

September 10-13, 2019
Clearwater Beach, Florida

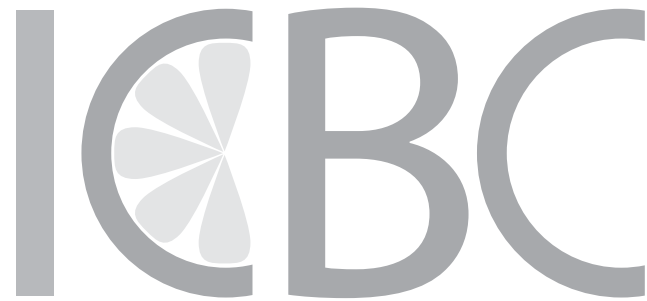
IOBC

International Citrus &
Beverage Conference

UF | IFAS Extension
UNIVERSITY of FLORIDA

FS Human Nutrition
Food Science **HN**
University of Florida





International Citrus & Beverage Conference

September 10-13, 2019

Sheraton Sand Key Resort
Clearwater Beach, Florida, USA

www.conference.ifas.ufl.edu/citrus

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Welcome to the 2019 International Citrus and Beverage Conference

This year's conference will focus on key issues facing our industry, and will span the topics of global juice and beverage operations to the marketing of new and emerging products and ingredients. Please join us for discussions on recent research and consumer insights regarding the beverage category, especially orange juice, the impact of new regulations and technology innovations on our industry, as well as an exciting session on flavor and taste. The Friday morning "Hot Topics" will again focus on research and new approaches to issues facing our industry, including HLB control strategies, both short- and long-term.

Appreciation goes to everyone who has contributed to this year's event. We would like to recognize our committee members, whose expertise within academia, industry and government led to the selection and invitation of our knowledgeable speakers. We would also like to give a special thank you to our invited speakers, who enthusiastically agreed to share their insights and knowledge. Lastly, we would like to express a very heartfelt thank you to our sponsors, whose generosity enhances the value, affordability and uniqueness of this event each year.

We look forward to the next few days of talks and interaction, with opportunities to meet old friends and business contacts and the chance to make new ones. Once again, we hope you will find this conference a rewarding and valuable experience.

Renée Goodrich Schneider

Program Organizer and Professor

UF/IFAS Food Science & Human Nutrition

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Planning Committee

Clarissa Albarran

Brown International Corporation, LLC, Winter Haven, FL

Beto Amador

Firmenich Inc., Lakeland, FL

Elizabeth Baldwin

USDA-ARS, Ft. Pierce, FL

Richard Bogey

Florida's Natural Growers, Lake Wales, FL

Jessica Brower

USDA, AMS, FV, PPB, Winter Haven, FL

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Firmenich Inc., Lakeland, FL

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Savy Quality Review, Inc., Daytona Beach, FL

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Nick Shields

The Coca-Cola Company, Apopka, FL

Linda Staten

USDA-AMS, Winter Haven, FL

Douglas Van Strijp

Southern Gardens Citrus, Clewiston, FL

Yu Wang

UF/IFAS CREC, Lake Alfred, FL

Elizabeth Webb

Peace River Citrus, Arcadia, FL

Barry Wilson

Safe Chem Inc., Zellwood, FL

2019 Agenda

Presenting author names appear in **bold**

Tuesday, September 10, 2019 Registration	
4:00pm - 7:00pm	Registration Open Registered attendees may pick up name tag and program [Sand Key Room]

Wednesday, September 11, 2019 First Day of Sessions	
7:30am - 5:00pm	Registration Open [Sand Key Room]
7:30am - 8:55am	Light Morning Refreshments [Island Ballroom] Sponsored by: • Vincent Corporation
GENERAL SESSION [Beach/Gulf/Palm Rooms]	
Welcome and Introductory Remarks	
9:00am - 9:30am	<ul style="list-style-type: none"> - Renée Goodrich Schneider UF/IFAS Food Science & Human Nutrition, <i>ICBC Program Organizer</i> - Susan Percival UF/IFAS Food Science & Human Nutrition, <i>Department Chair</i> - David Johnson Peace River Citrus Products, <i>ICBC Program Chair</i>
Session 1: The World of Fruit, Juices and Beverages – A Global Perspective	
Moderator: Savy DiBenedetto , Savy Quality Review, Inc.	
9:30am	What's New in Sicily: An Overview of Sicilian Citrus "Specialities" - Chiara Corleone , Agrumaria Corleone S.p.A. <i>(pg.8)</i>
10:10am	Coffee Break [Island Ballroom]
10:40am	Overview of the Citrus Production in Mexico - Ricardo Martinez , Citrofrut SA de CV <i>(pg.9)</i>
11:20am	Sustainable Lemon Industry in Argentina - Alex Nolte , Citrusvil S.A. <i>(pg.10)</i>
12:00pm	Lunch Break (<i>on your own</i>)

Wednesday, September 11, 2019 (continued)	
GENERAL SESSION [Beach/Gulf/Palm Rooms]	
Session 2: Strategic Planning, Marketing and Consumer Trends	
Moderator: Doug Van Strijp , Southern Gardens Citrus	
1:30pm	Orange Juice Outlook, Research and Marketing - Marisa Zansler and Samantha Lane , Florida Department of Citrus <i>(pg.11)</i>
2:05pm	The Future of Grapefruit in Florida - Scott Kerr and Melanie Ressler , IMG Citrus <i>(pg.12)</i>
2:40pm	Coffee Break [Island Ballroom] Sponsored by: ● FGF Trapani
3:10pm	Consumer Insights – the Citrus and Beverage Market - Lisa House , UF/IFAS FRED <i>(pg.13)</i>
3:45pm	The Production and Marketing of Italian Citrus Co-Products - Simona Caratozzolo , Citrofood Srl and Giuseppe Ingrassia , Eurofood Srl <i>(pg.14)</i>
4:20pm	Juice Industry Association Update - Adam Thocher , Juice Products Association <i>(pg.15)</i>
4:55pm	Announcements
5:00pm	Session Concludes
6:00pm - 7:00pm	Networking Reception [Poolside] Sponsored by: ● Astral Extracts, Ltd ● Brown International Corporation, LLC ● Chemical Systems ● CitraSource ● Citrofood ● Citrus Oleo ● Doehler GmbH ● FGF Trapani ● Firmenich ● Florida Chemical Company, Inc. ● Givaudan Flavors Corp. ● Kerry ● Quattro Citrus Products, LLC ● Separator Technology Solutions US Inc ● Takasago International Corporation ● Treatt ● Trisun ● Vita-Pakt Citrus Products Co. ● ZIEMANN HOLVRIEKA GmbH

Thursday, September 12, 2019	
7:30am - 5:00pm	Registration Open [Sand Key Room]
7:30am - 8:25am	Light Morning Refreshments [Island Ballroom]
GENERAL SESSION [Beach/Gulf/Palm Rooms]	
Session 3: Ideas for Industry: From Food Safety to Novel Technologies	
Moderator: Keith Schneider , UF/IFAS Food Science & Human Nutrition	
8:30am	Innovation in Brewing Processes and Novel Beverages - Andrew MacIntosh , UF/IFAS FSHN <i>(pg.16)</i>
9:05am	High Pressure Processing – Technical Considerations - Randy Worobo , Cornell University <i>(pg.17)</i>
9:40am	FSMA – Intentional Adulteration Rule Training and Implementation - Donald Kautter , US Food and Drug Administration <i>(pg.18)</i>
10:15am	Break [Island Ballroom]
10:45am	Blockchain Technology in the Food Industry - Praveen Pathak , UF Warrington College of Business <i>(pg.19)</i>
11:20am	Agricultural Probiotics: Improving Crop Productivity and Soil Carbon Sequestration - Paul Zorner , Locus Agricultural Solutions <i>(pg.20)</i>
11:55am	Lunch Break <i>(on your own)</i>
Session 4: Flavor Technology and Innovation	
Moderator: Nick Shields , The Coca-Cola Company	
1:30pm	Chemical and Microbially Induced Flavor Changes in Thermally Processed Citrus Juices - Russell Rouseff , UF/IFAS CREC (Emeritus) <i>(pg.21)</i>
2:05pm	Leveraging Taste Receptor Technology for Citrus - Andrew Patron , Firmenich <i>(pg.22)</i>
2:40pm	Coffee Break [Island Ballroom]
3:10pm	Sweetness Taste Technology in Beverages - Douglas West , Givaudan <i>(pg.23)</i>
3:45pm	Enhancement of Saltiness with Volatiles - Linda Bartoshuk and Charles Sims, UF/IFAS FSHN <i>(pg.24)</i>
4:20pm	Without Lemons, How Would You Make Lemonade? - Cecilia Pereyra , International Flavors & Fragrances, Inc. <i>(pg.25)</i>
4:55pm	Announcements
5:00pm	Session Concludes
5:30pm - 7:00pm	Networking Reception [Poolside] Sponsored by: <ul style="list-style-type: none"> ● Advanced Logistics LLC ● Citromax ● Flavor Materials International ● International Flavors & Fragrances Inc (IFF) ● JBT Corporation

Friday, September 13, 2019	
7:30am - 10:00am	Registration Open [Sand Key Room]
7:45am - 8:30am	Buffet Breakfast [Grand Ballroom] Sponsored by: <ul style="list-style-type: none"> ● Bell Chem Corp. ● BioSun Flavors & Food Ingredients ● Ecolab ● Marc Neil Soudijn Research Foundation ● Odyssey FoodTrans, LLC ● Safe Chem Inc. ● Winniczuk Family
GENERAL SESSION [Grand Ballroom]	
Session 5: Hot Topics in the Industry	
Moderator: Clarissa Albarran , Brown International Corporation, LLC	
8:30am	CRISPR Technology and HLB-resistance - Fred Gmitter Jr. , UF/IFAS CREC <i>(pg.26)</i>
9:15am	Regulatory Considerations for New Varieties - Kristen Carlson , Florida Citrus Processors Association <i>(pg.27)</i>
10:00am	Pre-harvest Advancements in HLB Control - Tripti Vashisth , UF/IFAS CREC <i>(pg.28)</i>
10:45am	How Would the Scion and Rootstock Affect the Fruit Quality? - Yu Wang , UF/IFAS CREC <i>(pg.29)</i>
11:30am	Conference Concludes

Speaker Abstracts

Listed in order of presentation.

Presenting author names appear in **bold**.

We sincerely thank all speakers for agreeing to share their expertise and work. Our speakers have graciously prepared abstracts and we hope these will be useful to you as a possible source of industry practices. While informative, opinions and recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of UF/IFAS.

What's New in Sicily: An overview of Sicilian Citrus "Specialities"

Chiara Corleone

Agrumaria Corleone S.p.A., Palermo, Italy

Sicily has always been identified as the land of citrus.

It is the largest island in the Mediterranean, a rich territory with strong contrasts and a mild micro-climate that has produced over time citrus fruits of incomparable quality considered throughout the world to be the best of their kind and particularly sought-after for their organoleptic characteristics.

Sicilian producers have always paid great attention to the quality of their fruit, respecting tradition and the needs of the environment and protecting biodiversity. They have adapted to new market needs, specializing in organic and sustainable production, retaining a strong desire to protect their identity and the link with the local environment.

Today Sicily is the Italian region with the largest area of land dedicated to organic agriculture. In total around 360,000 hectares of land in Sicily are classified organic with approximately 11,000 operators involved in the sector. Around 25,000 hectares are dedicated to organic citrus farming. Sicily accounts for approximately 59% of total Italian organic citrus fruit production comprising mainly oranges, lemons and mandarins.

An awareness that in Sicily we deal with a raw material closely linked to the unique characteristics of the territory enables us to distinguish our activities in international markets by producing "specialities" (the Italian term for specialties) rather than "commodities" and led to the birth of a number of PROTECTION CONSORTIA whose function is to highlight and protect these differences with reference, in particular, to the "IGP" ("Indicazione Geografica Protetta" or Protected Geographical Indication) and "DOP" ("Denominazione di Origine Protetta" or Protected Designation of Origin) products such as "Limone di Siracusa IGP" (the IGP Lemon of Syracuse) and "Arancia Rossa di Sicilia IGP" (the IGP Red Orange of Sicily).

The "LIMONE DI SIRACUSA IGP" is considered, in terms of quantity and quality, as the primary point of reference for fresh lemons in the Italian and European markets. The geographical indication "Limone di Siracusa" is assigned exclusively to the Femminello cultivar, which is the most common lemon variety in Italy.

It is cultivated in Sicily in the area around Syracuse, a Sicilian city founded in the 8th century BC with unique geomorphological features which strengthen the link between the territory and the variety.

The "ARANCIA ROSSA DI SICILIA IGP" is another clear example of the close link between climatic factors and the special features of the product. As a matter of fact, the same varieties of oranges cultivated in other climates do not have the particular color and the specific organoleptic characteristics that have made Sicilian red oranges famous all over the world.

The production area is dominated by the Etna volcano and is located in the eastern part of the Sicily between the provinces of Catania, Enna and Syracuse.

The Protection Consortia were born mainly to protect fruits destined to the fresh-fruit market. However, Sicilian citrus fruit processors are also able to benefit from access to the fruit from these Protection Consortia as around 30-40% of production is delivered to processors who appreciate the quality which comes only from the best varieties and is selected according to rigorous standards.

Citrus fruits are processed by companies such as Agrumaria Corleone S.p.A., one of the leading citrus processors in Italy, located in Palermo, the capital of Sicily.

Since 1890 Agrumaria Corleone has been producing citrus juices and essential oils as a family business with entrepreneurial capital and technological growth, competing on international markets and capitalising on the human resources, social and environmental aspects of the area, thus adding value to the quality of Sicilian citrus fruits and assisting in the diffusion of their taste and perfume throughout the world.

Overview of the Citrus Production in Mexico

Ricardo Martinez

Citrofrut SA de CV, Monterrey, Nuevo Leon, Mexico

Mexico plays an important role in the world's citrus industry, both as a producer and processor of a wide range of citrus fruits. Mexico is the leading producer of lime and is gaining a prominent relevance within lemon, grapefruit and orange businesses. Our conversation will provide a historical perspective and analyze the factors that have led to Mexico's citrus production growth. I hope to provide a clear picture of where we are coming from, where we are today and what you can expect from Mexico in the future.

Sustainable Lemon Industry in Argentina

Alex Nolte

Citrusvil S.A., Capital Federal, Buenos Aires, Argentina

From its beginnings, Citrusvil has been committed to the environment and that is why today we are proud to be at the forefront in terms of sustainability in our sector.

This commitment only reaffirms our leadership and encourages us to continue along the same path.

If we do not commit ourselves, we know well that we will have a complex future, far from the one we desire for our coming generations. There is no time left to look the other way, actions must be carried out right away. The damages caused are almost impossible to be repaired but we know that we can stop destroying our planet, each one from their position.

Today we have the opportunity to show the world that we can also grow sustainably, but we need the support of different sectors, as well as our suppliers', peers' and customers'.

We cannot be sustainable one year and not the next one. Being sustainable is a way of seeing the present and the future and it is there that we understand we must continue along this path, despite the obstacles and high costs to achieve it.

Not only must we act, but also live and think sustainably for the sake of the future of our planet.

Florida Orange Juice Outlook, Research and Marketing

Marisa Zansler and ***Samantha Lane***

Florida Department of Citrus, Gainesville and Bartow, FL

The Florida citrus industry has experienced a precipitous decline in production over the past decade due to a combination of factors, chiefly those associated with HLB and the 2017 hurricane season. Despite the challenges faced by the industry, the Florida citrus industry remains a significant contributor to the State and local economies and is a notable supplier of processed orange juice to the domestic market. The Florida orange juice outlook, research, and marketing information is presented in three parts based on the 2018-19 citrus season: (1) An analysis of trends in Florida processor utilization of Florida oranges, imports/exports, orange juice movement, and ending inventories; (2) an overview of U.S. OJ demand and current retail sales trends of orange juice; and (3) an overview of current scientific research being conducted on OJ nutrition and how the FDOC markets OJ to consumers.

The Future of Grapefruit in Florida

Scott Kerr and ***Melanie Ressler***

IMG Citrus, Groveland, FL

IMG Citrus is a grower, packer, and marketer of fresh Florida citrus. We also import summer citrus to offer a year-round program to our customers. Positioned as one of the largest grapefruit growers in Florida we see continued market opportunity for fresh Florida grapefruit. Florida climate and soils offer the unique advantage of producing the best tasting grapefruit in the world and many consumers perceive the superior quality of the "Florida" appellation. Retailers and consumers recognize that Florida grapefruit is sweeter, juicier, and less bitter than grapefruit from other origins and they are ready to pay a substantial premium for Florida. Although fresh shipments of Florida grapefruit are 10% of what they were 20 years ago, world production of grapefruit/pomelo has doubled in the same period demonstrating the existing demand for this inherently healthy product. A niche market remains for Florida to supply consumers who want the best. Lower marketable volumes allows for a targeted market approach, identifying retailers throughout the world who value the Florida origin. In the field we continue to modify and learn how best to produce crops in this new greening environment. Groves are being planted with higher densities using new technologies in fertigation and tree protection. Shorter tree life and heavier capital requirements has changed the grapefruit model however market prices allow for profitability and attractive return on investments. We are seeing success in growing up new grapefruit trees, the challenge remains to produce fruit with the taste characteristics that has made the Florida name. Acquisitions of mature groves allows us to continue to offer great tasting Florida grapefruit to our consumers as our young trees mature. We do not know when, however we believe there will be a solution to greening and we want to stay in front of the consumers in the meantime.

Consumer Insights – The Citrus and Beverage Market

Lisa House

UF/IFAS FRED, Gainesville, FL

This presentation will focus on two different research projects. The first examines the issue of lapsed consumers in the orange juice market. Using data from a monthly survey of orange juice consumers, we investigate what causes someone who indicated they purchased orange juice in the past, but not recently. We then study the question of whether or not the factors that lead a person to lapse, when reversed, would lead a person to purchase again. Although demographics do significantly differ between lapsed and active consumers, we find they don't influence likelihood for lapsed consumers to return to the market in most cases. Not surprisingly, the longer a consumer has lapsed, the less likely they are to return. However, hearing positive media about orange juice did lead to higher willingness to return to the market. These results show that the paths to lapse and return are not symmetric, so companies should not merely focus on what makes a consumer lapse, but how to win them back. In the second study, we examine the impact of information overload in the context of front of package labels and the nutrition facts panel. Using an online choice experiment, we vary the number of labels presented on the front of food packages and allow participants to view the nutrition facts panel. By studying whether or not the participant selected to see the information from the back of the package, along with understanding which product they selected as preferred, we find that front of package labels to affect whether or not a consumer will search for information from the nutrition facts panel. Certain labels may lead to greater search for information, and labels impacted different food products differently. Depending on the impact of the nutrition facts panel on choice for a particular product, companies may consider whether labels on the front will help, or hinder, consumers search for information.

The Production and Marketing of Italian Citrus Co-Products

Simona Caratozzolo and ***Giuseppe Ingrilli***

Citrofood Srl and Eurofood Srl, (respectively), Capo d'Orlando, Italy

Comminuted products are obtained by shredding and homogenization of the entirety of the citrus fruit (pulp, juice, peel, essential oil). It is considered as a valid substitute for concentrated juices and used as a base ingredient for the beverage industry.

The use of comminuted products can enhance aroma in the final product, primarily due to its high essential oil content. Furthermore, comminuted products provide other desirable characteristics such as a natural flavoring and a natural cloudifier. This can be customized: the uniqueness of the product for the customer as juice and flavor percentages can be agreed according to specific parameters technical requirements.

Citrus peel types may be varied, and can be subject to several production processes. The type made with spellalbedo machine; the zest, a small size type; cubes-dices, a defined shape peel type; stripes and last but not least, shredded pulp, a mix of peel and pulp. The latter is heavily used in the marmalade food industry. Products can be produced in both organic and conventional. This talk will further explore the production and marketing of these types of co-products.

Juice Industry Association Update

Adam Thocher

Juice Products Association, Washington, DC

Juice Products Association's mission is to connect members to strengthen the juice products industry; provide a unified voice; serve as the expert resource, enhance industry best practices; and promote consumer benefits of juice products. JPA's Executive Director Adam Thocher will share an update on JPA's work and the progress that we've made in promoting a healthy, vibrant juice industry.

Innovation in Brewing Processes and Novel Beverages

Andrew MacIntosh

UF/IFAS FSHN, Gainesville, FL

Fermented beverages have been around for thousands of years and have been utilized by nearly every culture. These products have become one of the latest food trends, including novel products and great opportunities for innovation. However, as with many trends, genuinely great ideas can be misused through ignorance, and misinformation. This presentation will examine the science, safety and some potential benefits of fermented beverages, as well as opportunities and challenges for the industry.

High Pressure Processing – Technical Considerations

Randy Worobo

Cornell University, Ithaca, NY

The trend of non-thermal processing in the juice and beverage continues to rapidly increase. As dictated by various regulations, 21 CFR 120, 21 CFR 117, and 21 CR 114, there are requirements to meet specific pathogen reductions, and even proof that pertinent pathogens do not show growth over the length of shelf life, and longer. There are important factors that must be taken into consideration when performing pathogen validation studies, these include: duplication of processing conditions (pressurization, product temperatures, chamber fluid temperatures, hold times and temperatures), pathogen strain selection and inocula preparation, inoculation and sampling times. This presentation will provide an overview of important validation requirements, as well as critical factors in product formulation to meet the regulatory requirements and provide a safe finished product.

FSMA – Intentional Adulteration Rule Training and Implementation

Donald Kautter

US Food and Drug Administration, College Park, MD

Food Defense is the effort to protect food from acts of intentional adulteration (IA). In May 2016 FDA issued the final rule on Mitigation Strategies to Protect Food Against Intentional Adulteration with requirements for covered facilities to prepare and implement food defense plans. The IA rule applies to the owner, operator, or agent in charge of a domestic or foreign food facility that manufactures/processes, packs, or holds food for consumption in the United States and is required to register under section 415 of the FD&C Act, unless one of the exemptions provided in 21 CFR 121.5 applies. While this is the first time that companies are required to create a food defense plan, the FDA has taken an approach similar to Hazard Analysis Critical Control Point (HACCP) system, an approach adopted by industry for the identification, evaluation and control of food safety hazards. The FSMA rules advance and strengthen those safeguards. Each covered facility is required to prepare and implement a food defense plan. This written plan must identify vulnerabilities and actionable process steps, mitigation strategies, and procedures for food defense monitoring, corrective actions and verification. A reanalysis is required every three years or when certain criteria are met.

FDA also acknowledges that this is new regulatory territory for the industry and for the regulators. FDA has developed an implementation strategy for this regulation that reflects upon these facts. We have identified an approach that combines a high level, broad scale strategy for verifying that covered facilities have drafted and are maintaining food defense plans – the food defense plan Quick-Check inspections, coupled with a focused and risk-based facility inspection program to identify facilities with elevated food defense concern and to determine if those facilities are implementing appropriate mitigation strategies to protect the public health from acts of intentional adulteration – the Comprehensive inspections.

To support understanding and compliance of and to the regulation; FDA has published numerous guidance documents related to this regulation. In addition, numerous training modules are now or will soon be available for implementation of the regulation. FDA has established an Intentional Adulteration Subcommittee with the Food Safety Preventive Controls Alliance to develop food defense training resources for industry and regulators alike. Finally, The FDA FSMA Food Safety Technical Assistance Network is operational and provides a central source of information to support industry understanding and implementation of FSMA. Questions submitted online or by mail will be answered by information specialists or subject matter experts.

Blockchain Technology in the Food Industry

Praveen Pathak

University of Florida, Warrington College of Business, Gainesville, FL

Unlike traditional technologies blockchain technology is decentralized which means there is no single point of failure. Blockchain transactions are peer to peer. Hence it avoids the need for a third party to verify such transactions. At the same time the two parties involved in the transaction can verify that the transaction is authentic. Blockchain can be implemented in a public domain where anyone can see and trace the transactions. Or it could be implemented in private domain where only select actors are allowed access to it. Thus, blockchain technology affords transparency with pseudonymity. Once transactions are recorded on blockchain it is nearly impossible to reverse them. Each transaction is linked with transaction that came before it and it would take a bad actor to control more than half of the blockchain nodes to alter transactions without getting detected. Blockchains can also implement “smart contracts” that enables automated execution of processes when certain pre-specified conditions are met.

We will present the potential of blockchain technology to optimize supply chain, reduce fraud by improving traceability, and efficiently handle payment processing.

Agricultural Probiotics: Improving Crop Productivity and Soil Carbon Sequestration

Paul Zorner

Locus Agricultural Solutions, Solon, OH

We live in a world whose functional chemistry is mediated by microbes. Human health is mediated by our gut microbiome. Multiple aspects of plant vigor, crop yield and plant immune health are dependent on a diverse and healthy root microbiome mediated by metabolic signaling between microbial and plant genomes. Plants literally exude from their roots about 30% of the sugars synthesized during photosynthesis to build and nurture this complex metagenomic community. However, despite the importance of microbes to crop productivity, agriculture has had a difficult time broadly adopting live microbials to help naturally improve productivity because current extended manufacturing processes and supply chains result in extensive loss of microbial potency, and thus can result in inconsistent product performance. Locus Agricultural Solutions® has created a unique distributed production process to deliver fresh, customized “probiotic”-based solutions to support creation of more naturally balanced crop ecosystems that result in increased crop productivity, reduced chemical inputs and increased soil carbon sequestration which in turn helps mitigate atmospheric greenhouse gas accumulation. The company initially focused on the Florida citrus market, which is a \$9 billion industry and employs nearly 76,000 Floridians but whose groves are being decimated by Citrus Greening Disease. Locus Ag’s soil amendment is currently used on over 25,000 Florida citrus acres and has shown an ability to stimulate significant increases in fibrous root mass, crop canopy density, fruit size, fruit brix and ultimately yields increased over the previous year of as much as 30% after the first full year of treatment. The soil amendment has also been shown to decrease soil nitrous oxide emissions by as much as 85% and elevate soil carbon sequestration by over 4 MT CO₂e over grower practice. The mechanisms proposed to be supporting these results include microbial quorum sensing and a much improved ability of the citrus tree to serve as a “carbon pump”. Microbial agriculture has great potential to serve the citrus community globally to help support the economic success of communities and organizations producing citrus while also contributing to a cleaner, environmentally balanced environment.

This improves economic agricultural productivity, creates a cleaner environment and also provides local communities with greater control over key inputs important to local crop production. This helps a variety of people and businesses and contributes to more self sufficient and economically stable rural communities through the ability to more profitably and sustainably produce food and fiber, while fighting climate change.

Locus AG’s production technique requires the construction of local fermentation facilities, and current plans are to build the next center in Florida. This new production facility will help bring additional jobs to the state, improve the local economy and expand the available inventory of Rhizolizer treatments to additional growers.

The company’s business model and production approach is also easily and cost-effectively scaled to address challenges of any size—from local to global—creating an opportunity to help people and businesses around the world. In a little over a year since commercialization, Rhizolizer availability has already expanded to 33 states, with treatments on more than 30,000 acres across two dozen crops. With more than 2 million agriculture farms located in the U.S., and a \$5 trillion global food and agriculture market, there are endless opportunities for expansion and a massive market of businesses and employees that can benefit from this technology.

The system is a powerful economic engine that empowers us to help build and support natural assets - be those vines, groves or soil. Rhizolizer™ was launched commercially January 2018, is OMRI certified, registered in 39 states, and has shown significant and consistent positive impact on crop yields, crop quality and reduced production cycles on multiple crops. Rhizolizer also amplifies soil carbon sequestration over grower practice by up to 4.4 MT CO₂ equivalents/acre/year and is the foundation of a significant corporate initiative to increase agricultural soil carbon deposition, drive adoption of regenerative practices and create additional grower income streams.

Chemical and Microbially Induced Flavor Changes in Thermally Processed Citrus Juices

Russell Rouseff¹, Michelle Danyluk², and Yujiao Cheng³

¹UF/IFAS CREC (Emeritus), ²UF/IFAS CREC, and ³CRI Southwest University China

Citrus juices are traditionally processed to reduce microbial populations and inactivate enzymes as a food safety requirement. Thermal heating is the most economical way to accomplish this. However, heating causes certain chemical reactions to occur and many of them impact the flavor of citrus juices negatively. Some of the most potent flavor changes are due to the formation of sulfur volatiles from flavorless amino acid precursors. The formation of sulfur based off-flavors such as methanethiol and dimethyl sulfide as well as the thermal formation of the positive grapefruit character impact volatile, 1-p-menthene-8-thiol will be discussed. Finally, the off-flavors produced from thermophilic bacteria such as *Alicyclobacillus*, will be presented as well as ways to minimize their formation.

References

Danyluk, M. D., Friedrich, L. M., Jouquand, C., Goodrich-Schneider, R., Parish, M. E., & Rouseff, R. (2011). Prevalence, concentration, spoilage, and mitigation of *Alicyclobacillus* spp. in tropical and subtropical fruit juice concentrates. **Food Microbiology**, 28, 472-477.

RuizPerez-Cacho, P., Mahattanatawee, K., Smoot, J. M., & Rouseff, R. (2007). Identification of Sulfur Volatiles in Canned Orange Juices Lacking Orange Flavor. **Journal of Agricultural and Food Chemistry**, 55(14), 5761-5767.

Leveraging Taste Receptor Technology for Citrus

Andrew Patron

Firmenich, San Diego, CA

When we consume food or beverages, the ingredients within these products are exposed to taste receptor cells located in taste buds on the surface of the tongue. These interactions are directly responsible for the perceived tastes, such as sweet, umami, bitter, sour or salty. Humans have evolved to detect bitter substances through 25 different bitter taste receptors. Using cell based assays, at least 22 of these receptors have now been functionalized. Surprisingly a single bitter taste receptor can be activated by many chemically diverse ligands and, conversely, a specific bitter ligand can activate multiple bitter receptors. Firmenich has utilized a classical discovery paradigm for the identification and development of potent bitter receptor antagonists that can potentially serve as FMPs for the food, beverage, and pharmaceutical industries. This presentation will focus on how we can utilize this technology to address specific needs in the area of citrus.

Sweetness Taste Technology in Beverages

Doug West

Givaudan, Cincinnati, OH

Sugar has played a major role in the way that consumers perceive and appreciate beverages for as long as they have been around. The management of calories by consumers has been of great interest for decades and the replacement of sugar with sweetness alternatives has evolved over time. With the expansion in the desire for "clean label" products led by Natural products, the management of calories moved from simply what tastes the best to what tastes the best with the most appealing product label. While pleasing consumers is the most critical task, pressure from regulators, advocacy groups, bloggers, etc. has affected the approach to sweetness and calorie management. Sensory testing has led the way when looking to nature for technology which can replace sugar with ingredients which have the sweetness intensity and sugar flavor cues which provide consumers with complete product satisfaction. The testing and approach to the eventual goal of replacing sugar is technology which has progressed greatly in the last 20 years and has provided profiles which are appealing to consumers and provide labeling which consumers accept. The testing and strategy around delivering sweetness without using sugar will be discussed.

Enhancement of Saltiness with Volatiles

Linda Bartoshuk and *Charles Sims*

UF/IFAS FSHN, Gainesville, FL

Volatiles are perceived in two ways: orthonasally (sniffed, smell) and retronasally (through the mouth, flavor). Some volatiles (perceived retronasally) interact with taste messages in the brain. The earliest studies were done on volatiles that interacted with sweet; by 2012, about a dozen volatiles had been identified that could enhance perceived sweetness. Subsequent studies at the University of Florida on a variety of fruits revealed a much larger number of sweet-enhancing volatiles than previously known. The set of such volatiles in each fruit tends to be unique; the total now identified is about 100. The effect of any one sweet-enhancing volatile is very small; however, the effects add. Even within a given fruit type, variation in the number of sweet-enhancing volatiles can more than double the sweetness of a given fruit depending on the number of such volatiles present. Combinations of the volatiles are tested by adding them to sucrose solutions. For example, combining volatiles from tomatoes and strawberries nearly doubled the sweetness of 2% sucrose. The potential magnitude of sweet enhancement produced by adding these volatiles across many different fruit types is still unknown.

Study of volatiles that can enhance perceived saltiness began later than those for sweet and have not progressed as far. The University of Florida studies are using a new technique to identify foods/beverages that contain salt-enhancing volatiles. Informally called the “nose-bump” technique, it utilizes our ability to prevent retronasal olfaction by pinching the nostrils shut. For example, pinch the nostrils closed, put a stimulus in the mouth and swallow it, noting the intensity of the salty taste. Open the nostrils and note any change in the salty taste. When the stimulus is pure NaCl, there is no intensification of the salty taste when the nostrils are opened. On the other hand, repeat this with ham; the salty taste nearly doubles. The next step in this research is to identify the salient volatiles in ham and test these in a pure NaCl solution. This intensification of salty taste results because opening the nostrils allows volatiles to move from the mouth, behind the palate to the olfactory receptors. The input from olfactory receptors enhances the sweet message in the brain by a mechanism still unknown. Adding salt-enhancing volatiles to foods will increase the perceived saltiness of the foods without adding sodium.

Without Lemons, How Would You Make Lemonade?

Cecilia Pereyra

International Flavors & Fragrances Inc, Dayton, NJ

Consumers are shifting at a pace never seen before. What will our brave new food of tomorrow smell, taste, feel, touch and sound like? Catch a glimpse into the future of the sensorial renaissance, regenerative design and the new reality of trust and transparency. How will customization, experience, and regeneration change the needs of our industry? While there are no future certainties, macro trends and long-term drivers of change in society help shape future operating environments. Long, medium, and short range shifts are pivotal to the development of long-term strategic decision making. IFF Futures is the framework and language around their significant research into trends shaping the global food industry of the future. At this year's conference, Cecilia Pereyra, Global Marketing Manager, will be sharing "IFF Futures: A Pantopic Approach". IFF Futures is a tool for embracing uncommon sense, one that helps us see the world from a new perspective, and challenge us to create what's next. Embark on a journey of the senses and re-imagine the possibilities of tomorrow.

CRISPR Technology and HLB-resistance

Fred G. Gmitter Jr.

University of Florida, Citrus Research and Education Center, Lake Alfred, FL

Genome editing, particularly using CRISPR technology, has become part of the common contemporary vocabulary, even outside of scientific circles. It has been hailed as a revolutionary new genetic technique that holds great promise to attack some of the most important and difficult challenges in human health and agriculture; of specific interest to the global citrus industry is its potential to provide a pathway to development of durable resistance to Huanglongbing (HLB). Genome editing technology, indeed, is a powerful approach to alter targeted traits in any living organism, but as is the case with most new developments in science, there is some degree of misunderstanding, apprehension, excessive expectation, and controversy in the general public. The recent editing of human embryos by a scientist in China has brought even greater scrutiny of the technology to the fore. This talk will focus on the basic elements of the technology, to describe in simple terms how it works and what is required for its use. The differences between genome editing by CRISPR and genetic engineering or genetically modified organisms (GMOS) will be clarified. Several examples of current successes in agriculture will be presented, to illustrate the potential power of the technology, as well as to highlight some of its limitations. Finally, consideration of its role in future developments of HLB-resistant citrus trees will be made.

Regulatory Considerations for New Varieties

Kristen Carlson

Florida Citrus Processors Association, Tampa, FL

Just when we thought that the named fruit in standardized orange juice products in the U.S. and around the world was a closed question, enter those pushy inter-specific citrus hybrid disrupters. The scientific community no longer views *C. sinensis* as a true species and a solution to HLB may only come in the form of new HLB tolerant hybrid trees (developed through traditional breeding techniques or gene-editing). If any emerging HLB tolerant plant materials have orange-like fruit with good orange juice quality, a place at the table will need to be set for these newcomers. Currently, fruit from inter-specific hybrid trees cannot be used in standardized juice products due to standards limiting product definitions to sweet orange i.e. *Citrus sinensis*). In order for growers to have confidence to plant any new inter-specific hybrid plant materials that may be developed and for processors to buy this fruit and use it without restriction, necessary regulatory changes should be in place by the time any commercial plantings begin.

Pre-harvest Advancements in HLB Control

Tripti Vashisth

UF/IFAS CREC, Lake Alfred, FL

Huanglongbing (HLB; citrus greening) is a serious endemic citrus disease caused by the bacterium *Candidatus Liberibacter asiaticus* (CLas). About 80-90% of citrus trees in Florida are estimated to be infected, resulting in >70% decline in citrus production over the last decade. Fruit from HLB-affected trees are often of poor quality with non-uniform peel color, lopsided, and small size. In addition, symptomatic fruit have an off flavor and higher acidity, which makes them less desirable or unmarketable. We are conducting number of field trials to evaluate the effect of mineral nutrition on fruit quality and postharvest storage life of HLB-affected mandarin and sweet oranges. We have found that good mineral nutrition program for the HLB-affected citrus can improve fruit size, quality, and post-harvest storage. The presentation will focus on a HLB tolerant mandarin 'LB8-9' study. A field study was conducted to evaluate the effect of preharvest foliar applied mineral nutrients (K, Ca, B, and combinations) on postharvest storage life and fruit quality of HLB-affected mandarin trees. Ten-year-old, 'LB8-9' trees grafted on Swingle rootstock, and exhibiting mild HLB symptoms were used in this study. Eight foliar applied nutrient treatments are as follow: control (grower standard), K, Ca, B, K+Ca, K+B, Ca+B and K+Ca+B. Treatments were applied at three time points (July, September and October) in 2018. Potassium nitrate, calcium nitrate and sodium borate were used as mineral nutrient sources for K, Ca and B respectively. Randomized complete block design with four replications was used and each replicate consisted of three trees. Following harvest, fruit were stored at 25 °C with 85% relative humidity for 21 days. With K+B treatment, fruit weight, diameter, peel color 'a' and 'hue' values were increased compared with the control. Fruit compression force and peel color 'b' value were higher with Ca treatment than other treatments. Sensory evaluation using the general labeled magnitude scale showed higher scores for mandarin flavor intensity and sweetness, and lower scores for sourness in K- and B-treated-fruit compared with the control fruit. Overall, K and B separately and in combination improved the fruit quality attributes of HLB-affected 'LB8-9'.

How Would the Scion and Rootstock Affect the Fruit Quality?

Yu Wang

UF/IFAS CREC, Lake Alfred, FL

Flavor is the # 1 driver of juice purchase. Flavor perception integrates sensory input from chemical receptors triggered by taste- and aroma metabolites to contribute to food flavor quality. Many factors alter flavor quality and then affect fruit quality and fruit/juice consumption. Various scions and rootstocks have been developed to be HLB-tolerant. In order to develop more scions/rootstocks not only HLB-tolerant/resistant but also providing good flavor quality, we will mainly discuss how the scion and the rootstock would affect the fruit flavor (i.e. sweet orange, mandarin and lemon flavors etc.) in this talk and the relevant metabolites will be discussed as well.

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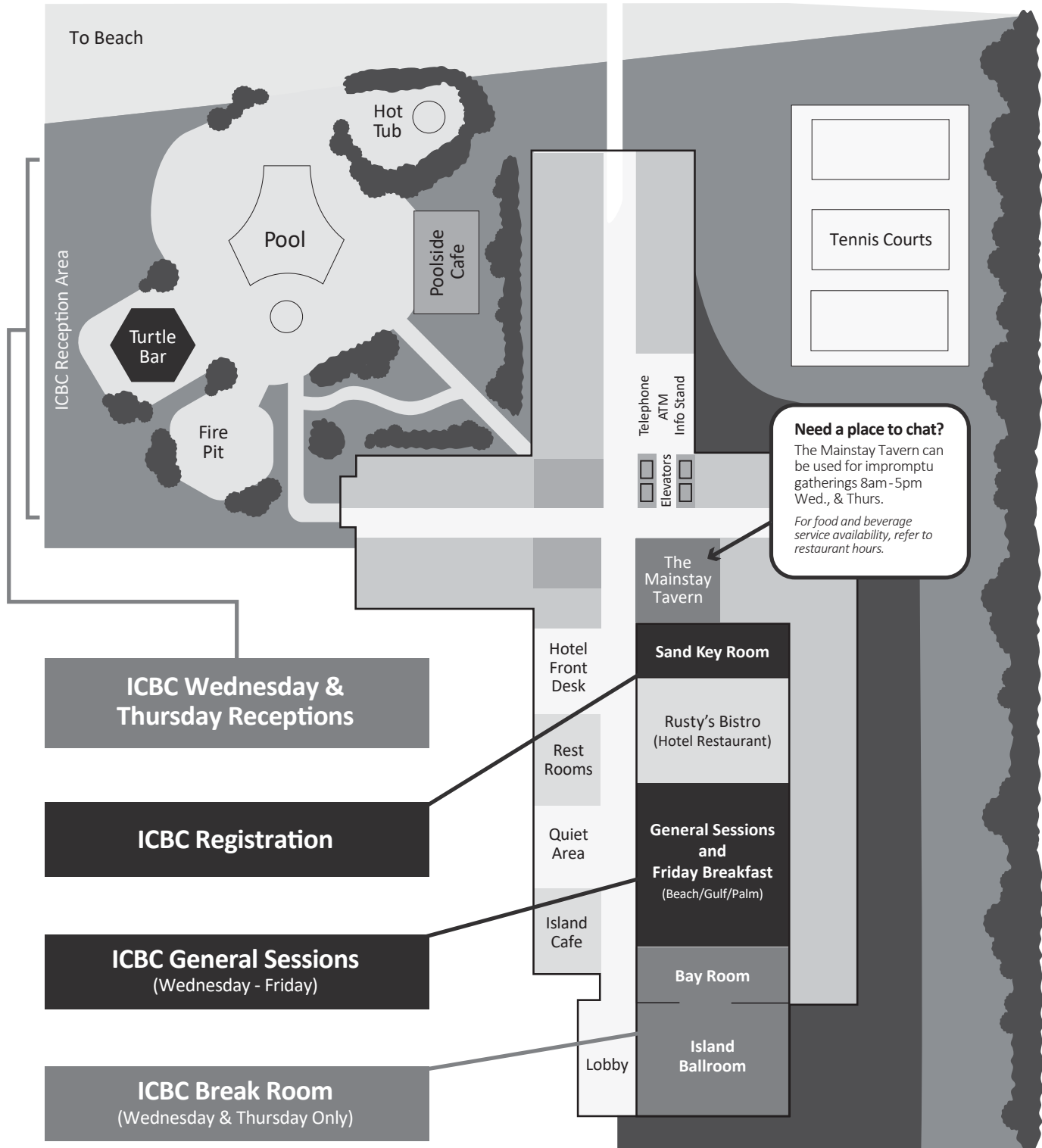
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Friday Breakfast



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