

**FORTIETH ANNUAL
CITRUS
PACKINGHOUSE
DAY**

August 30, 2001

**CITRUS RESEARCH & EDUCATION CENTER
700 Experiment Station Road
Lake Alfred, FL 33850**

**STATE OF FLORIDA--DEPARTMENT OF CITRUS
Lakeland, Florida**

**IN COOPERATION WITH
FLORIDA CITRUS PACKERS**

COOPERATIVE EXTENSION SERVICE

INSTITUTE OF FOOD & AGRICULTURAL SCIENCES

UNIVERSITY OF FLORIDA, GAINESVILLE

REGISTRATION - 8:30 AM

**PROGRAM - 9:30 AM
EXHIBITS - AFTERNOON**

Packinghouse Day Coordinators:

Mark Ritenour, Ph.D. - Program Coordinator

Bill Miller, Ph.D. - Exhibits Coordinator

Renée Goodrich, Ph.D. - Local Arrangements Coordinator

FORWARD

Welcome to the Fortieth Annual Citrus Packinghouse Day! In an effort to continually increase the value of Packinghouse Day, each year we make improvements to justify your time investment. This year we begin featuring a keynote speaker to help address our theme topic. Keynote speakers will bring new perspectives and information concerning issues that are important to Florida's citrus industry. **This year's theme is "Food Safety."** Our keynote speaker this year is Dr. Jim Rushing from Clemson University who will discuss how food safety issues have affected produce industries in South Carolina and what Florida's citrus industry might learn from their experiences.

Local academic and industry presenters will address a number of important food safety issues for Florida's citrus packinghouses. Principles of food safety contained in the FDA's "Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables" will be discussed focusing on their application to citrus packinghouses. Researchers will also provide practical information on how to monitor microbial populations within packinghouses and discuss what "Traceback" means, why is it important, and how it can be implemented in our industry. A representative from Publix supermarket will discuss their food safety requirements for fresh produce suppliers and the Florida Citrus Packers Association will present their views on how issues of food safety are affecting Florida's fresh citrus industry.

Not neglecting other important issues to fresh citrus packers, we have included updates on some exciting work on postharvest decay control and present results on reducing stem-end and breakdown. Finally, with the technology of optical grading and sorting equipment improving, Dr. Bill Miller will discuss economic/labor factors involved in determining

whether or not to invest in such equipment for your packinghouse.

Because of a generous donation from FMC FoodTech, another improvement this year is that lunch is both improved and FREE for the first 200 to register!! Be sure to stop by FMC's exhibitor booth to say thanks! Corporate sponsors for lunch will also be sought in future years to keep lunches free for our participants. Over 30 commercial exhibitors will be on hand to provide valuable information for your business. Check out what they have to offer after lunch. An exhibitor list is provided including the names, addresses, telephone numbers and products sold.

Be sure to stick around for the door prize drawings. Another change for this year is that we will be giving out \$250 in door prizes **DIRECTLY TO THE WINNERS** (not their employer). The only catch is that you have to be present to win. **WE NEED YOUR HELP** to continue to improve Packinghouse Day! Please complete and turn in an evaluation form to give us valuable feedback on how we can improve Packinghouse Day for the future. One of the door prizes will be awarded only to participants who turn in a completed evaluation form.

Mark A. Ritenour
Indian River Research & Education Center
Program Coordinator

PROGRAM

8:30 AM REGISTRATION

9:30 AM WELCOME (10 min.)

Dr. Harold W. Browning, Center Director

Citrus Research and Education Center, Lake Alfred

INTRODUCTORY REMARKS (10 min.)

Dr. Mohamed A. Ismail

Scientific Research Director, Fresh Fruit

Florida Department of Citrus, Lake Alfred

PRESIDING (10 min.)

Mr. Billy Heller, Jr.

General Manager

Heller Brothers Packing Corporation

Winter Garden, FL USA

10:00 AM FOOD SAFETY - James W. Rushing, Clemson University, Coastal Research and Education Center, 2865 Savannah Highway, Charleston, SC 29414 jrshng@clemson.edu

In recent years the primary concern for produce food safety has shifted from pesticide residues to the possibility of contamination with microbial pathogens that cause human illness. Many major fruit and vegetable industries, including tomatoes, strawberries, melons, and several others, have had to cope with outbreaks of illness associated with consumption of fresh products. While reports of outbreaks may be due in part to the improved ability of health professionals to detect, diagnose, and trace illness back to the source, clearly there are concerns about produce food safety that industry and regulatory agencies must address.

South Carolina's fresh produce industries have had a number of unfortunate experiences

with food safety issues. Our fresh-market tomato industry, valued at approximately \$50 million, has twice been implicated in outbreaks of salmonellosis. The first known outbreak of Cyclospora-related illness in the U.S. occurred in S.C., although the source of contamination was later identified to be imported berries rather than local product. More recently, the Food and Drug Administration has isolated human pathogens from cantaloupes and green onions produced in S.C. Most other states have had similar problems. These experiences have motivated us to take a highly proactive approach to the prevention of microbial contamination on our produce.

Presented here is an overview of actions taken within the state to cope with food safety issues. Educational programs have been developed that are directed to all food handlers, including field, packinghouse, and shipping employees, food-service workers, and home consumers. Programs are conducted in English and Spanish. Numerous specialists working cooperatively in regional, national, and international programs have developed food safety management guidelines for all segments of the produce industry. This information is made available to appropriate audiences in ongoing programs. An increased awareness of the causes, consequences, and steps toward prevention of foodborne illness is essential to the safety of our food supply.

Biographical Sketch: Jim Rushing is an Associate Professor of Horticulture and Postharvest Extension Specialist with Clemson University's Coastal Research and Education Center (REC) in Charleston, SC. Jim worked for over 6 years as a technical assistant at the Citrus REC while completing a B.S. in Citrus Production at Florida Southern College (1979). He attended graduate school at the University of Florida, earning his M.Ag. in Fruit Crops (1981) and Ph.D. in Vegetable Crops (1985). In 1991 he moved to Santiago, Chile and was self-employed as a consultant in the fruit and vegetable export industries. He returned to his faculty position at Clemson in 1994 and now has statewide responsibility for postharvest extension activities with the fruit and vegetable industries of S.C.

10:30 AM [PRINCIPALS OF PACKINGHOUSE FOOD SAFETY - Mark A. Ritenour](#),
University of Florida, Indian River Research and Education Center, Fort Pierce, FL

Postharvest researchers and extension specialists have long promoted the importance of

good sanitation practices to reduce postharvest decay. However, in recent years, reported cases of human illnesses caused by fresh fruits and vegetables contaminated with human pathogens has increased, sparking governmental organization and produce buyers to look more closely at risks associated with consuming fresh fruits and vegetables.

In 1997, president Clinton announced a Food Safety Initiative that led to the Food and Drug Administration's (FDA) release of the "Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables," also known simply as "the guide." The good agricultural practices (GAPs) and good manufacturing practices (GMPs) described in "the guide" are not governmental regulations, but retail and produce buyers have begun requiring shippers to follow these guidelines and implement third-party verification. This presentation discusses these guidelines and ways they can be implemented within citrus packinghouses.

Food safety is an integrated concept, involving both pre- and postharvest practices that must be followed from "field to fork." The primary goal is to prevent contamination in the first place; once product is contaminated, it is extremely difficult to remove all the pathogens. The major source of microbial contamination comes from human or animal feces. Other sources of contamination can include foreign materials or debris (e.g. chemicals, metal, glass, wood, etc.) or contaminants from insects, rodents, etc. To minimize contamination keep in mind the following principals:

Water: Use only clean, potable water for all fruit contact. Know the quality of irrigation water and water used on product in the packinghouse; test for bacteria, protozoa and viruses. Do not use open water sources for field washing. Sanitize recirculated water systems and change as often as necessary to maintain sanitary conditions.

Animal Feces, Manure and Municipal Biosolids: Insure that manure is properly treated to reduce microbial hazards when it is used on groves that produce fruit for the fresh market. Take steps to minimize animal access to the fields.

Worker Hygiene: Train employees to follow good hygiene practices and encourage sick employees to stay home. Cover employee wounds so they do not contact the product. Maintain sanitary, well-supplied toilets and sinks.

Packinghouse Sanitation: Design packing facilities so that the dirtiest product is treated outside the packinghouse - keep dirty product separated from clean product. Avoid contact

between fruits, vegetables, bins, etc. and soil. Clean and sanitize harvest and packing equipment, storage rooms, packing areas, bins, storage containers, and loading areas. Handle produce carefully to prevent cuts and bruises that may allow internal contamination. Implement an effective pest control program to keep animals (birds, rodents, etc.) away from the equipment and fruit. Discard fruits and vegetables that fall on the floor and remove cull fruit and debris promptly. Prepare cartons only as needed. Avoid delays in product cooling. Maintain up-to-date packinghouse sanitation records.

Transportation: Insure that all parties understand product and sanitary requirements. Clean and check that equipment is in working order. Watch for incompatibilities of previous or current mixed loads (e.g. previous hauling of animal products). Maintain proper temperature throughout shipment.

Traceback: Document and include product identification so that problem units can be traced back to the specific grove.

10:40 AM MICROBIAL DETECTION AND CITRUS PACKINGHOUSE SANITATION - Steven Pao, Florida Department of Citrus, Citrus Research and Education Center, Lake Alfred, FL.

Ensuring food safety is a common goal shared by all branches of food and agricultural industry. In the citrus industry, packinghouse procedures such as washing and waxing are capable of reducing microbial contaminants on fruit surfaces. These fruit surface treatments when used with adequate fruit handling, plant sanitation, and employee hygiene can effectively protect the integrity of fresh fruit and their products.

Microbial detection methods have long been used in the food industry to monitor processing sanitation and product safety. Regular testing of packinghouse equipment and fruit surfaces may also help to provide useful information to the overall packinghouse sanitation program. Modern techniques of sampling and rapid detection of microorganisms have become more simplified and fairly economical. There are a number of companies which provide sterile sampling devices and rapid detection media for these purposes.

For a successful and meaningful detection, careful planning is needed. Some testing methods can be utilized by a trained in-house staff with very little time and effort; other tests require assistance from a qualified service laboratory. The result of these microbiological evaluations may be used to affirm good manufacturing practices and fruit safety.

Pao, S. and G.E. Brown. 1998. Reduction of microorganisms on citrus fruit surfaces during packinghouse processing. *Journal of Food Protection*. 61:903-906.

Pao, S., C.L. Davis, D.F. Kelsey, and P.D. Petracek. 1999. Sanitizing effect of fruit waxes at high pH and temperature on orange surfaces inoculated with *Escherichia coli*. *Journal of Food Science*. 64:359-362.

Pao, S., C.L. Davis, and D.F. Kelsey. 2000. Efficacy of alkaline washing for the decontamination of orange fruit surfaces inoculated with *Escherichia coli*. *Journal of Food Protection*. 63:961-964.

10:50 AM [FOOD SAFETY - THE ROLE OF TRACEBACK - Renée Goodrich](#),
University of Florida, Citrus Research and Education Center, Lake Alfred, FL

11:00 AM A SUPERMARKET'S APPROACH TO FOOD SAFETY - Clayton Hollis,
Vice President of Public Affairs, Publix Super Markets, Lakeland, FL

With consumers becoming more aware of food-safety issues, it has increasingly become our responsibility as a retailer to ensure the safety of the products we sell. While quality and food safety have always been important to Publix, we've taken that commitment to a new level. Last year we introduced food-safety training throughout the company. It was an initiative that came from the top. It included certification for management and training for associates. Once training was complete, we instituted quarterly third-party auditing at all locations.

As part of our continued commitment to food safety, we implemented a program this year that encourages our produce suppliers to develop food-safety procedure manuals, conduct

self audits and incorporate third-party audits to their operations. We see this program as an opportunity for the suppliers and Publix to save time and money.

We all recognize that competition in the food market has become strong internationally. By making food safety a priority at your company, you are ensuring your position in the market in years to come.

11:15 AM FOOD SAFETY: KEY ISSUES - Billy Heller, Jr., Heller Brothers Packing Corp., Winter Garden and Richard Kinney, Florida Citrus Packers, Lakeland

We will provide an updated evaluation of several key concerns on issues related to food safety and citrus packinghouses, including:

(1) How soon will the trade require packinghouses to adhere to certain minimum food safety requirements? Citrus has a natural barrier (peel) to the introduction of pathogens that may be harmful to consumers. Consequently, the trade has indicated that citrus shipper/suppliers are low on the list in having to meet certain verifiable food safety minimums. Ok, but when? Can you afford to wait? What are your competitors doing?

(2) What will be included in those requirements and how are other citrus regions attempting to meet requirements? The industry has developed a template, minimum requirements for Florida citrus packinghouses. However, other citrus regions have also developed programs for their shippers. An attempt to "marry" various citrus food safety programs is ongoing, to create a generic program that the trade may endorse. A report on this effort and a copy of the "generic document" will be provided at Packinghouse Day. Will a comprehensive food safety program necessarily include practices from the grove to packinghouse?

(3) Where does state and federal rule/law come into play? State and federal food safety regulations apply to all producers/packagers of food. This "base" of information will be helpful in understanding your responsibilities.

11:30 AM POSTHARVEST DECAY CONTROL - SYNTHETIC FUNGICIDES AND NATURAL PRODUCTS - Jiuxu Zhang, Florida Department of Citrus, Citrus Research and Education Center, Lake Alfred, FL

Postharvest diseases of citrus fruit can cause significant economic losses when environmental and fruit conditions are conducive to pathogen infections and disease development. Postharvest losses are usually greater than realized due to added cost of harvesting and handling. Decay control in Florida is implemented as an integrated procedure using synthetic fungicides as the core. However, only three fungicides, thiabendazole (TBZ), imazalil and sodium o-phenylphenate (SOPP), are registered and approved for citrus postharvest treatments. There is no guarantee that these three fungicides will be available for use in the future because of new regulations, pathogen resistance, etc. Within the FDOC-Scientific Research Department, our current approaches in postharvest decay control program are briefly described below:

We continue to search and evaluate new effective synthetic fungicides for postharvest decay control. Janssen Pharmaceutica Inc., which manufactures imazalil, is registering at least one new synthetic fungicide for postharvest decay control and we have been involved in the evaluation phase of the new fungicide. Another synthetic fungicide Abound (Zeneca Inc.) containing an active ingredient azoxystrobin, that is classified as a risk-reduced compound, has been registered for preharvest citrus disease control. We are currently evaluating the potential of Abound for postharvest decay control.

Because of consumers concern about chemical residues on fresh fruit, marketing of chemical-free and organic citrus is expanding, especially in overseas markets. Obviously, alternative approaches for decay control should also be pursued. We are searching and evaluating natural products for postharvest decay control. We have tested some bicarbonate-based products against green mold, and found that two formulations performed effectively against green mold in a simulated commercial application. These products have been registered by Church & Dwight company for disease control. Another new natural product (Messenger) from Eden Bioscience Corporation has been marketed. The active ingredient in Messenger is a protein which elicits or triggers plant defense responses to many pathogens. We are currently evaluating the potential of Messenger for postharvest decay control by the application of Messenger in both preharvest and postharvest stages.

Another alternative approach that we are pursuing is to evaluate and develop biocontrol

agents of postharvest decays. Two biological products, Aspire (Ecogen Corporation) based on the yeast *Candida oleophila*, and BioSave 1000 (EcoScience Inc.) based on the bacterium *Pseudomonas syringae*, have been registered and marketed for commercial applications to fresh fruit for the control of postharvest decays on citrus. However, these two biocontrol products have not been used by the Florida citrus industry due to many reasons. We are working with EcoScience Inc. to assess the feasibility of its products for citrus postharvest decay control. We are also searching for new effective biocontrol agents in our lab at Lake Alfred. We have found that at least one *Bacillus subtilis* strain and several *Bacillus* spp. isolates have good potential for green mold control. Collectively, our research goals on postharvest decay control are to establish an effective, integrated postharvest decay control system for the Florida citrus industry. This system will include physical, chemical and biological methods.

11:40 AM [STEM-END RIND BREAKDOWN OF CITRUS - Huating Dou](#), Florida Department of Citrus, Citrus Research and Education Center, Lake Alfred, FL and Mark A. Ritenour, University of Florida, Indian River Research and Education Center, Fort Pierce, FL

In recent years, stem-end rind breakdown (SERB) of fresh 'Valencia' oranges (*Citrus sinensis*) has been frequently reported at destination markets. High rates of SERB and aging have also been found in fresh grapefruit and have resulted in substantial economic losses. SERB is characterized by the collapse and subsequent darkening of epidermal tissues around the stem end of citrus fruit. A 2 to 5 mm ring of unaffected tissue immediately around the stem (button) is a distinctive symptom of SERB; that area contains no stomata and a thick layer of natural wax on the cuticle.

SERB is more severe on small oranges, when there are delays between picking and packing, or when fruit is held under dry storage conditions. It has been recommended that fruit be packed as soon as possible after harvest and that excessive brushing in the packinghouse be avoided. Our recent studies demonstrate that storage temperature is the most significant factor influencing SERB of 'Valencia' oranges. Fruit stored at 70°F (21°C) with 70±3% relative humidity (RH) had 61% SERB when examined three weeks after packing whereas only 1.3% of the fruit had SERB when stored at 40°F (7°C) for the

same duration and under the same RH. Use of different wax formulations did not result in consistent effects on fruit SERB incidence. Fruit size and harvesting methods (pulling vs. clipping) did not significantly influence the incidence of 'Valencia' oranges with SERB symptoms. It has been suggested that rootstocks, nutrition, and irrigation may influence fruit susceptibility to SERB. However, recent preliminary studies have not found significant effects of these factors on SERB development on 'Valencia' oranges.

In conclusion, to minimize SERB development, especially on fruit known to be susceptible, pack fruit as soon as possible after harvesting, optimize brushing in the packinghouse, and hold fruit at low but non-chilling temperatures with high RH. The current recommended storage temperatures of Florida Department of Citrus are 33-40°F for oranges and 45°F for grapefruit both at 93±3% RH.

11:50 AM EVALUATION OF AUTOMATION FOR FLORIDA CITRUS

PACKINGHOUSES - William M. Miller, University of Florida, Citrus Research and Education Center, Lake Alfred, FL

Industrial automation has been touted as the technological implementation to keep industries in the United States ahead of global competition. Such automation is envisioned as computers, sensors, actuators, and robots executing routine jobs in a highly efficient manner at preset standards for uniformity and quality. In such tasks, automation replaces human labor prone to mental fatigue and physical injury due either to the task requirements or its repetitive nature. Fruit and vegetable production and processing are likely U.S. industries to implement automation due to a high reliance on seasonal labor and stringent food safety regulations. However, such automation usually is associated with large capital expenditures which may be prohibitive in certain citrus operations.

An engineering economic model has been developed to assess one packinghouse automation possibility, i.e., automatic grading with machine vision. Various capital expenditure levels, incorporating savings in fungicides and waxes, were evaluated. Other factors considered were maintenance and operating costs and productivity limitations in manual grading for fruit lots of very low packout. With respect to labor, number of graders replaced by automation as well as inclusion of a skilled operator for automation were

considered. For a \$400,000 expenditure, an 8 grader reduction yielded an equivalent 5-year cost projection. A reduction of 14 graders would be required for a higher level \$800,000 capital outlay.

Other packinghouse operations should be considered also for automation. These include fruit bagging and packing, environmental control in degreening and cold storage, and more extensive carton palletizing. Secondary benefits to automation may include higher pricing through identification of premium product, product traceability for consumers, food safety compliance, and industry uniformity in grade standards.