effective control.

ABSTRACTS

From *Postharvest Biology and Technology.* 2006. Vol. 39: 10–18.

SEGREGATION OF PEACH AND NECTARINE (*PRUNUS PERSICA* (L.) BATSCH) CULTIVARS ACCORDING TO THEIR ORGANOLEPTIC CHARACTERISTICS

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Cultivar segregation according to the sensory perception of their organoleptic characteristics was attempted by using trained panel data evaluated by principal component analysis of four sources per cultivar of 23 peach and 26 nectarine cultivars as a part of our program to develop minimum quality indexes. Fruit source significantly affected cultivar ripe soluble solids concentration (RSSC) and ripe titratable

acidity (RTA), but it did not significantly affect sensory perception of peach or nectarine flavor intensity, sourness or aroma by the trained panel. For five out of the 49 cultivars tested, source played a role in perception of sweetness. In all of these cases when a source of a specific cultivar was not classified in the proposed organoleptic group it could be explained by the fruit having been harvested outside of the commercial physiological maturity (immature or over-mature) for that cultivar. The perception of the four sensory attributes (sweetness, sourness, peach or nectarine flavor intensity, peach or nectarine aroma intensity) was analyzed by using the three principal components, which accounted for 92 and 94% of the variation in the sensory attributes of the tested cultivars for peach and nectarine, respectively. Season did not significantly affect the classification of one cultivar that was evaluated during these two seasons. By plotting organoleptic characteristics in PC1 and PC2 (~76%) for peach and nectarine, cultivars were segregated into groups (balanced, tart, sweet, peach or nectarine aroma and/or peach or nectarine flavor intensity) with similar sensory attributes; nectarines were classified into five groups and peaches into four groups. Based on this information, we recommend that cultivars should be classified in organoleptic groups and development of a minimum quality index should be attempted within each organoleptic group rather than proposing a generic minimum quality index based on the ripe soluble solids concentration (RSSC). This organoleptic cultivar classification will help to match ethnic preferences and enhance current promotion and marketing programs.

From *Postharvest Biology and Technology*. 2005. Vol. 38: 239–246.

RELATIONSHIP BETWEEN RIPE SOLUBLE SOLIDS CONCENTRATION (RSSC) AND CONSUMER ACCEPTANCE OF HIGH AND LOW ACID MELTING FLESH PEACH AND NECTARINE (*PRUNUS PERSICA* (L.) BATSCH) CULTIVARS

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The minimum RSSC needed to reach high consumer acceptance for peach and nectarine was determined by using ‘in-store’ consumer tests of low and high RTA melting flesh cultivars as a part of our program to develop minimum quality indexes. For ‘Ivory Princess’, a low acid, white flesh peach, ‘Honey Kist’, a low acid, yellow flesh nectarine, ‘Elegant Lady’, a high acid, yellow flesh peach, and ‘Spring Bright’, a high acid, yellow flesh nectarine, degree of liking and consumer acceptance were associated with ripe soluble solids concentration (RSSC) regardless of ripe titratable acidity (RTA). For the two high acid (0.70–0.90% RTA) cultivars tested, consumer acceptance increased rapidly as RSSC increased, reaching ~90%. In these cultivars, consumer acceptance reached a plateau and above which, it became insensitive to any additional increase in RSSC. For ‘Elegant Lady’ and ‘Spring Bright’, the plateau was reached at 11–12%, and 10–11% RSSC with ~90% consumer acceptance, respectively. For the low acid cultivars (0.30–0.50% RTA), ‘Ivory Princess’ and ‘Honey Kist’, consumer acceptance progressively increased as RSSC increased without reaching a plateau, and attained nearly 100% acceptance with RSSC of 16 and 15%, respectively.

For these low acid and high acid cultivars, consumer acceptance was closely related to

RSSC but maximum consumer acceptance was attained at different RSCC levels depending on the cultivar. The fact that these cultivars reached high consumer acceptance with different RSSC levels indicates that a single generic RSSC quality index would not be reliable to assure consumer satisfaction across all cultivars.

From *Postharvest Biology and Technology*. 2007. Vol. 44: 271–276.

SEGREGATION OF PLUM AND PLUOT CULTIVARS ACCORDING TO THEIR ORGANOLEPTIC CHARACTERISTICS

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Cultivar segregation according to the sensory perception of their organoleptic characteristics was attempted by using trained panel data evaluated by principal component analysis of 12 plum and four pluot cultivars as a part of our program to understand plum minimum quality. The perception of the four sensory attributes (sweetness, sourness, plum flavor intensity, plum aroma intensity) was reduced to three principal components, which accounted for 98.6% of the variation in the sensory attributes of the tested cultivars. Using the Ward separation method and PCA analysis (PC1 = 49.8% and PC2 = 25.6%), plum and pluot cultivars were segregated into groups (tart, plum aroma, and sweet/plum flavor) with similar sensory attributes. Fruit source significantly affected cultivar ripe soluble solids concentration (RSSC) and ripe titratable acidity (RTA), but it did not significantly affect sensory perception of plum flavor intensity, sourness, sweetness, and plum aroma intensity by the trained panel on fruit harvested above their physiological maturity.

Based on this information, we recommend that validation of these organoleptic groups should be conducted using "in store" consumer tests prior to development of a minimum quality index within each organoleptic group based on ripe soluble solids concentration (RSSC). This organoleptic cultivar classification will help to match consumer preferences and enhance current promotion and marketing programs.

From *Postharvest Biology and Technology*. 2007. Vol. 44: 248–253.

RELATIONSHIP BETWEEN NONDESTRUCTIVE FIRMNESS MEASUREMENTS AND COMMERCIALLY IMPORTANT RIPENING FRUIT STAGES FOR PEACHES, NECTARINES AND PLUMS

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Fruit firmness measurement is a good way to monitor fruit softening and to predict bruising damage during harvest and postharvest handling. Ripening protocols traditionally utilize a destructive penetrometer-type fruit firmness measure to monitor ripening. Until recently, methods of assessing fruit texture

properties nondestructively were not commercially available. The nondestructive Sinclair iQ™ firmness tester was investigated to monitor ripening and predict bruising susceptibility in stone fruit. This work was carried out on four peach, three plum, and five nectarine cultivars over two seasons. The correlations between destructive and nondestructive firmness measurements were significant (p-value = 0.0001), although too low for commercial applications as they varied from r^2 = 0.60–0.71 according to fruit type. Using a different approach, the relationship between destructive and nondestructive firmness measures was characterized in terms of segregating these fruit according to their stages of ripening. This was done by using discriminant analysis (66–90% agreement in ripeness stage classification was observed in validation tests). Discriminant analysis consistently segregated nondestructive firmness measured fruit into commercially important classes ("ready to eat", "ready to buy", "mature and immature"). These represented key ripening stages with different bruising potentials and consumer acceptance. This work points out the importance to relate nondestructive measurements directly to important commercial physiological stages rather than to correlate them with the current standard penetrometer values. Thus, destructive and nondestructive firmness measurements can be directly used to identify the stage of ripeness and potential susceptibility to bruising during postharvest changes. Further work is recommended to evaluate the performance of this nondestructive sensor in segregating fruit according to their stage of ripeness under packinghouse or processing plant conditions.

FUTURE DATES

2007 Variety Displays and Research Update Seminars at the Kearney Agricultural Center, 9240 S. Riverbend Avenue, Parlier, CA. Sponsored by University of California Cooperative Extension and the Kearney Agricultural Center.

8:00 – 9:00 a.m.	Variety display by stone fruit nurseries, breeders and the USDA
9:00 – 10:00 a.m.	Research Update Topic and discussion in the field

Mark your calendars for these dates:

- Friday, May 18 — Summer pruning and fruit corking
- Friday, June 15 — Mites and miticides
- Friday, July 13 — TBA
- Friday, August 10 — Preventing fruit doubles, deep sutures and other disorders

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Upcoming events are posted on the Postharvest Calendar at the ANR website at:
http://ucce.ucdavis.edu/calendar/calmain.cfm?calowner=5423&group=w5423&keyword=&ranger=3650&calcat=0&specific=&waste=yes

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