UNIVERSITY OF FLORIDA
IFAS EXTENSION

Cooperative Extension Service

Institute of Food and Agricultural Sciences

PACKINGHOUSE NEWSLETTER

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All previous and present Packinghouse Newsletters (PHNL) are available on the Internet at the University of Florida's postharvest web site (http://postharvest.ifas.ufl.edu) and can also be accessed through our citrus resources web site (http://flcitrus.ifas.ufl.edu). Newsletters delivered by e-mail may arrive a month before the printed version. To receive e-mail delivery, simply contact the editor (see contact information above).

Effect of Fruit Coatings on Chilling Injury of Citrus

Mark A. Ritenour, Indian River REC, Ft. Pierce

Chilling injury (CI) is a physiological disorder of citrus that is most often characterized by areas of the peel that collapse and darken to form pits (Fig. 1). Less severe symptoms may show up as circular or arch shaped areas of discoloration or scalding. Chilling injury is caused by exposing citrus (especially grapefruit) to low, but non-freezing temperatures (e.g., below 50 ^{o}F for grapefruit). However, fruit can sometimes be held at chilling temperatures without visible injury depending on the physiological condition of the fruit and the application of various postharvest treatments. Refer to the UF/IFAS extension publication, "Chilling Injury of Grapefruit and its Control" (at http://edis.ifas.ufl.edu/HS191) for a more complete description of CI, factors influencing chilling sensitivity, and practices to prevent/reduce the occurrence of CI symptoms.

Fig. 1. Symptoms of CI

Most packer/shippers have optimized their fresh citrus handling procedures so that CI is usually not a problem, even when fruit are shipped at what would normally be chilling injury inducing temperatures. However, we still receive occasional reports of CI on arrivals of fresh Florida citrus. Obvious causes include miscommunication between shippers and equipment operators, or equipment failures resulting in fruit exposure to chilling temperatures. However, there are also other, often subtle, changes in the fruit or postharvest handling practices that result in increased susceptibility to CI. In particular, we have seen several cases where increased CI may be tied to changes in the wax coating used.

How do citrus wax coatings affect CI? Exposure to high CO_2 concentrations (e.g. 10%) reduces CI of citrus. Fruit respiration uses O_2 and gives off CO_2. Covering fruit with a semipermeable film or wax coating slows the movement of O_2 into the fruit and CO_2 out of the fruit so that internal O_2 concentration decreases while CO_2 levels rise. The extent of tolerance that coated fruit have to CI is related to the coating's gas permeability: lower gas permeability results in higher internal CO_2 levels and a reduced tendency to develop CI. Thus, waxes that form a stronger barrier to gas exchange (e.g., shellac) reduce CI more than do waxes that "breathe" more (e.g., carnauba). However, too little gas exchange leads to off flavors (anaerobic respiration) and the development of other physiological disorders (such as postharvest pitting).

The take-home message: When changing the wax coating used for fresh citrus, reevaluate storage and transit temperatures, taking into consideration the gas permeability of the coating. Use of waxes that allows fruit to "breathe" more, often require storage and shipment at warmer temperatures.

Minimizing Postharvest Water Loss from Citrus Fruit

Mark A. Ritenour, Indian River REC, Ft. Pierce
Jeff Brecht and Steve Sargent, UF/IFAS, Horticultural Sciences Department, Gainesville

Fresh citrus fruits are composed of roughly 90% water, which is vital for normal biochemical processes and is responsible for important textural qualities such as firmness. Following harvest, fruit are separated from their source of water. Excessive water loss during handling and storage will accelerate softening and promote the development of stem-end rind breakdown and symptoms of other physiological disorders such as chilling injury. Thus, minimizing water loss after harvest is critical for maintaining fruit quality.

Water loss from fresh citrus fruit occurs through evaporation into the surrounding air. Natural barriers, such as the peel and waxy cuticle covering it, help prevent water loss. Plugs, cuts, and abrasions break these natural barriers and increase water loss. Thus, **reducing injury through careful harvest and postharvest handling is the first step in reducing water loss of fresh citrus.**

However, even undamaged fruit will lose some water during handling and storage. The rate of water loss depends on the fruit's contact with surrounding air and the dryness of the air. At a given temperature, air can only hold so much water vapor. If air is holding all the water vapor it can, we say it is saturated. Relative humidity (RH) is the ratio of actual water vapor content within the air

to the maximum possible water content at a given temperature. Therefore, saturated air is at 100% RH. When the air contains half as much water at the same temperature, the RH is 50%. At a given temperature, **the lower the RH of the air, the faster water is lost from the fruit.** For example, at 60 ^{o}F (16 ^{o}C), increasing storage RH from 80% to 91% reduced water loss in grapefruit by 57%.

Therefore, to minimize water loss, RH should be maintained between 90% to 95% during degreening, and at about 90% during storage and transport. Humidifiers are the most effective means for adding moisture to the air; wetting the floor in storage rooms has some benefit, but also promotes development of decay organisms and is a safety hazard to workers. During degreening or other times when greater than 90% RH is required, bins and containers must be constructed of rigid, water-resistant materials (such as plastic) to prevent container deterioration.

It is also important to consider that **warmer air holds much more water vapor than cooler air**. Or, to put it another way, it takes much less water vapor to saturate cooler air than warmer air. Thus, air at 50 ^{o}F (10 ^{o}C) and 100% RH will only be at about 50% RH after warming to 68 ^{o}F (20 ^{o}C), and 68 ^{o}F (20 ^{o}C) air at 50% RH will be saturated after cooling to 50 ^{o}F (10 ^{o}C). This is why, at the same RH, 'Valencia' oranges held at 38 ^{o}F develop much less stem-end rind breakdown than when held at 70 ^{o}F: warmer air can extract more water from the oranges than colder air at the same RH. Once the fruit are cool, **air movement around the commodity should be minimized.** This allows a thin layer of saturated air (known as a boundary layer) to form around the fruit, slowing water loss. Thus, water loss can be minimized by quickly cooling the product and keeping it at it's lowest safe temperature (minimizing temperature fluctuations) during all handling and shipping operations.

Methods to reduce water loss:

- Handle fresh citrus fruits carefully.
- Harvested fruit should be shaded in the grove and at the packinghouse.
- Minimize time between harvest and waxing, especially during hot, dry, or windy weather.
- Avoid excessive brushing during packing operations. Keep brush speeds below 100 rpm and use automatic wipeouts to prevent fruit abrasion while sitting idle on the brushes.
- Use waxes or other surface coatings, wraps, plastic carton liners, and other packaging to slow water loss.
- Quickly cool the fruit and maintain temperatures at the lowest safe temperature (i.e. non-chilling or freezing temperatures).
- Minimize fluctuations in fruit and air temperatures.
- Reduce fan speeds when fruit are not being degreened or cooled.
- Add moisture to the air through the use of humidifiers to maintain RH at the highest recommended level without causing commodity or container deterioration. This is especially important during degreening when the air is warm and able to hold more water.
- Design cooling systems so that the evaporator coils run within 2 ^{o}F (1^{o}C) of the air temperature. This will minimize dehumidification (condensation forming on the coils).

Forty-Fourth Annual Citrus Packinghouse Day	Indian River Postharvest Workshop
Thursday, September 1, 2005 Citrus Research and Education Center 700 Experiment Station Road, Lake Alfred, FL 33850	Thursday, September 8, 2005 Indian River Research and Education Center 2199 S. Rock Rd. Ft. Pierce, FL 34945
Lunch Sponsor: DECCO/Cerexagri Includes exhibits by more than 30 companies	Lunch Sponsor: FMC FoodTech No exhibitors

Mark your calendars for the Citrus Packinghouse Day on September 1st, and the Indian River Postharvest Workshop on September 8th. Both programs begin at 9:30 AM. The two programs will have different speakers and information.

Packinghouse Day program will include presentations on:

- How to pass a 3rd party food safety audit, with brief information about EurepGap and BRC (British Retail Consortium) requirements. (Keynote speaker **Juan Muniz** with **Primus Labs.**)
- Fruit and Packingline Sanitation (Jan Narciso – USDA/ARS)
- Packinghouse biosecurity (Renée Goodrich – UF/IFAS).
- Citrus Canker Eradication Progress (Division of Plant Industry).
- Use of color separation before degreening (Bill Miller – UF/IFAS).
- Prospects and progress for robotic harvesting of fresh Florida citrus (Tom Burks – UF/IFAS).
- Prospects for good fruit quality this year (Gene Albrigo – UF/IFAS).

Indian River Postharvest Workshop program will include the latest information on citrus canker eradication (Tim Schubert – DPI), packinghouse biosecurity issues (Renée Goodrich – UF/IFAS), and presentations by Juan Muniz (Primus Labs.) covering:

- How to pass a 3rd party food safety audit.
- EurepGap Food Safety Requirements.
- BRC (British Retail Consortium) Food Safety Requirements.

Both programs will offer the same supplemental, training sessions covering:

- Canker decontamination certification from the Division of Plant Industry.
- Packinghouse Postharvest Treatments - Biocides, Waxes, Recordkeeping, Worker Hygiene, and Environmental Safety for Citrus Operations.
- Forklift Driving Safety.

A Certificate of Completion will be awarded to each person completing the training. **Registration is free** for both programs. To register, simply fill out the form below and mail or fax to Jane Wilson, 700 Experiment Station Rd. Lake Alfred FL 33850; 863-956-4631; mjw@crec.ifas.ufl.edu. Visit the UF Postharvest Website (http://postharvest.ifas.ufl.edu) for more information (including program details) or contact Dr. Mark Ritenour at (772) 468-3922, ext. 167 (mritenour@ifas.ufl.edu).

Registration Form

I will be attending:

❑ **Packinghouse Day**
September 1, 2005. CREC Lake Alfred, FL

❑ **Indian River Postharvest Workshop**
September 8, 2005. IRREC Fort Pierce, FL

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Admission - Admission is free. Please return registration form by August 25, 2005 so that we have an idea of the number of participants for each session.

Seminars – Seminars will focus on important issues currently faced by citrus packers such as packinghouse food safety, citrus canker, and biosecurity.

Workshops – workshops will offer training in citrus canker decontamination, forklift safety, and postharvest chemical handling and worker hygiene.

Lunch is **FREE** and will be provided by our industry sponsors:
Decco/Cerexagri – Packinghouse Day
FMC FoodTech – Indian River Postharvest Workshop

Name_____ **Company**_____

Address_____

Phone_____ **Fax**_____ **E-mail**_____

Please indicate which sessions you plan on attending:

❑ Main Session – Seminars 9:30am - 12:00pm

Workshops – about 2 hours each, may be concurrent with seminars (or tradeshow at Packinghouse Day).
- ❑ Forklift Safety (concurrent with seminars).
- ❑ Canker Decontamination Certification (concurrent in the afternoon).
- ❑ Packinghouse Postharvest Treatments - Biocides, Waxes, Recordkeeping, Worker Hygiene, and Environmental Safety for Citrus Operations (concurrent in the afternoon).

Mail or fax completed forms to Jane Wilson, 700 Experiment Station Rd. Lake Alfred FL 33850; Fax: (863) 956-4631; Tel: (863) 956-1151, ext. 1309; mjw@crec.ifas.ufl.edu.