

49th Annual Short Course for the Food Industry

The International Citrus & Beverage Conference



September 15-18, 2009

**Sheraton Sand Key Resort
Clearwater Beach, FL**

Hosted by:

- University of Florida/IFAS,
Food Science and Human Nutrition Department
- University of Florida, Juice and Beverage Center

www.conference.ifas.ufl.edu/citrus

Welcome to the 2009 International Citrus & Beverage Conference!

This year's conference will focus on the following key issues facing citrus processing and related industries: the global nature of our business, challenges facing the Florida citrus industry, technology in the processing plants, new markets and the research to support them. The impact of greening disease on the citrus industry cannot be overstated, and this year we have dedicated two sessions to discuss its implications. Greening disease topics will include scientific research activities, and the economics of the industry and potential impact on processed citrus products. Our invited speakers, all active in academia, industry and government, were selected because of their depth of knowledge in these pertinent topics and their enthusiasm in sharing their insights. This event will bring together our invited speakers with industry leaders, researchers, technical and managerial personnel, and partners who are actively involved in the food, beverage and citrus industries. We look forward to your participation!

Renée Goodrich Schneider

Program Organizer

University of Florida, IFAS, FSHN
Gainesville, FL

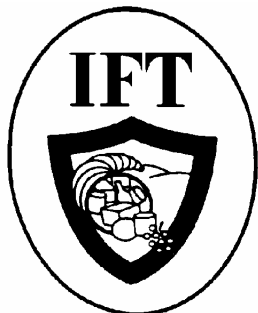


Table of Contents

Welcome Letter	i
Conference Committee	v
Agenda	vii
Abstracts	1
Notes	25

Conference Committee

Liz Baldwin

USDA-ARS
Citrus & Subtropical Products Lab.
Winter Haven, FL

Richard Bogey

Florida's Natural Growers
Lake Wales, FL

Robert J. Braddock

Professor Emeritus
University of Florida
Winter Haven, FL

Jessica Brower

USDA, AMS, FV, PPB
Winter Haven, FL

Michelle Danyluk

University of Florida, CREC
Lake Alfred, FL

Savy DiBenedetto

Coca-Cola North America
Houston, TX

Renée Goodrich Schneider

Program Organizer
University of Florida, FSHN Dept.
Gainesville, FL

Joe Gruber

Enerfab
Ormond Beach, FL

Donald L. Hendrix

Firmenich Inc.
Safety Harbor, FL

David Johnson

Program Chair
Peace River Citrus
Arcadia, FL

Gary Merritt

JBT FoodTech
Lakeland, FL

Keith Schneider

University of Florida, FSHN Dept.
Gainesville, FL

Douglas P. Van Strijp

Southern Gardens

Roger D. Waters

Brown Citrus Systems
Winter Haven, FL

Barry Wilson

Safe Chem Inc.
Zellwood, FL

Alan Wyland

Coca-Cola North America
Apopka, FL

Agenda

Tuesday, September 15, 2009

4:00PM Registration (*until 7:00PM*)

Wednesday, September 16, 2009

7:30AM Registration (*until 5:00PM*)

7:30AM Morning Refreshments

Sponsored by: *Vincent Corporation*

8:30AM **Welcome and Introductory Remarks**

Renée Goodrich Schneider, Program Organizer, UF, IFAS, FSHN

Neil Shay, Department Chair, UF, IFAS, FSHN

Millie Ferrer-Chancy, Interim Dean, UF, IFAS, Office of Dean for Extension

Dave Johnson, Program Chair, Peace River Citrus Products, Inc.

Session 1 – Global Issues and Marketing

Moderator: *Keith Schneider, UF, IFAS, FSHN*

9:00AM **The Citrus Processing and Byproduct Industry of Argentina**, *Victor F. Onchi Navarro*, Brown International Corp. LCC(p. 13)

9:40AM **Citrus Production and Greening in China**, *Fred Gmitter*, UF, IFAS, CREC.. (p. 5)

10:20AM Break

10:40AM **Global Food Safety Standards – an Overview**, *Tatiana Lorca*, Ecosure..... (p. 9)

11:20AM **Healthy Beverages for the Global Consumer**, *Jennifer Zhou*, Firmenich(p. 24)

Session 2 – Marketing Trends and New Products

Moderator: *Alan Wyland, Coca-Cola North America*

1:30PM **Regulatory and Technical Aspects of Stevia Used in Beverages**, *Amy Boileau*, Cargill, Inc. (p. 3)

2:05PM **Consumer-driven Trends in Beverages**, *Kristen Heimerl*, Givaudan Flavors Corporation (p. 7)

2:40PM Break

3:00PM **Functionality and Utilization of Citrus Fiber in Consumer Products**, *Rebecca Miller*, Kansas State University.....(p. 10)

3:35PM **Enriching Beverages with Fiber**, *Adrienne Stucky*, Tate & Lyle.....(p. 23)

4:10PM **Consumer Health and Nutrition Insights**, *Dave Schmidt*, International Food Information Council.....(p. 16)

Wednesday, September 16, 2009 (continued)

4:45PM Florida Section IFT and Citrus Products Division Awards Ceremony

6:00PM Networking Reception (*until 7:00PM*)

Sponsored by:

- *Brown International Corp., LLC*

- *Chemical Systems*

- *Firmenich*

- *Food Equipment & Engineering Co.*

- *Givaudan Flavors Corp*

- *VELCORIN®*, *LANXESS Corporation*

Thursday, September 17, 2009

Session 3 – Processing and Technology Updates

Moderator: *Savy DiBenedetto, Coca-Cola North America*

7:30AM Registration (*until 5:00PM*)

7:30AM Morning Refreshments

8:30AM **Calculating the Carbon Footprint of Florida Agricultural Products,**
Tom Spreen, UF, IFAS, FRE(p. 20)

9:05AM **Citrus Pectin Production and World Market,** *Jan Staunstrup, CP Kelco*(p. 21)

9:40AM **Mexican Lime and Lemon Essential Oils – Production and Utilization,**
Luis Haro, Luis Haro Consulting (p. 6)

10:15AM Break

10:35AM **VELCORIN® as a Processing Aid,** *Riaz Musaheb, LANXESS Corporation*...(p. 11)

11:10AM **Screw Press Operating Hints,** *Bob Johnston, Vincent Corporation* (p. 8)

Session 4 – Grower and Industry Hot Topics – Part 1

Moderator: *Doug Van Strijp, Southern Gardens*

1:30PM **Greening from the Grower’s Perspective,** *Jim Snively, Southern Gardens Citrus Groves*(p. 18)

2:15PM **USDA/South Florida Greening Projects Overview,** *David Hall, USDA-ARS*

3:00PM Break

3:30PM **Controlling the Psyllid – Guava Volatiles and Other Remedies,** *Lukasz Stelinski, UF, IFAS, CREC*(p. 22)

4:15PM **Effect of Greening on Fruit Size and Yield,** *Tim Spann, UF, IFAS, CREC*(p. 19)

Thursday, September 17, 2009 (continued)

6:30PM Dinner & Entertainment (until 8:30PM)

Sponsored by:

- *ENERFAB, Inc*
- *JBT FoodTech*
- *JBT FoodTech FranRica*

Friday, September 18, 2009

Session 5 – Grower and Industry Hot Topics – Part 2

Moderator: *Doug Archer, UF, IFAS Research Administration*

7:30AM Registration (*until 10:00AM*)

7:45AM Breakfast

Sponsored by:

- *Bell Chem Corp.*
- *BioSun Flavors & Food Ingredients*
- *D L Newslow & Associates, Inc.*
- *HT/DcR Engineering, Inc.*
- *Safe Chem Inc*
- *Symrise, Inc.*

8:30AM **Clues to Symptom Development in HLB-infected Fruit through Analysis of Global Gene Expression Change**, *Jackie Burns*, UF, IFAS, CREC (p. 4)

9:15AM **Volatile Changes in Juice from Greening-Affected Fruit**, *Russ Rouseff*, UF, IFAS, CREC(p. 15)

10:00AM **Consumer Sensory Testing of Greening-Affected Products**, *Charlie Sims*, UF, IFAS, FSHN.....(p. 17)

10:45AM **Effect of Greening on the Economy of Citrus**, *Bob Norberg*, Florida Department of Citrus(p. 12)

-and-

Economic Impacts of the Florida Citrus Industry in 2007-08, *Mohammad Rahmani*, UF, IFAS, FRE(p. 14)

11:30AM Adjourn

Speaker Abstracts

Listed in alphabetical order by presenter's name

Regulatory and Technical Aspects of Stevia Used In Beverages

*Amy Boileau*¹ and *John C. Fry*²

¹Cargill Incorporated, Wayzata, MN

²Connect Consulting, Horsham, UK

Stevia is a generic term for extracts from the herb *Stevia rebaudiana* (Bertoni), while the sweet components are more precisely known as steviol glycosides. Stevioside and rebaudioside A are the most prevalent sweet glycosides in the leaf. Commercial interest in stevia has been high for a long time. Regulatory barriers caused by inadequate specifications and unresolved safety questions previously prevented steviol glycoside sweeteners from becoming more widely marketed. Following the completion of ingredient characterization and safety studies by Cargill and The Coca-Cola Company, a generally recognized as safe (GRAS) notification for purified rebaudioside A (rebiana) for use as a general purpose sweetener was sent to the FDA in May 2008. Potential users of steviol glycosides require specific information on potency, taste quality and stability to guide their development efforts. Work has been done to address each of these prerequisites. Stability (hydrolytic and photo) of a sweetener in a beverage system is also an important consideration for regulators. Understanding of the limitations on stability and the identification of degradation products is essential for assuring the safety of an ingredient for its intended use. Today the use of purified rebiana in beverages is increasing. As a dry powder, rebiana is stable for at least 3 years at ambient temperature and controlled humidity. In aqueous solutions, stability is dependent on pH, time and temperature. Rebiana is most stable between pH 4 and 8 and noticeably less stable below pH 2 with decreased stability noted at higher temperatures. Recently, photostability of rebiana was demonstrated in cola (pH 2.4) and lemon-lime (pH 2.6) beverage systems.

Contact Information:

Amy Boileau, Regulatory and Scientific Affairs, Cargill, Inc., 15407 McGinty Road West, MS 163, Wayzata, MN 55391, Tel: 952-742-4262, Email: amy_boileau@cargill.com

Clues to Symptom Development in HLB-infected Fruit through Analysis of Global Gene Expression Change

Jackie K. Burns

University of Florida, IFAS, CREC, Lake Alfred, FL

Citrus Huanglongbing (HLB, also known as greening) is a citrus disease suspected to negatively impact fresh fruit and juice quality. We evaluated gene expression and phytohormone changes in HLB-symptomatic, HLB-asymptomatic and healthy ‘Valencia’ and ‘Hamlin’ sweet orange (*Citrus sinensis*) fruit tissues for clues to symptom development. To determine gene expression changes in fruit flavedo (FF), juice vesicles (JV) and vascular tissue (VT) located below the calyx abscission zone, an Affymetrix sub-genomic array containing 33,879 citrus genes was used. Changes in phytohormones ethylene, auxin and abscisic acid were also investigated. Analysis of gene expression changes and their identities indicated 175, 810 and 1383 genes in JV, VT, and FF, respectively, were altered by HLB infection. Of these, 68 genes were altered in all three tissues. Integration of microarray data sets and organization of gene expression into functional pathways was accomplished using Pathway Studio and Mapman software packages. HLB infection caused extensive changes in pathways of diverse primary and secondary metabolisms, including those involved in light responses, signal transduction, pathogen resistance, wounding and stress, cell wall development, and metabolite accumulation and transportation. In particular, differently regulated transcripts encoding sulfur transporters, flavonoid metabolism, sucrose biosynthesis, and ascorbate- related genes in HLB-infected JV may lead to juice quality impacts. Whole fruit ethylene production and its biosynthetic precursor ACC in FF was significantly higher in healthy compared with symptomatic or asymptomatic fruit. Auxin content was two-fold higher in FF of symptomatic compared with asymptomatic or healthy fruit, however HLB-induced changes were absent in juice vesicle tissues. ABA content of symptomatic and asymptomatic FF was higher than healthy fruit. Changes in phytohormone content suggest a role in HLB-associated changes in fruit shape, size and color development. The results highlight the potential for metabolism shifts and alteration of phytohormone content in HLB affected tissues; the implication for such adjustments on fruit and juice quality changes will be discussed.

Contact Information:

Jackie Burns, Interim Center Director and Professor, Citrus Research and Education Center, IFAS, UF, 700 Experiment Station Rd., Lake Alfred, FL 33850, Tel: 863-956-1151 ext.1215, Fax: 863-956-3579, Email: jkbu@crec.ifas.ufl.edu

Citrus Production and Greening in China

Fred G. Gmitter, Jr.

University of Florida, IFAS, Lake Alfred, FL

China is the center of origin of many *Citrus* species, and the country has a long history of citrus cultivation, going back four thousand years or more. Certain Chinese citrus growing areas have been ravaged by Huanglongbing (aka HLB or “greening”) for more than a century. Despite the challenges presented by this disease, the Chinese citrus industry has continued to survive, and in fact it has expanded substantially in the last decade, now with more area planted than any other country in the world, resulting in second ranking in total citrus production. Part of the successful expansion of the industry and the increasing production certainly can be attributed to the exploitation of growing regions that are sufficiently inhospitable to the Asian citrus psyllid vector of HLB, as well as isolated from regions where HLB has been widespread. However, some major production areas, such as Guangdong, Guangxi, and Fujian provinces, are regions where HLB is a very serious endemic condition; nonetheless there remain profitable citrus industries in these provinces even with the challenges of HLB. Several trips to these areas over the past two years, and visits to a number of citrus orchards (together with local scientists, commercialization experts, production managers, and farmers themselves), have provided insight on the management and production techniques that have enabled the industries to survive HLB and to remain profitable enterprises. Although what has been learned is not all directly transferrable to the Florida industry because of differences in culture, climate, and geography, there are some fundamental principles that can help guide researchers and our citrus industry in developing and implementing strategies and techniques to manage the vector, and thereby the disease, in the Floridian citrus environment. There is a host of factors that appear to influence the impact of disease, and therefore the economic outcome, in HLB-affected regions in China. Among these is the use of cultivars that may be more tolerant of HLB, or cultivars that produce fruit that command very high prices, so profits are achieved in spite of the unavoidable tree and production losses caused by HLB. The precisely targeted psyllid control practices that have evolved over time appear quite effective when implemented on an area wide basis; empirically, the critical times for pesticide application have been determined, and are resulting in a more cost-effective management strategy. The use of pathogen-free young trees for new plantings or resets has become more widely accepted in some areas, despite the higher per tree costs. Maintaining good tree health through focus on optimal nutrition is widely believed to be a critical component in minimizing the impact of HLB in the more successful orchards. Finally, higher planting density and canopy management approaches have beneficial effects on psyllid population levels and on the economics of production overall, with greater yields early in orchard life and better economic returns long-term. This HLB management strategy has enabled the Chinese industry to continue to prosper, and may provide approaches that can be adapted to citrus production in Florida, as well.

Contact Information:

Fred Gmitter, Professor, Citrus Research and Education Center, IFAS, University of Florida, 700 Experiment Station Road, Lake Alfred, FL 33850, Tel: 863-956-1151, Fax: 863-956-4631, Email: fgg@crec.ifas.ufl.edu

Mexican Lime and Lemon Essential Oils - Production and Utilization

Luis Haro

Luis Haro Consulting, Colima, Mexico

Mexico is an important citrus producer. It occupies the world's fourth place in total citrus production with close to seven million metric tons produced in 2007. Due to Mexico's ample climate diversity a wide variety of citrus is grown in the country. Among them limes and lemons have an important place. They are second only after the oranges. For many years Mexico had the world's first place in the production of limes and lemons. It was only superseded by India in 2007. Four main fruits within the lemon and limes group have economical importance: Sweet limes, Persian limes, Mexican limes and lemons. Mexican limes are by far the main crop, followed by Persian limes and lemons. Sweet limes have a minor participation. The amounts produced over the years are graphed so the trends can be visualized. All but the sweet lime show a trend to increase in volume. That of lemon is quite marked. Their geographical distribution, basically along the two coasts: Pacific and Gulf of Mexico is indicated. Their main uses as fresh fruits are described. Only three of them are processed industrially as sweet limes are all consumed fresh. The amounts processed are cited and the processes used for the production of the different types of essential oils are described. Being of recent introduction Mexico supplies only 3% of the world consumption of lemon oil but over 50% of the Persian lime oil. The more mature Mexican lime industry has been supplying around 70% of the world's market for many years. The history of its cultivation spans over three centuries. The oil qualities and characteristics are discussed. As most of the citrus oils their main utilization is as flavoring agent for the soft drinks. Other uses are mentioned.

Contact Information:

Luis Haro, Director, Luis Haro Consulting, Quesería 308-A, Villa de Alvarez, Colima 28976, Mexico, Tel: 523123303898, Fax: 523123303898, Email: lharog@aromasdecolima.com.mx

Consumer-driven Trends in Beverages

Kristen Heimerl

Givaudan Flavors Corporation, Cincinnati, OH

Givaudan FlavorVision(SM) -- Connecting market dynamics and consumer influences to provide insight into what's shaping the global flavor horizon. Gain an understanding of "what's next" in the world of foods and beverages through a journey of 5 global megatrends shaping consumer behavior and preferences today. Walk away with inspirational flavors and trends to fuel new product innovation.

Contact Information:

Kristen Heimerl, Director Sweet Goods, Givaudan Flavors, 1199 Edison Drive, Cincinnati, OH 45216,
Tel: 513-948-5527, Fax: 513-948-5090, Email: kristen.heimerl@givaudan.com

Screw Press Operating Hints

Bob Johnston

Vincent Corporation, Tampa, FL

It was in 1952 that Vincent Corporation manufactured their first screw press. Since that date engineers at Vincent have worked continuously in the development of these machines. Today the firm sells fifty to one hundred screw presses per year.

In the last two years major improvements have been achieved, mostly in the design of the screw, which is the heart of the press. The economical availability of VFD's to drive the presses has greatly facilitated these improvements.

This presentation covers the four major problem areas associated with screw press operation. These areas are addressed in the light of the most recent changes in screw press design.

Contact Information:

Bob Johnston, Engineer, Vincent Corp., 2810 E. 5th Avenue, Tampa, Fl, 33605, Tel: 813-248-2650, Fax: 813-247-7557, Email: bob@vincentcorp.com

Global Food Safety Standards – an Overview

Tatiana Lorca

Ecosure, St. Paul, MN

The Global Food Safety Initiative (GFSI) was founded by the Consumer Goods Forum (formerly the CIES Food Business Forum) in 2000 with a purpose to continuously improve and harmonize food safety management standards. Improvement and harmonization of food safety management standards and their supporting systems has been accomplished through a rigorous benchmarking process where these are compared against the GFSI requirements. The requirements include food safety compliance, auditable criteria, certification, availability and include accreditation requirements. These requirements therefore encompass the minimum expectations all benchmarked system programs are expected to meet. Those successfully completing the benchmark process are formally recognized by the group. Currently, the GFSI recognize four food safety management system programs SQF2000, BRC, IFS, and Dutch HACCP and have given the FSCC 22000 program (includes ISO 22000 and PAS 220) conditional recognition. This session will focus on the benchmark process, recent activities of the GFSI and provide a brief comparison of the food safety standards.

Contact Information:

Tatiana Lorca, Manager, FSQA, EcoSure, Ecolab, Inc., 370 Wabasha St., N, EUC-11, St. Paul, MN 55102-1390, Tel: 540-998-9366, Fax: 540-381-7968, Email: tatiana.lorca@ecolab.com

Functionality and Utilization of Citrus Fiber in Consumer Products

Rebecca Miller

Kansas State University, Manhattan, KS

Bread yield, the quantity of bread that can be produced from a given weight of flour, is of economic importance to commercial bakers. One way to increase bread yield is to increase the amount of water in the final product. Fiber has been used for many years at high levels to increase the dietary fiber content of bread. However, at those high levels, fiber has a deleterious effect on dough and the resulting bread. Recently fiber has been added to food products at low levels for its functional properties. The objective of this study was to determine whether the addition of low levels of citrus peel fiber would increase bread yield.

Low levels of citrus peel fiber dramatically increased water absorption of white pan bread, hamburger buns and gluten-free bread with only a minor increase in mixing time and no noticeable effect on dough handling properties. The resulting bread was significantly larger in volume with no change in crumb grain appearance or gumminess. The increased water absorption resulted in an increased moisture content of the final bread. Thus, the addition of low levels of citrus peel fiber was an effective way to increase bread yield. The yield improvement comes by two mechanisms. The increased water absorption allows the baker to produce more dough from a given weight of dry ingredients at little to no additional cost. In cases where bread products are sold based on size or number rather than weight, the increased volume allows a lower scale weight per piece to get the same size product; thus more pieces from a given weight of dry ingredients.

Contact Information:

Rebecca Miller, Wheat Quality Lab Director, Dept of Grain Science, Kansas State University, 201 Shellenberger Hall, Manhattan, KS 66506, Tel: 785-532-6194, Email: beckym@ksu.edu

VELCORIN[®] (dimethyl dicarbonate) as a Processing Aid

Riaz Musaheb

LANXESS Corporation, Pittsburgh, PA

The goal, now and in the future, for the Food Industry is to manufacture safe, quality and healthy products that taste great for the consumers and the Beverage Industry is no exception. One possible solution to achieve this goal for fruit juice based beverages is:

To process juice beverages with VELCORIN[®] Technology

VELCORIN[®] is an anti-microbial technology that is highly effective in eliminating a wide range of micro-organisms, e.g. *Zygosaccharomyces bailii*, *Lactobacillus brevis*, *Penicillium citrinum* without affecting the taste, aroma or color of the beverage. VELCORIN[®] Technology can be easily integrated into the bottling process, where it is added to the beverage prior to the filler stage. This captures spoilage micro-organisms at the most critical point of the bottling operation. Once added to the beverage, it breaks down in a very short time into products, which are naturally found in fruit juices and therefore, does not have to be declared on the label. VELCORIN[®] Technology is widely used in the wine industry and is in use in over 500 beverage companies across the world.

Where taste, aroma and color are key selection criteria for a beverage of the highest quality, VELCORIN[®] is able to set the ideal platform for a sophisticated and outstanding beverage. VELCORIN[®] Technology has been proven to be a flexible, cost efficient and modern alternative to traditional preservatives, cold aseptic and hot fill bottling technologies. Thereby satisfying consumers' primary key preference, TASTE!

Contact Information:

Riaz Musaheb, Regional Manager, LANXESS Corporation, 111 RIDC Park West Drive, Pittsburgh, PA 15275-1112, Tel: 412-897-6588, Email: riaz-e.musaheb@lanxess.com

Effect of Greening on the Economy of Citrus

*Robert Norberg*¹ and *Mohammad Rahmani*²

¹Florida Department of Citrus, Lakeland, FL

²University of Florida, IFAS, Food and Resource Economics Department, Gainesville, FL

With the discovery of Greening (HLB) in Florida and its subsequent spread through-out the citrus belt the question of economic consequences has been paramount. Since 2003-04 the production of citrus in Florida has declined by 35-40%. A large part of the decline was due to eradication of trees to control the spread of Citrus Canker. Those eradication programs have stopped. However, eradication efforts to control the spread of greening is on-going, trees infected with greening are becoming un-productive, and replanting efforts are not sufficient at this time due to lack of trees and uncertainty regarding the ability to avoid future infection. These facts will prevent Florida production from rebounding to pre-2003 levels and will very likely mean a continuation of smaller crops into the future. Smaller crops will have a direct, negative impact on the citrus economy in Florida. The question is, “How much will crops economic impact decline?”

There is significant work being done today and needed to be done in the future if we are to answer this question. This report will focus on the ongoing work and forecast future scenarios given various assumptions about crop sizes and industry responses, including prices.

It is important to first understand the current situation. The industry is comprised of many facets and those facets have been reacting to citrus disease. Growers, processors and packers and their personnel all contribute to the economic impact of the citrus industry. Dr. Mohammad Rahmani will present his recent calculation of the impact of the Florida citrus industry on the economy of Florida for the crop year 2007-08. A separate abstract for that work follows. The remainder of the presentation will focus on future implications and what needs to be done to alter those consequences.

Contact Information:

Bob Norberg, Deputy Executive Director, Florida Department of Citrus, 1115 E. Memorial Blvd, Lakeland, FL 33802-0148, Tel: 863-499-2503, Fax: 863-499-2436, Email: bnorberg@citrus.state.fl.us

The Citrus Processing and Byproduct Industry of Argentina

Víctor Francisco Onchi Navarro

Brown International, Nuevo León, Mexico

Argentina has been known as the lead Lemon producer and processor country in the world, but lemons are less than half of the total citrus produced in this country. While Argentina is the seventh largest global citrus producing country it is the fourth largest citrus processor in the world after Brazil, USA and Mexico. Being located in the southern hemisphere, Argentina has taken advantage of the counter season citrus production to strengthen their fresh fruit exports. This activity drives the production of sweet citrus (oranges, mandarins and grapefruits) to produce export quality fruit to supply both Western and Eastern Europe, where Eastern Europe is their stronger destination.

This area has had an explosive citrus growing period on their production and process driven mostly by Lemon oil demand, followed in recent years for an adjustment period. Argentina passed from a 37% contribution to the global processed lemons 15 years ago to about a current 50% or more, depending on weather conditions affecting different growing regions around the world. Climate conditions have played an unusual alignment affecting in 2008 most producing Lemon areas around the globe. This has created an unprecedented rise on Lemon byproduct market demand causing great instability on the supply and affecting final consumption by lack of supply. Lemon byproduct reached prices never seen before on this industry. This year, after weather is returning to more regular conditions, an important struggle will be seen for defining what should be a fair market price. Many factors on both supply and demand are affecting a final settlement that can satisfy both sides of the equation. In the second half of this year a freeze in Tucuman, Argentina's main Lemon producing area, is bringing a new condition for price negotiations and a revision for forecasted process volume.

Argentina will be consolidated as the main Lemon producer and processor of the world. Lemon oil is benefiting from resurgence on soft drink market. Lemon juice has come from being a byproduct of Argentina's industry to becoming the main revenue generator. In new applications where lemon juice has been proven to be a good alternative as a natural acidulant used to correct natural deficiencies of fruit juices. Process equipment is being replaced with newer and modern technology. Improved process culture is paying attention to process efficiencies and environment protection and agricultural residues are being closely watched making this region the leader on this safe practice around the world. Sweet citrus juices from Argentina have developed a niche market due to unique specifications resulting from processing fruit based on fresh fruit market needs.

Contact Information:

Victor Onchi Navarro, Sr. Vice President Latin America, Brown International Corporation, LLC, Frontera No. 114, Montemorelos, Nuevo León 67520, Mexico, Tel: 528262632322, Fax: 528622634110, Email: victor.o@brown-intl.com

Economic Impacts of the Florida Citrus Industry in 2007-08

Mohammad Rahmani and *Alan W. Hodges*

Food and Resource Economics Department, IFAS, University of Florida, Gainesville, FL

The total economic impacts of the Florida citrus industry in the 2007–08 season were evaluated using published values for citrus fresh fruit production, processed juices, and byproducts, together with a regional input-output model for Florida. Data were taken from reports by the United States Department of Agriculture/National Agricultural Statistics Service (USDA/NASS), the Florida Department of Citrus, the Florida Agricultural Statistics Service (FASS), the Florida Citrus Processors Association, Feedstuffs Magazine, and quotes from Florida Distillers, Inc. and Peace River Citrus Products. The *IMPLAN Pro* economic impact and social accounting software package, was used to develop a regional input-output model of the Florida economy with adjustments for the citrus industry. *IMPLAN* is an input-output modeling system that enables the estimation of the overall effects of changes in final demand for one or more industries in a defined region through the use of economic multipliers. Four industry sectors in *IMPLAN* were used to analyze the Florida citrus industry: fruit farming (#4), frozen foods (#53), canned fruit and vegetable juices (#54), and wholesale trade (#319). The production function for the fruit farming sector was adjusted based on budgeted production costs reported by Muraro (2007–2008) for cultural programs. Production expenditures were estimated for the major citrus types, and for the production regions in Florida, including both fresh and processed early-season and mid-season oranges, Valencia oranges, and white and red grapefruit in the central, southern, and Indian River regions, respectively.

The total value of Florida citrus fruit based on delivered prices in 2007–08 was \$1.76 billion, with fresh fruit accounting for \$253 million and processed fruit accounting for \$1.50 billion. The total (F.O.B.) value of citrus juices was \$3.45 billion, including \$2.37 billion for chilled juices and \$1.08 billion for frozen juices. In addition to orange and grapefruit juices, the citrus processing industry produces several other byproducts, such as citrus pulp and meal, molasses, and citrus oil valued at about \$136 million. The total output impact of the industry exceeded \$8.9 billion, including \$3.57 billion from citrus fruit for juice production, \$601 million from citrus fruit for fresh market, \$4.32 billion from citrus juice and byproducts, and \$415 million from fresh citrus marketing (packing). The indirect output impacts resulting from purchases of inputs from other industry sectors were \$1.37 billion, while the induced output impacts resulting from consumer spending by employee households were \$3.51 billion. The Florida citrus industry had a total employment impact of 75,828 jobs, including 27,425 jobs directly in the industry, plus 16,967 indirect jobs in allied industries, and 31,436 jobs created by employee spending (induced effect). Total value-added or net income impacts were \$4.62 billion. Labor income impacts amounted to about \$2.77 billion, which represented all wages and salary earnings by industry employees and proprietor's income to business owners. Other property income impacts were \$1.45 billion and indirect business tax impacts to local and state governments were \$310 million. Naturally, the largest impacts occurred in the agriculture and manufacturing groups, where the direct impacts occurred from fruit farming and citrus processing.

Contact Information:

Mohammad Rahmani, Coordinator of Economic Analysis, Food and Resource Economics Department, IFAS, University of Florida, P.O. Box 110240, Gainesville, FL 32611-0240, Tel: 352-392-1881 ext.315, Fax: 352-392-3646, Email: rahmani@ufl.edu

Volatile Changes in Juice from Greening-Affected Fruit

Russell Rouseff¹, Lilibeth Dagulo¹, Filomena Valim³, Michelle Danyluk¹, Renée Goodrich², Charles Sims² and Tim Spann¹

¹University of Florida, IFAS, CREC, Lake Alfred, FL

²University of Florida, IFAS, FSHN, Gainesville, FL

³Florida Department of Citrus, Lake Alfred, FL

The effects of Huanglongbing (HLB), or citrus greening infection on volatile flavor compounds in Hamlin and Valencia orange juices were examined using GC-MS and GC-O. Gas chromatography-olfactometry was employed to detect and characterize aroma active compounds and to search for off flavors. Duplicate studies on three sets of Hamlin and three sets of Valencia juices failed to find a single aroma active off flavor. The aroma profiles of juice from control fruit from infected trees which did not display external characteristics of greening infection were essentially identical to controls. However, juice from fruit displaying external symptoms was different from control juice aroma profiles. The major difference between aroma profiles was quantitative rather than qualitative. The aroma profile of infected fruit juice was similar to that of immature fruit even though the juices were obtained from trees in the same groves from trees of identical age. Esters, especially ethyl butanoate (a key positive aroma component), were 29-87% lower in symptomatic juices compared to control. On the other hand, terpenes (i.e. β -pinene, myrcene, γ -terpinene, were significantly higher compared to control. Linalool, responsible for a floral, citrusy smell was significantly higher in HLB juices. The concentration of valencene, a commonly accepted maturity marker, was also 50-67% lower in symptomatic juice compared to control.

The compound(s) responsible for producing flavor differences in juice from HLB infected and control fruit appear to be primarily associated with apparent immaturity. The reported off-flavor associated with HLB symptomatic juices apparently stem from a lower concentration of sugars, a higher concentration of acid, and “immature” volatile profile, at least under Florida growing conditions.

Contact Information:

Russell Rouseff, Professor of Food Chemistry, Citrus Research & Education Cntr., IFAS, University of Florida, 700 Experiment Station Rd., Lake Alfred, FL 33850, Tel: 863-956-1151 ext.1477,

Email: rrouseff@ufl.edu

Consumer Health and Nutrition Insights

Dave Schmidt

International Food Information Council, Washington, DC

Results from the 2009 International Food Information Council Foundation Food & Health Survey will highlight the impact of the economy and several other factors affecting the diets of US consumers. It also explores motivators for making diet and lifestyle changes and gaps preventing better consumer understanding of food and health. This research gauges consumers' inclination to learn about specific nutrition and health issues. The latest data from IFIC's 2009 consumer survey of US consumer attitudes towards functional foods will be compared to more than 10 years of previous data to determine trends in the US marketplace. Attendees will gain a comprehensive overview of where US consumers are placing priorities in the new economy.

Contact Information:

David Schmidt, President & CEO, International Food Information Council, 1100 Connecticut Avenue, N.W., Suite 430, Washington, DC 20036, Tel: 202-296-6540, Fax: 202-296-6547,
Email: schmidt@ific.org

Consumer Sensory Testing of Greening Affected Products

Charles Sims, Renée Goodrich-Schneider, Tim Spann, Michelle Danyluk and Russell Rouseff
IFAS, University of Florida, Gainesville, FL

Greening (Huanglongbing, HLB) is known to adversely affect citrus tree health and production, but the impact on juice from affected fruit has not been widely reported. The objective of this research was to determine the acceptability of orange juice from fruit harvested from greening-affected trees in order to better understand the flavor changes caused by greening.

Oranges (*Citrus sinsensis*) were collected at 6 harvest dates during the 2007-2008 season, with 3 harvests of Hamlin (mid-season) and 3 harvests of Valencia. The following categories of fruit were collected from each harvest by a citrus horticulturist with expertise in the identification of greening disease: greening-affected fruit (++), non-affected fruit (asymptomatic) from greening-affected trees (-+), and control fruit (--). Juice was expressed from each sample, analyzed for routine quality parameters (Brix, acidity), and frozen for later sensory analysis. During the 2009 season, Valencia fruit (same 3 categories of fruit) were harvested at 2 dates (April, May) and handled in a similar manner to the 2007-2008 fruit. However, a portion of each juice was pasteurized (195F, 12 seconds) prior to freezing to determine if pasteurization affects the differences seen between treatments.

For sensory analysis, consumer panels (n=100) evaluated the 3 juice treatments from each harvest. Panelists rated the overall acceptability, orange flavor, and sweetness on a 1-9 hedonic scale (1=dislike extremely, 9=like extremely). Juices from the 2009 season were evaluated in a similar manner, with panelists evaluation all 6 juices from a harvest (--, -+, ++, both pasteurized and non-pasteurized). Data from each harvest was subjected to analysis of variance and mean separation to determine significant differences between treatments.

For all 6 harvests of the 2007-2008 fruit, greening-affected fruit (++) produced juice that was rated significantly lower for overall acceptability, orange flavor, and sweetness than -+ and -- fruit. Juice from ++ fruit also had lower Brix, higher acidity, and lower Brix:acid ratio than juice from -+ or -- fruit. There were very few differences in consumer acceptability, Brix, or acidity between juices from -+ and -- fruit and no consistent trends.

For the 2009 fruit, there was only a slight difference in consumer acceptability between juice from ++ fruit and juice from -+ and -- fruit at the early harvest (April), and the results were similar for both pasteurized and non-pasteurized juices. At the May harvest, both pasteurized and non-pasteurized juices from the ++ fruit were rated significantly lower in overall acceptability, orange flavor, and sweetness than juices from -+ and -- fruit. There were no significant differences in acceptability between pasteurized and non-pasteurized juices from -+ and -- fruit. The most common comments from the panelists indicated that the juices from the greening-affected fruit were “not sweet enough”, “too sour”, “not enough flavor”, or “bitter”.

In conclusion, greening-affected fruit produces juice that has lower consumer acceptability than juices from control fruit or asymptomatic fruit from greening-affected trees. There were no consistent differences in acceptability between juices from control and asymptomatic fruit, and the differences in acceptability between juices tended to be consistent with both pasteurized and non-pasteurized juices.

Contact Information:

Charles Sims, FSHN, IFAS, University of Florida, PO Box 110370, Gainesville, FL 32611-0370,
Tel: 352-392-1991 ext.211, Email: csims@ufl.edu

Greening from the Grower's Perspective

Jim Snively

Southern Gardens Citrus Groves, Clewiston, FL

Huanglongbing is present throughout all of the commercial citrus growing counties in the state of Florida. As of today Huanglongbing, also known as HLB or Greening, is present in most citrus growing regions throughout the world. HLB has been identified in China, Japan, Taiwan, Vietnam, Cambodia, Indonesia, Thailand, Brunei, India, Malaysia, Bangladesh, Sri Lanka, Philippines, New Guinea, Africa, Saudi Arabia, Yemen, Brazil, and just recently in the Yucatan Peninsular of Mexico. In the United States it has not only been detected in Florida but has also been found in Louisiana.

The disease is spread by an insect known as the Asian Citrus Psyllid. This spread occurs when the psyllid feeds on an infected tree, then digests the disease, moves to feed on a healthy tree, and transmits the disease into the phloem of that tree. This vector is found in all areas where the disease is present. It has also been found in the citrus growing regions of Costa Rica, Texas, and Southern California but at this time HLB has not been found in these areas.

As of today there is no cure for HLB. The only known method is to manage the disease. The management steps recommended today are, to inspect your trees for HLB, remove the infected trees, replant with uninfected nursery stock, and control the psyllid populations to the best of your ability.

At Southern Gardens we have seen our infection rate climb to a peak of 8% in one inspection during 2008. Our cumulative infection rate as of August 2009 is 16.9%. But we are starting to see a down slope in infection rate at two of our groves. We are optimistic that this reduction in infection rate will continue and hopefully stay in the lower range of 1%-2% or less per inspection. We will know more by the summer of 2010.

The biggest concern to the grower today is the economics of managing the disease during the short term. With production cost being \$1,300.00 to \$1,400.00 per acre the average Florida Grower will need to receive \$1.00 per pound solid to break even without any debt or \$1.29 per pound solid to break even with debt. Even with these prices the grower doesn't make anything to put in his pocket.

For the grower to survive and remain viable he will have to be very efficient in all of his practices to maximize production, research will have to develop better tools and or cures, consumption of Orange Juice must increase, and prices to the grower have got to increase to a \$1.25 per pound solid or better.

Contact Information:

Jim Snively, Southern Gardens Citrus Groves, 1820 CR 833, Clewiston, FL 33440, Tel: 863-902-4327, Email: jsnively@southerngardens.com

Effect of Greening on Fruit Size and Yield

Timothy M. Spann, W. Chris Oswald Arnold W. Schumann, and Michelle D. Danyluk
UF, IFAS, CREC, Lake Alfred, FL

Citrus greening disease or huanglongbing (HLB) is a bacterial disease caused by the phloem-limited bacteria *Candidatus Liberibacter* spp. The disease causes phloem collapse which leads to a number of unique symptoms expressed in leaves and fruit of infected trees. Fruit symptoms include small fruit size, misshapen and lopsided fruit, an inverted color change and off flavors in the fruit. Because of the off flavors, it is important to keep greening affected fruit from entering the processing plant where they could destroy large volumes of juice. We hypothesized that there is a significant difference in the fruit size distribution, more heavily weighted to smaller fruit, in greening infected trees than healthy trees. This change in size distribution caused by greening could be used to grade out affected fruit when fruit are harvested from a potentially infected area. Additionally, a load of fruit with a disproportionately high number of small fruit could be an indicator of possible greening infection, thus helping to direct scouting efforts.

Contact Information:

Timothy Spann, Assistant Professor, Citrus Research and Education Center, IFAS, University of Florida, 700 Experiment Station Rd, Lake Alfred, FL 33850, Tel: 863-956-1151, Fax: 863-956-4631, Email: spann@ufl.edu

Calculating the Carbon Footprint of Florida Agricultural Products

Thomas H. Spreen, Puneet Dwivedi and Rene Goodrich Schneider

¹Food and Resource Economics, University of Florida, Gainesville, FL

²Department of Forestry and Conservation Resources, University of Florida, Gainesville, FL

³Food Science and Human Nutrition Department, University of Florida, Gainesville, FL

With the passage of the carbon cap and trade bill in the U.S. House of Representatives, there is increased interests in the role of carbon in agricultural and food production. In this paper, the carbon footprint associated with the production and distribution of not-from-concentrate orange juice is calculated. This calculation considers the entire process of orange production and processing beginning with the tree nursery through grove maintenance, harvest, processing, storage, packaging, and distribution to the consumer. The role the citrus trees play in sequestering carbon is also considered by estimating the biomass associated with an citrus orchard over its productive life.

Contact Information:

Tom Spreen, Professor, Food and Resource Economics, University of Florida, P.O. Box 110240, Gainesville, FL 32611, Tel: 352-392-1826 ext.209, Fax: 352-846-0988, Email: tspreen@ufl.edu

Citrus Pectin Production and World Market

Jan Staunstrup

CP Kelco, Lille Skensved, Denmark

Pectin is a natural component of all edible plant material, located in the plant cell walls and in middle lamella. Pectin gives firmness to the plants and influences growth and water household.

Pectin is one of the most versatile stabilizers available. Its gelling, thickening and stabilizing attributes makes it an essential additive in the production of many food products. It is a hydrocolloid and binds a lot of water resulting in thickening and gelling properties.

Traditionally, pectin was primarily used in the production of jams and fruit jellies - in low as well as high sugar products. Now it is used broader, in bakery products, dairy applications, confectionery, beverages, pharmaceutical and health products. Pectin is a growing industry.

The predominant commercial source of pectin is citrus peel - a by-product of the lemon, lime and orange juice and oil industry. The peel is washed to remove sugars and carefully dried. It is shipped to a pectin plant where pectin is extracted and sold as a dry powder to the food industry.

Other commercial sources of pectin exist, like apple pomace, sugar beet residue, and sunflower heads. However, comparing the availability and the pectin quality obtainable, citrus peel is the best choice.

The process of making dry peel is more complicated than the use of peel for cattle feed (CPP). When making CPP, the peel is mixed with lime in order to degrade the pectin – and thereby release the bound liquid and minimize drying costs.

The recent years focus in the juicing and oil industry has been on improving juice and oil yields. A major obstacle to this is the pectin in the fruit, as pectin increases viscosity of the liquid streams and binds the water.

The use of pectin degrading enzymes is known in the juicing industry for improving yields. However, incorrect use may lead to degradation of the pectin in the peel. CPKelco has long tradition and experience in working with juice producers to get the best possible quality of peel without having negative influence on the juice or oil yield – creating value for both.

Contact Information:

Jan Staunstrup, Research Fellow, CP Kelco, Ved Banen 16, Lille Skensved, DK-4623, Denmark,
Tel: 4556165740, Email: jan.staunstrup@cpkelco.com

Controlling the Psyllid – Guava Volatiles and Other Remedies

Lukasz Stelinski

UF, IFAS, CREC, Lake Alfred, FL

The Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama, is one of the most important insect pests of citrus worldwide. During phloem sap feeding, ACP transmits three phloem-limited bacterial pathogens in the genus *Candidatus Liberibacter*, responsible for huanglongbing (HLB). ACP, a native pest to Asia, was introduced into the U.S. and was first discovered in Florida in 1998; since then it has established throughout the state. HLB was first confirmed in Florida in 2005 and by 2008 it became established throughout the citrus growing areas of Florida. HLB infected citrus trees become unproductive and eventually die threatening the survival of the US\$1.3 billion Florida citrus industry. Our research focuses on ACP and HLB management with a multifaceted approach that includes: 1) investigating the behavior and ecology of this insect vector to identify weak links that can be exploited for pathosystem management; 2) improving effectiveness and economics of current insecticide-based tactics, 3) developing novel and biorational insecticide alternatives, 4) conserving biological control of ACP and other citrus pests, and 5) preventing development of resistance to insecticides.

Contact Information:

Lukasz Stelinski, Assistant Professor, Entomology, CREC, IFAS, University of Florida, 700 Experiment Station Rd, Lake Alfred, FL 33850, Tel: 863-956-1151, Fax: 863-956-3579, Email: stelinski@ufl.edu

Enriching Beverages with Fiber

Adrienne Stucky

Tate & Lyle, Decatur, IL

Despite dietary surveys consistently showing that fiber intake remains below recommended levels across countries, Tate & Lyle's latest consumer research shows a growing awareness of the importance of fiber. In fact, 79% of Americans surveyed believe it is beneficial to their digestive health, a view echoed by 76% of Europeans. A similar figure of 71% responded likewise in a recent broad study in China. More importantly, over two-thirds of Europeans and Americans believe fiber is important to the diet of their children. This trend is reflected in other geographies, although percentages vary slightly.

During 2008, detailed fiber studies were conducted in the United States, Mexico, Brazil, United Kingdom, France and Germany. This followed earlier studies in 2006 about the benefit of functional ingredients, including fiber, in the U.S., UK, France and Germany. Across the countries surveyed, consumers have a positive view of fiber and are looking to add more of it to their diets.

Is it important to add more fiber to your diet? Well 56% of Americans said yes, 53% of Brazilians, and 71% from Mexico agreed. The findings from all countries surveyed indicate that consumers are willing to pay more for a product with fiber and prefer simple, concise labels that clearly show a product's health benefits.

Before fibers can be incorporated into food and beverage products, it's important to understand the characteristics of fiber like solubility, fermentability, and viscosity. Fibers also can differ in the positive and negative physiological effects they produce once consumed.

Attendees will gain the information needed to formulate beverages with fiber that help meet consumer desires for better-for-you products. An example of a beverage with added fiber will be discussed that demonstrates the ease with which fiber, like STA-LITE[®] polydextrose, can be incorporated into beverages and the resulting health benefits.

Contact Information:

Adrienne Stucky, Beverage Scientist, Tate & Lyle, 2200 E Eldorado St, bldg 63, Decatur, IL 62525, Tel: 217-421-2405, Fax: 217-421-2869, Email: adrienne.stucky@tateandlyle.com

Healthy Beverages for the Global Consumer

Jennifer Zhou

Firmenich, Inc., Plainboro, NJ

Hippocrates said, “Let food be your medicine and your medicine be your food.” This statement has never been truer, as consumers increasingly integrate functional foods and beverages into their healthy lifestyles. During this presentation we will explore the global health concerns that consumers are facing and how the beverage industry can meet these needs through functional flavors. Firmenich conducted a consumer survey to find foods and/or flavors that consumers linked with functional claims. Nine relevant claims were included, such as, but not limited to: Boosts Energy, Good for Your Heart, Enhances Beauty, and Relieves Stress. The results not only show which tonalities are perceived to deliver functional benefits, but also how functional flavors have evolved from 2006 to 2008.

Contact Information:

Jennifer Zhou, Marketing Manager, Beverages, Firmenich, Inc., 250 Plainsboro Rd, Plainsboro, NJ 08536, Tel: 609-580-4544, Email: jennifer.zhou@firmenich.com

