

**U.S. CITRUS AND SUBTROPICAL PRODUCTS LABORATORY
600 AVENUE S, N.W.
WINTER HAVEN, FLORIDA 33881**

PUBLICATIONS AND PATENTS

VOLUME VI

2004-PRESENT

**U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURE RESEARCH SERVICE
SOUTH ATLANTIC AREA**

A LIST OF PUBLICATIONS AND PATENTS WITH ABSTRACTS REPORTING RESEARCH
CONDUCTED AT THE U.S. CITRUS AND SUBTROPICAL PRODUCTS LABORATORY
WINTER HAVEN, FLORIDA

SOME MAJOR ACHIEVEMENTS OF THE LABORATORY

Frozen concentrated orange juice (FCOJ). This laboratory developed the original FCOJ process for commercial application. The facilities at that time were located at 500 3rd Street, S.W., and designated as the U.S. Citrus Products Station which had been established in 1931. During World War II research emphasis shifted to national defense needs and in 1942 the staff was augmented by research workers of the Florida Citrus Commission. In quest of a high-quality orange juice that contained less water and could be shipped long distances with less weight and space, the process for FCOJ was developed and became commercial within the next few years. The researchers from the Florida Citrus Commission and USDA who worked on this project were presented a USDA Distinguished Service Award in 1952. The original patent for the process is listed in Volume I of laboratory publications.

Dehydrated citrus products. This laboratory pioneered the development of several types of citrus dehydration processes, including freeze-drying, vacuum foam drying, and foam-mat drying processes. Dehydrated citrus products developed here included instant orange juice for space and undersea explorations, orange juice tablets and dried orange segments.

Canned single-strength juice. This laboratory pioneered the development of canned single-strength citrus juices which served as the main focus of research programs during the 1930's. Some of the first studies made concerning different types of packaging and their suitability for single-strength citrus juices, and later for frozen concentrated juices, were carried out here.

Waste disposal problems. Research projects have developed systems for recovering materials from waste streams and easing problems of waste disposal at citrus processing plants. Related studies led to development of new or improved citrus by-products such as flavoring oils, essences, pulp, animal feed and ethanol.

Fresh peeled citrus. Personnel at this laboratory developed and patented a vacuum infusion process for peeling fresh citrus fruit with commercial food grade enzymes. The process is being used in several plants throughout the world to produce fresh whole peeled orange and grapefruit, and fruit segments.

Edible coatings. Research at this laboratory has led to the development of numerous new coatings for whole fruit and fruit pieces. These include a patented edible coating licensed for prolonging shelf life of fresh fruit and vegetables, and new wax coatings for citrus fruit which can significantly extend shelf life and quality.

Flavor studies. The laboratory currently has a balanced research program studying fundamental aspects of flavor, quality of nutrients in natural food crops and applied aspects of new processes, products and by-products. Recent results of such flavor and natural

constituent studies formed the basis for official classification of the Ambersweet hybrid as an orange for concentrate manufacture.

These studies and many others on related subjects are reported in the publications listed herein. Individual copies of available publications may be obtained without cost upon request. From the beginning the research program has sustained close contact and cooperation with the research arm of the citrus industry and appropriate state agencies. Articles and patents representing research accomplishments before 1964 are listed in Volume I of this list, 1965 through 1975 are listed in Volume II, 1976 through 1988 are listed in Volume III and 1989 through 1997 are listed in Volume IV. Copies of these other volumes are available from the laboratory upon request.

923. Effect of Pretreatment of Intact 'Gala' Apple with Ethanol Vapor, Heat or 1-Methylcyclopropene on Quality and Shelf Life of Fresh-cut Slices

Jinhe Bai, Elizabeth A. Baldwin, Robert C. Soliva Fortuny, James P. Mattheis, Roger Stanley, Conrad Perera and Jeffrey K. Brecht
For: J. Amer. Soc. Hort. Sci., 129(4):583-593 (2004)

'Gala' apples were treated with ethanol vapor (5 mL kg fruit⁻¹ for 24 hours at 25 °C), heat (4 days at 38 °C and >98% RH), or 1-methylcyclopropene (1-MCP; 1 or 0.625 µL L⁻¹ for 18 hours at 20 °C) prior to processing into slices, then dipped in anti-browning solutions or coatings, drained, and packaged in perforated polyethylene bags. Residual effects of pretreatments on fresh-cut slice physiological and quality attributes were investigated during storage for up to 19 days at 5.5 °C. Ethylene production was reduced by ethanol, heat and 1-MCP pretreatments, while ethanol and heat also reduced slice respiration. Heat and 1-MCP pretreatments inhibited slice texture changes, while ethanol had no effect on instrumental texture measurements but reduced sensory firmness. Ethanol pretreatment increased the contents of ethanol and ethyl esters in slices but reduced acidity, while heat reduced both acidity and aroma volatile levels. Both ethanol and heat pretreatments led to lower sensory scores for apple flavor and ethanol-pretreated slices also received higher scores for altered flavor, although all scores were based on appearance was 15-16 days for ethanol-pretreated slices and 12 days for heat-pretreated slices compared to that of control, which was 8-9 days.

924. Effect of Volatiles and their Concentration on Perception of Tomato Descriptors

Elizabeth A. Baldwin, Anne Plotto, Kevin L. Goodner, Karen Prichett and M. Eienstein
For: J. Food Sci., 69(8):S310-S318 (2004)

Coarse chop partially deodorized tomato puree was spiked with 1 to 3 levels of individual food-grade volatiles, reported to contribute to tomato flavor or volatile mixes and presented to a trained descriptive panel for flavor analysis in 2 different years. Six to eight panelists rated 9 aroma, 8 taste, and 1 aftertaste descriptors on a 15 cm unstructured line scale. Panelists detected significant differences in concentration for various individual aroma compounds for a range of descriptors. Various descriptors also had correlations with levels of individual volatiles. Combined volatile mixes included "green", "earthy" and "fruity", made up of volatiles that gave descriptors in these three areas. Principle component analysis revealed that spiking with the "earthy" and "green" mixes and 1-penten-3-one were drivers for high loadings on the earthy and green descriptors, whereas the "fruity" mixes, furaneol, beta-ionone, benzaldehyde, and 2-phenylethanol were drivers for high loadings on sweet tomato and floral aromas.

925. Relationship of Tomato Fruit Sugar Concentration with Physical and Chemical Traits and Linkage of RAPD Markers

N. Georgelis, J.W. Scott and E.A. Baldwin

For: J. Amer. Soc. Hort. Sci., 129(6):839-845 (2004)

Small-fruited cherry tomato accession PI 270248 with high fruit sugars was crossed to large-fruited inbred line Fla. 7833 that had normal to low fruit sugar. Sugars in the F2 were positively correlated with soluble solids, glucose, fructose, pH, and titratable acidity, and inversely correlated with fruit size. Sugars were not correlated with yield or pedicel type. Fruit from indeterminate plants had significantly more sugars than from determinate plants. Six random amplified polymorphic DNA (RAPD) markers linked to high sugars were found with five dominant and one co-dominant. Five of the markers were also linked to small fruit size and one of these also to low yield. The sixth marker was linked to indeterminate plant habit.

926. Odour and Flavour Thresholds for Key Aroma Components in an Orange Juice Matrix: Terpenes and Aldehydes

Anne Plotto, Carlos A. Margaría, Kevin L. Goodner, Renée Goodrich and Elizabeth A. Baldwin

For: Flavour and Fragr., 19:491-498 (2004)

This study presents the method and results of threshold values of compounds important for orange juice flavor, terpenes and aldehydes, obtained by using a deodorized orange juice matrix as the dilutant. The results show that by using the orange juice matrix, odor and taste thresholds are increased by 15 to 200 fold, and by two to 60 fold, respectively. These results will serve as indicators for orange juice manufacturers who may need to standardize flavors with individual compounds.

927. Ethylene and Postharvest Commodities

Elizabeth A. Baldwin

For: HortScience, 39(7):1538-1540 (2004)

Ethylene is a gaseous plant hormone, and biologically active at low concentrations. As a gas, it is easily transported long distances via diffusion from sites of synthesis. Sources of ethylene gas include ripening fruit senescent fruits and vegetables, wounded or stressed plant tissue, combustion engines, soil/water bacteria, and green mold. Ethylene gas is synthesized at some level in all plant tissues. Ethylene causes ripening, senescence, inhibition of longitudinal growth and abscission among other physiological responses. Ethylene biosynthesis can be inhibited under conditions of low oxygen and high carbon dioxide, (controlled or modified atmosphere). Genetic engineering can also be used to reduce fruit ethylene production (down regulation of ethylene receptor or enzymes in the ethylene biosynthesis pathway. 1-methylcyclopropene (1-MCP) can inhibit ethylene perception by the plant and data on cut apples shows effect of 1-MCP reduction of cut apple softening, autocatalytic ethylene production and respiration.

928. Nobiletin, A Citrus Flavonoid Isolated from Tangerines, Selectively Inhibits Class A Scavenger Receptor-Mediated Metabolism of Acetylated LDL by Mouse Macrophages
Stewart C. Whitman, Elzbieta M. Kurowska, John A. Manthey and Alan Daugherty
For: *Atherosclerosis*, 178(1):25-32 (2005)

Chemicals in citrus peel have strong cholesterol-lowering actions in animals. The biological mechanisms of these chemicals have been investigated, and have been shown to block the production of lipids (fats) and cholesterol by liver cells. An additional mechanism has been found to occur for one of these compounds, nobiletin. This study shows that nobiletin prevents atherosclerosis at the level of the vascular wall by inhibiting macrophage foam cell formation.

929. Lycopene From Two Food Sources Does Not Affect Antioxidant or Cholesterol Status of Middle-aged Adults
J.K. Collins, B.H. Arjmandi, P.L. Claypool P. Perkins-Veazie, R.A. Baker and B.A. Clevidence
For: *Nutrition Journal*, 3:15 (2004)

Epidemiological studies have reported associations between reduced cardiovascular disease and diets rich in tomato and/or lycopene. Intervention studies have shown that lycopene-containing foods may reduce cholesterol levels and lipid peroxidation, factors implicated in the initiation of cardiovascular disease. The objective of this study was to determine whether consumption of lycopene rich foods conferred cardiovascular protection to middle-aged adults as indicated by plasma lipid concentrations and measures of *ex vivo* antioxidants.

930. Fractionation of Orange Peel Phenols in Ultrafiltered Molasses and Mass Balance Studies of Their Antioxidant Levels
John A. Manthey
For: *J. Agric. Food Chem.*, 52:7586-7592 (2004)

The phenols in molasses were fractionated by adsorption (SP70), ion-exchange (DE52), and size-exclusion (P2) chromatography. These chromatographic separations allowed the recovery of groups of compounds with common structural features, including the hydroxycinnamates, polymethoxylated flavones, flavanone disaccharides, and flavanone trisaccharides. Also recovered was a fraction containing extremely high concentrations of unknown, polar phenols. The phenolic contents of each of these fractions were measured by the Folin's assay with gallic acid as the standard. Each of these fractions were also analyzed for their total antioxidant strengths, including the DPPH radical scavenger assay, and the NBT assay for superoxide anions. The fraction rich in the unknown, polar phenols was the richest in antioxidant strength, and good correlations were observed between antioxidant strength and phenolic content in all of the other fractions.

931. Separation, Detection and Quantification of Galacturonic Acid Oligomers with a Degree of Polymerization Greater than 50

Randall G. Cameron and Karel Grohmann

For: J. Liquid Chromatography and Related Technol., 28(4):59-570 (2005)

Pectin, a major component of citrus fruit peel, is used in the food industry as a gelling and stabilizing agent. Potential industrial uses for pectin, modified pectin or pectin containing bio-based products includes additives for a variety of manufactured products, ion exchange resins, flavor or aroma encapsulators and as coatings. The functional properties of pectin depend on its chemical structure. Small changes in its structural properties can produce very different functional properties. One method of changing structural properties is by enzymatic demethylation. To characterize these small structural changes it is often necessary to separate and measure very small fragments of the original material. Detecting and quantifying these small fragments has been especially difficult. The techniques described in this work improve our ability to both detect and to quantify these small fragments. These techniques will allow us to reconstruct the modified structural features that resulted in new or improved functional qualities and to compare the way different demethylating enzymes affect pectin fine structure.

932. Exogenous Coating Influences on Chilling Injury and Postharvest Quality of White 'Marsh' Grapefruit

Hauting Dou, G. Eldon Brown, Shelly Jones and Robert D. Hagenmaier

For: Acta Hort. (ISHS), 628:333-341 (2003)

NO REPRINTS AVAILABLE.

The effect of squalene coating on the reduction of grapefruit chilling injury (CI) and maintenance of fresh fruit quality was studied in the 1999-2002 seasons. With emulsified squalene there was a significant increase of fruit chilling injury after 16 weeks storage at 3.8°C. To identify which chemicals in the squalene emulsion resulted in CI, other components of the emulsion were also tested. Polysorbate or sorbitan monostearate each increased CI damage. However, fruit treated with non-emulsified squalene in water had reduced CI compared to control.

933. Comparison of Two Headspace Solid Phase Microextraction Fibers for the Detection of Volatile Chemical Concentration Changes due to Industrial Processing of Orange Juice
María J. Jordán, Kevin L. Goodner, Manuel Castillo and Jose Laencina
For: J. Sci. Food Agric., 85:1065-1071 (2005)

Solid phase microextraction (SPME) with two polymeric coatings, polydimethylsiloxane (PDMS) and polyacrylate (PA), was used to isolate and quantitate orange juice volatile compounds from the headspace of fresh orange juice after the finishing, deaeration and pasteurisation processes. The results from the two fibers were largely consistent. Statistically significant changes in concentration due to the deaeration process were detected for medium-volatility alcohols, hexanal and seven terpenes as measured by SPME-PDMS. However, when using the PA-coated fiber, more statistically significant changes in concentration were detected for aldehydes and esters. Alcohols and terpenes presented similar results using both polymeric coatings. The pasteurisation process did not modify the aromatic profile of the deaerated orange juice, except for methyl butyrate. These results indicate that the PA coating seemed to be more suitable for the analysis of the evolution of the orange juice aromatic fraction during industrial processing.

934. Characterization of Esterified Blocks in Pectin Homogalacturonan Regions After De-Esterification with the Thermally Tolerant Pectin Methyltransferase from Citrus Fruit
Randall G. Cameron, Gary Luzio, Steven W. Kauffman and Karel Grohmann
For: Proc. Fla. State Hort. Soc., 117:410-415 (2004)

A non-calcium sensitive pectin, with a degree of esterification (DE) of 73%, was demethylated at pH7.5 with a mono-component preparation of a thermally tolerant pectin methyltransferase (TT-PME, EC 3.1.1.11) isolated from citrus fruit tissue. The DE of the parent pectin (73%) was lowered to 66.5% and 59%. Endo-polygalacturonase (EPG) was used to digest the pectin and estimate the maximum length of methylprotected blocks in the homogalacturonan (HG). Following enzymatic demethylation and EPG digestion, the pectin was exhaustively demethylated with 0.1 M LiOH. Methyl-protected block size was estimated by high performance anion exchange chromatography coupled to an evaporative light scattering detector. The largest EPG protected block for the 66.5% DE pectin was a 19-mer although GA oligomers up to 44 residues were observed for the 59% DE pectin.

935. Effect of Polysaccharide Coatings on Quality of Fresh Cut Mangoes (*Mangifera indica*)
Anne Plotto, Kevin L. Goodner, Elizabeth A. Baldwin, Jinhe Bai, Nithiya Rattanapanone
For: Proc. Fla. State Hort. Soc., 117:382-388 (2004)

Fresh-cut fruits and vegetables are convenient and nutritious. Mangoes were cut and dipped in several treatments to improve quality and extend shelf life. Treatments were: chlorine dioxide - a sanitizer, calcium ascorbate - an antibrowning and firming agent, carboxymethylcellulose (CMC) and carboxymethylcellulose with maltodextrin (CMM), two formulations of polysaccharide coating. The calcium ascorbate treatment decreased fresh-cut mango browning, and the slices maintained better visual quality. Other quality parameters such as titratable acidity, firmness, sugar content, were not improved by any of the treatments. Slices stored at 5 °C had a better appearance than when stored at 10 °C, but the aroma was much reduced when stored at 5 °C. In a second experiment, more coatings were investigated, including chitosan, potato starch, whey protein, and soybean oil emulsion. CMM coating was rated highest, and the two controls and whey protein were rated lowest for visual quality and flavor.

936. Fruit Coatings Containing Ammonia Instead of Morpholine
Robert D. Hagenmaier
For: Proc. Fla. State Hort. Soc., 117:396-402 (2004)

The use of morpholine in fruit coatings in the U.S. is common, however ammonia can be used instead. Resin coatings were made from aqueous ammonia solutions of shellac and wood rosin. The affect of rosin coatings on internal gas concentrations was found to be highly variable, depending on the amount of plasticizer added—thus opening the possibility of developing a rosin coating of citrus fruit that is more flavor friendly. Wax coatings were made from ammonia-based anionic microemulsions of various waxes, with emphasis on carnauba wax. Preparation of these microemulsions involved development of a new laboratory method for their preparation as well as selection of the most appropriate fatty acids. For carnauba-wax coatings, which consist partly of fatty acids, the optimum formulation consisted of a mixture of oleic, lauric and myristic acids, with total fatty acid content equal to about 14% of the wax. Carnauba wax coatings allowed for optimum exchange of gases on pummelo fruit. These ammonia-based fruit coatings were also successfully tested on apples, oranges and grapefruit. The results indicate that morpholine is not a necessary ingredient of fruit coatings.

937. Differentiating Orange Juices Using Routine Analyses as Compared to Instrumental Methods

Kevin L. Goodner

For: Proc. Fla. State Hort. Soc., 117:407-410 (2004)

Standard citrus laboratory procedures such as °Brix, acid, °Brix/acid ratio, color, pH, Scott oil, vitamin C and pulp, are compared to various instrumental methods for differentiating commercial orange juice products. Statistical models were generated using the data from an electronic nose (e-nose), a head space gas chromatograph (GC), and a mass spectrometer (MS) based chemical sensor. The separation using data from the standard procedures was similar to that obtained from the instrumental methods (e-nose, GC, MS), but has the advantage that these tests are already being performed by industry and there is likely available data for modeling. Additionally, there would be no extra costs involved unlike with the other instrumental methods. Seven not-from-concentrate and 3 from-concentrate orange juice products were analyzed with excellent separation using the data from standard procedures. This compares favorably with the other methods examined in previous years.

938. Determination of Galacturonic Acid Content of Pectin Using a Microtiter Plate Assay

Gary A. Luzio

For: Proc. Fla. State Hort. Soc., 117:416-421 (2004)

The amount of galacturonic acid residues in samples containing pectin is an important parameter in the quantitative and structural analysis of this complex polysaccharide. This paper describes a method to determine the content of galacturonic acids in samples containing pectin, using a glass microtiter plate and microtiter plate-reading equipment with standard interference filters. The assay is a modification of a procedure involving the hydrolysis of pectin in 80% sulfuric acid at 80 °C followed by a coloring step with 3,5 dimethylphenol reagent at room temperature. The previous assay was difficult to apply routinely if large numbers of samples were to be analyzed due to color changes in the assay that are time dependent. In addition the assay involves transferring of strongly acidic solutions to a cuvette prior to reading. The use of a microtiter plate assay has several practical advantages such as an accurate estimate of background absorbance by multiple reading of the plates, and many samples can be rapidly assayed in one plate to minimize errors due to fading of the chromophore. This method is particularly advantageous when a large number of pectin samples must be analyzed for their content of galacturonic acid residues and it minimizes the transfer of strongly acidic solutions.

939. Development of Electronic Nose Measurements for Mango (*Mangifera indica*) Homogenate and Whole Fruit

Marc Lebrun, Marie-Noelle Ducamp, Anne Plotto, Kevin Goodner and Elizabeth A. Baldwin

For: Proc. Fla. State Hort. Soc., 117:421-425 (2004)

The electronic nose is a relatively new technology that crudely mimics the human nose in nonselective binding of aroma compounds that send a signal to the computer, rather than to the brain as in human odor detection. This technology could be useful for non-destructive discrimination of mango fruit for maturity at harvest, or variety. First, however, an optimal method must be determined by which mango puree or whole fruit can be sampled by this instrument, which was worked out in this study.

940. Isolation, Characterization, and Pectin-Modifying Properties of a Thermally Tolerant Pectin Methyltransferase from *Citrus sinensis* Var. Valencia

Randall G. Cameron, Brett J. Savary, Arland T. Hotchkiss and Marshall L. Fishman

For: J. Agric. Food Chem., 53:2255-2260 (2005)

The thermally tolerant pectin methyltransferase (TT-PME) was isolated as a monocomponent enzyme from sweet orange fruit (*Citrus sinensis* var. Valencia). It was also isolated from flower and vegetative tissue. The apparent molecular weight of fruit TT-PME was 40,800 by SDS-PAGE and the isoelectric point estimated as pI 9.31 by IEF-PAGE. MALDI-TOF mass spectroscopy identified no tryptic-peptide ions from TT-PME characteristic of previously described citrus PMEs. TT-PME did not absolutely require supplemented salt for activity, but salt activation and pH-dependent activity patterns were intermediate to thermolabile-PMEs. Treatment of non calcium-sensitive pectin with TT-PME (reducing the degree of methylesterification by 6%) increased the calcium-sensitive pectin ratio from 0.01 to 0.90, indicating a block-wise mode of action. TT-PME produced a significantly lower end-point degree of methylesterification at pH 7.5 than at pH 4.5. Extensive de-esterification with TT-PME did not reduce the pectin molecular weight or z-average radius of gyration, as determined by HPSEC.

941. Variation in Furanocoumarin Content and New Furanocoumarin Dimers in Commercial Grapefruit (*Citrus paradisi* Macf.) Juices

Wilbur W. Widmer and Carl Haun

For: J. Food Sci., 70(4):C307-312 (2005)

Grapefruit sales and crop value have declined during the last decade. One reason is from a concern about possible drug interactions. There are compounds in grapefruit juice that inhibit an enzyme in the human intestine which breaks down some drug medications. When this happens more of the drug is absorbed and can be a health concern. It is fairly well accepted after more than a decade of research that components responsible are a class of compounds called furanocoumarins or psorelans. Commercial grapefruit juice samples were collected from the market over a two year period and the furanocoumarin content measured. Furanocoumarin content varied considerably in the commercial sample and additional studies are being conducted which are measuring furanocoumarin components in different varieties of grapefruit and how they change as the fruit matures.

942. Edible Coatings

Elizabeth A. Baldwin

For: Environmentally Friendly Technologies for Agricultural Produce Quality, Shimshon Ben-Yehoshua, Editor, CRC Taylor & Francis Group, Boca Raton, FL, Chapter 10, pp. 301-314 (2005)

This chapter explains the role of edible coatings for fresh fruit and vegetables in prolonging shelf life and quality for intact and fresh-cut fresh produce. These coatings can be used to reduce decay, suffocate fruit fly larvae, improve appearance, reduce weight loss, and maintain flavor. On the other hand inappropriate coatings can result in off-flavor development due to induced anaerobic respiration. Environmentally friendly coatings are made from renewable resources such as natural waxes, carbohydrates and proteins and can reduce the need for plastic packaging.

943. A Comparison of Ethane, Ethylene and CO₂ Peel Permeance-Diffusion for Fruit With Different Coatings

Robert D. Hagenmaier

For: Postharvest Biol. Technol., 37:56-64 (2005)

Oranges, bell peppers and apples were treated with different coatings, and the peel permeance coefficients were measured for ethane, CO₂ and ethylene. The shellac and wood resin coatings reduced ethane permeance of orange and apple peels by approximately 95% from the values for non-coated peel, and the carnauba-wax coatings gave about 85% reduction. Measurements on individual fruit made it possible to do calculations for individual fruit that were atypical in terms of CO₂ respiration, ethylene production or peel permeance. These calculations showed that high-barrier resin coatings do not perform well for non-average fruit.

944. Distribution of Furanocoumarins in Grapefruit Juice Fractions

John A. Manthey and Béla S. Buslig

For: J. Agric. Food Chem., 53:5158-5163 (2005)

Grapefruit juices were fractionated and the fractions analyzed to determine the composition and structures of compounds suspected to interact with various prescription medications. The fractions rich in grapefruit juice pulp and pulp material were richest in the interactive compounds. Methods are given for the HPLC-MS analysis of these compounds.

945. One Tangerine/Grapefruit Hybrid (Tangelo) Contains Trace Amounts of Furanocoumarins at a Level too Low to be Associated with Grapefruit/Drug Interactions

Wilbur Widmer

For: J. Food Sci., 70(6):C419-C422 (2005)

Many medical professionals are recommending to patients that they do not consume grapefruit when taking certain drugs (like static drugs including Lipitor and Zocor) due to compounds in grapefruit that prevent breakdown of these drugs. Tangerine and tangelo fruit contain grapefruit parentage and, therefore, could also possibly contain compounds that interact with drugs. These citrus relatives of grapefruit were tested and found not to contain drug-interactive compounds.

946. Response of Four Apple Cultivars to 1-Methylcyclopropene Treatment and Controlled Atmosphere Storage

Jinhe Bai, Elizabeth A. Baldwin, Kevin L. Goodner, James P. Mattheis and Jeffrey K. Brecht

For: HortSci., 40(5):1534-1538 (2005)

A new compound, 1-methylcyclopropene (1-MCP), has been approved for postharvest use on apple fruit. This compound slows down ripening and extends the storage life of many fruits. Apples are currently stored in a controlled atmosphere of relatively low oxygen and high carbon dioxide at low temperature for up to a year. In this study analyzed treating or not treating apples with 1-MCP and then storing in a regular air compared to controlled atmosphere. Results showed that controlled atmosphere storage was not really necessary if the apples were treated with 1-MCP for maintaining apple quality (firmness and acidity) during extended low temperature storage.

947. A Comparison of Anatomical Changes between Normal and Chilling Injury Longan Fruit Pericarp

S. Jaitrong, N. Rattanapanone, D. Boonyakiat and E. Baldwin
For: *Acta Horticulturae*, 682:1565-1570 (2005)

Longan is a grape-sized tropical fruit that is popular in Asia, the Caribbean and Latin America. Being tropical in origin, the fruit suffer easily from cold temperatures used in transport. This study investigated the reason why these fruit incur chilling injury by looking at their surface and sub-surface structure. All fruits and vegetables have a waxy layer that was found to be damaged in chilling-injured longan fruit. Subsurface cells also were found to be leaking the cell contents indicating that the cell membranes were also impaired.

948. Aromatic Profiles of *Thymus hyemalis* and Spanish *Thymus vulgaris* Essential Oils by GC-MS/GC-O

K.L. Goodner, K. Mahattanatawee, A. Plotto, M.J. Jordán and J.A. Sotomayor
For: Proceedings 2005 Annual Meeting of the Association for the Advancement of Industrial Crops: International Conference on Industrial Crops and Rural Development, M.J. Pascaul Villalobos, F.S. Nakayama, C.A. Bailey, E. Correal and W.W. Schloman, Jr., Editors, Pardo Communication, S.L., Murcia, Spain, p. 405-411. (2005)

Two species of thyme (*Thymus hyemalis* and *Thymus vulgaris*) vary greatly with regards to chemical composition. Shrubs were harvested at five different maturation stages during the plant vegetative cycle. Alayses were conducted on each maturation stage. A total of 96 (*hyemalis*) and 52 (*vulgaris*) aromas were detected with the 27 (*hyemalis*) and 26 (*vulgaris*) most important reported here. Three previously unreported compounds are detailed in this study.

949. Seasonal Variation of *Thymus hyemalis* Lange and Spanish *Thymus vulgaris* L. Essential Oils Composition

M.J. Jordán, R.M. Martinez, K.L. Goodner, E.A. Baldwin and J.A. Sotomayor
For: Proceedings 2005 Annual Meeting of the Association for the Advancement of Industrial Crops: International Conference on Industrial Crops and Rural Development, M.J. Pascaul Villalobos, F.S. Nakayama, C.A. Bailey, E. Correal and W.W. Schloman, Jr., Editors, Pardo Communication, S.L., Murcia, Spain, p. 390-404. (2005)

Two species of thyme (*Thymus hyemalis* and *Thymus vulgaris*) vary greatly with regards to chemical composition. Shrubs were harvested at five different maturation stages during the plant vegetative cycle. Analyses were conducted on each maturation stage to determine essential oil composition in each species and at each maturation stage. This technique identified 99 and 98 components in *T. hyemalis* and *T. vulgaris* essential oils, respectively. There were changes in the composition of the essential oil during the maturation process, which could be useful to processors wishing to maximize the content of specific chemical compounds.

950. A Comparison of Sanitation Systems for Fresh-Cut Mango

Jan Narciso and Anne Plotto

For: HortTech., 15(4):837-842 (2005)

Discussions on methods of removal of microorganisms from the surface of mango fruits from the field and also prior to cutting are presented. Further sanitation of the cut fruit is detailed as well as the result of storage studies on the variously treated cut fruits. Authors present a sanitation system compatible with the organic industry.

951. Analysis of Flavors Using a Mass Spectral-Based Chemical Sensor

Vanessa R. Kinton and Kevin L. Goodner

For: Natural Flavors and Fragrances: Chemistry, Analysis and Production, ACS Symposium Series #908, Carl Frey and Russell L. Rouseff, Editors, American Chemical Society, Washington, DC, Chapter 6, pp. 91-101 (2005)

A mass spectrometer based chemical sensor was used to model citrus peel oils. Seven samples and one duplicate were analyzed and subsequently modeled with multivariate analyses such as principal component analysis (PCA) and Soft Independent Modeling of Class Analogy (SIMCA). Discrimination between samples were excellent with clear distinctions between the samples and considerable overlap of the duplicate sample. Samples were also analyzed with a gas chromatograph/mass spectrometer (GC/MS) using similar multivariate models. GCMS results were similar to the ones obtained by sampling the static headspace, but with longer analysis times. Statistics obtained using SIMCA analysis allowed for the determination of which samples were most similar to a "target" sample.

952. Strawberries and Raspberries

Charlotte L. Deuel and Anne Plotto

For: Preprocessing Fruits: Science and Technology, Second Edition, Diane M. Barrett, Laszlo Somogyi and Hosahalli Ramaswamy, Editors, CRC Press, Boca Raton, FL, Chapter 22, pp. 531-561 (2005)

The book chapter describes in detail which products are made from strawberries and raspberries, and how they are processed commercially. This includes frozen purees and puree concentrates, frozen whole and sliced fruits, juice concentrate, dehydrated berries, jams preserves, condiments, syrups, fillings, toppings, beverages and wines. Frozen fruit include individually quick frozen, block frozen, cans and aseptic products. The juice concentrate process describes in detail the process, from received raw material (quality check), heat and enzyme treatments, pressing centrifugation, filtration, and concentration and essence recovery. The chemistry of berries and berry products is reviewed for strawberry, raspberry and their processed products. This includes color and flavor components, as well as nutritional value and health benefits attributed to phenolic compounds. The chapter also addresses world and regional production and markets, commercial cultivars grown and the quality of cultivars of strawberries and raspberries.

953. *Pseudomonas* Biological Control Agents: Do They Have a Role in Citrus Packinghouses?

Jan A. Narciso

For: University of Florida/IFAS Extension Service, 200:1-3 (2004)

Biological control agents are often used as part of an Integrated Pest Management strategy. There are many biocontrol agents available: some are very disease specific and some are more directed at general plant pathogen problems. In this study, a biocontrol agent (Bio-Save) was used to test its efficiency against decay by a wound pathogen (e.g. *Penicillium*) commonly found in citrus. The Bio-Save organism (*Pseudomonas syringae*) was found to control decay for short periods in storage. As this product is certified organic, it has applications for incorporation into organic packinghouse lines.

954. A Method for Detecting Fungal Contamination in Paperboard Cartons

J.A. Narciso and M.E. Parish

For: University of Florida/IFAS Extension Service, 105:1-5 (2005)

Contamination of refrigerated juice products in gable-top cartons may occur by filamentous fungi that are present in the paperboard. A new method has been developed which assesses contamination in the paperboard easily and efficiently. This method incorporates routinely used mycological techniques, including medium and incubation procedures, which insure that conditions for fungal growth are optimal.

955. Inheritance of High Sugars from Tomato Accession PI 270248 and Environmental Variation between Season

N. Georgelis, J.W. Scott and E.A. Baldwin

For: J. Amer. Soc. Hort. Sci., 131(1):41-45 (2006)

Consumers prefer sweeter tomatoes, thus breeding programs aim to increase sugar levels in tomato breeding lines. In this study a high sugar small-fruited cherry tomato was crossed with a large -fruited tomato that had normal to low fruit sugars and the subsequent generation back-crossed to the respective parents over several seasons (spring and fall in Florida) to study sugar inheritance patterns as affected by environmental conditions. It was found that the sugar level is controlled by more than one gene, and that levels were affected by season perhaps due to the higher amount of solar radiation in spring, resulting in higher sugar levels, than in fall.

956. Ethanol Vapor Prior to Processing Extends Fresh-cut Mango Storage by Decreasing Spoilage, but Does Not Always Delay Ripening

A. Plotto, J. Bai, J.A. Narciso, J.K. Brecht and E.A. Baldwin

For: Postharvest Bio. Technol., 39:134-145 (2006)

Fresh-cut fruit are healthy and convenient to eat, but have a short shelf life after the fruit tissue has been cut. In this work, ethyl alcohol (grain alcohol or ethanol) vapors, known to delay fruit ripening, were applied to whole mangoes prior to cutting, and conditions of treatment were optimized. Ethanol effect on slice shelf life varied and depended on factors such as maturity stage, and whether or not fruit had been prior subjected to a high quarantine heat treatment, commonly done on imported fruit. When the dose applied was too high, the treatment imparted a residual off flavor to the fruit. At lower doses, the treatment was not as effective. Whole fruit treatment with ethanol suppressed microbial growth on the slices of treated mangoes at all doses tested. Therefore, ethanol treatment of whole mangoes could be used as a safe way to block microbial spoilage of the sliced fruit.

957. Use of Edible Coating to Preserve Pecans at Room Temperature

Elizabeth A. Baldwin and Bruce Wood

For: HortSci., 41(1):188-192 (2006)

Shelled Pecans are high in quantities of unsaturated fatty acids, which while healthy, also undergo degradation resulting in rancid off-flavor. For this reason these nuts must be stored at low or freezing temperatures which is costly. In this research edible coatings were developed to protect the nuts and prevent rancidity. These coatings extended the shelf life of pecans at room temperature by several months.

958. Use of an Evaporative Light Scattering Detector Coupled to MALLS for Determination of Polysaccharide Molecular Weights

Gary A. Luzio

For: J. Of Liquid Chromatography & Related Technol., 29:185-201 (2006)

Knowing the size of molecules and charge characteristics is important to understand how they behave in industrial applications. Usually these determinations are made under conditions where the charge characteristics are not taken into consideration while measuring the molecular weight. This is because of the difficulty in performing molecular weight determinations with changing salt concentrations to separate molecules based on charge. This work describes a technique for performing the molecular weight determination while separating the molecules based on charge.

959. Guidelines and Acceptable Postharvest Practices for Organically Grown Produce
Anne Plotto and Jan A. Narciso
For: HortSci., 41(2):287-291 (2006)

This manuscript goes through the USDA-National Organic Program regulations for handling and processing. The basic requirements, principles of sanitation and pest management for a processing plant which processes organic products are reviewed. The list of some of the synthetic and non-agricultural substances that can be used on fruit and fruit products is discussed. Examples are given for sanitation practices and fruit coatings.

960. Lycopene From Two Food Sources Does Not Affect Antioxidant or Cholesterol Status of Middle-aged Adults
J.K. Collins, B.H. Arjmandi, P.L. Claypool, P. Perkins-Veazie, R.A. Baker and B.A. Clevidence
For: Nutrition Journal, 3:15 (2004)

Epidemiological studies have reported associations between reduced cardiovascular disease and diets rich in tomato and/or lycopene. Interception studies have shown that lycopene-containing foods may reduce cholesterol levels and lipid peroxidation, factors implicated in the consumption of lycopene rich foods conferred cardiovascular protection to middle-aged adults as indicated by plasma lipid concentrations and measures of *ex vivo* antioxidants.

961. Consumption of Watermelon Juice Increases Plasma Concentrations of Lycopene and β -Carotene in Humans
Alison J. Edwards, Bryan T. Vinyard, Eugene R. Wiley, Ellen D. Brown, Julie K. Collins, Penelope Perkins-Veazie, Robert A. Baker and Beverly A. Clevidence
For: Amer. Soc. Nutritional Sci., 1043-1050 (2003)

The bioavailability of lycopene from two food sources was evaluated with no additional heat treatment, and it was found that lycopene was bioavailable from both fresh-frozen watermelon and canned tomato juices. Plasma concentrations of lycopene were significantly and similarly elevated from 18 to 20 mg lycopene per day from fresh-frozen watermelon juice or canned tomato juice.

962. Specific Anosmia Observed for β -Ionone but not for α -Ionone: Significance for Flavor Research

A. Plotto, K.W. Barnes and K.L. Goodner
For: J. Food Sci., 71(5):S401-S406 (2006)

In this study, it was found that threshold for β -ionone was about 5,000 times higher for 50% of the panelists tested. The isomer of β -ionone, α -ionone, did not show such trend, and was perceived at the same level for all the panelists. These findings are of great significance for food flavorists: if they use the threshold values found with non-perceivers to create a flavor, that flavor will be, and maybe objectionable to perceivers. On the other hand, if they use the threshold values found for perceivers, non-perceivers will not enjoy the targeted flavor.

963. Fourier Transform Infrared Spectroscopic Analysis of the Polymethoxylated Flavone Content of Orange Oil Residues

John A. Manthey
For: J. Agric. Food Chem., 54:3215-3218 (2006)

A potentially valuable set of compounds, termed the polymethoxylated flavones, are recovered from orange oil residues. Measurements of the contents of these compounds in orange oil residues is currently done by a method requiring many steps and elaborate instrumentation. A new, one-step analytical method has been developed that allows for easier and more rapid analysis of the polymethoxylated flavones in the orange oil residues.

964. Volatile Constituents and Character Impact Compounds of Selected Florida's Tropical Fruit

Kanjana Mahattanatawee, Kevin L. Goodner and John A. Manthey
For: Proc. Fla. State Hort. Soc., 118:414-418 (2005)

The aroma volatile compounds of Florida grown tropical fruit including guava, mango and carambola were isolated with instrumentation that would identify the compounds and allow a human to smell the individual compounds. The volatile components were analyzed using two different sample preparation techniques. The combination of the two techniques resulted in 53, 48 and 46 aroma active compounds detected in carambola, guava and ripe mango, respectively. There was no single aroma character impact compound that contributed to the aroma of these fruits.

965. Differentiating Orange Juices Using Fourier Transform Infrared Spectroscopy (FT-IR)

Kevin L. Goodner and John A. Manthey
For: Proc. Fla. State Hort. Soc., 118:410-413 (2005)

Five different methods for analyzing orange juice are compared for their ability to differentiate orange juices using multi-variate statistics. These methods measure different qualities of the juices and each method has advantages and disadvantages compared to the other techniques. This type of analysis could prove useful to quality control labs at citrus processing facilities.

966. Effect of Seasonal Variation on Enzymatic Hydrolysis of Valencia Orange Peel Waste
Mark R. Wilkins, Wilbur W. Widmer, Randall G. Cameron and Karel Grohmann
For: Proc. Fla. State Hort. Soc., 118:419-422 (2005)

This study explored whether fruit maturity during the course of the Valencia orange harvest had an effect on sugar yields from enzymatic hydrolysis. Valencia oranges were picked from the same tree at four times during harvest. Juice was extracted from the oranges, and the peel waste left over was hydrolyzed to sugars using enzymes. Harvest time had an effect on arabinose and galacturonic acid yields. Dry matter content of the peel waste before hydrolysis increased during the course of the harvest, which resulted in increased potential ethanol yields.

967. Production of Narrow-range Size-classes of Polygalacturonic Acid Oligomers
Randall G. Cameron, Gary Luzio, Elizabeth A. Baldwin, Jan A. Narciso and Anne Plotto
For: Proc. Fla. State Hort. Soc., 118:406-409 (2005)

Pectin, a major component of citrus fruit peel, is composed largely of polygalacturonic acid (PGA). Potential uses for PGA, modified PGA or PGA containing bio-based products include additives for a variety of manufactured products, ion exchange resins, flavor or aroma encapsulators, as coatings or surface treatments and as substrates for studying how pectin degrading enzymes function. Small changes in polymer length can produce very different functional properties. One method of changing its structural properties is by enzymatic degradation. In this report we used an endo-polygalacturonase enzyme and differential precipitation methods to produce three different narrow-range size-classes will be used to study how different pectin degrading enzymes function, their efficiency in binding specific pollutants and their ability to delay decay in minimally processed fruits.

968. A Furanocoumarin-Free Grapefruit Juice Establishes Furanocoumarins as the Mediators of the Grapefruit Juice-Felodipine Interaction
Mary F. Paine, Wilbur W. Widmer, Heather L. Hart, Susan N. Pusek, Kimberly L. Beavers, Anne B. Criss, Sherri S. Brown, Brian F. Thomas and Paul B. Watkins
For: Amer. J. Clinical Nutr., 83:1097-1105 (2006)

Furanocoumarins are the active ingredients in grapefruit juice responsible for enhancing the systemic exposure of felodipine and probably other CYP3A4 substrates that undergo extensive intestinal first-pass metabolism.

969. Total Antioxidant Activity and Fiber Content of Select Florida-Grown Tropical Fruits

Kanjana Mahattanatawee, John A. Manthey, Gary Luzio, Stephen T. Talcott
For: J. Agric. Food Chem., 54(19):7335-7363 (2007)

Florida-grown tropical fruits (red and white guava, carambola, red and white pitaya, mamey sapote, sapodilla, lychee, longan, green and ripe mango, ripe and green papaya) were tested for antioxidants, vitamin C and fiber. These compounds all contribute to the healthful benefits of these fruits. The information was then compared to other common fruits such as apple, blueberry, peach, etc. The reports showed that these tropical fruits had as much or more antioxidant capacity, vitamin C and fiber compared to other common fruits, and thus, offer healthful benefits to consumers. In addition, great and ripe mango and papaya were compared since the ripeness stage of these fruits depends on ethnic background.

970. An Assessment of Methods to Clean Citrus Fruit Surfaces

Jan A. Narciso
For: Proc. Fla. State Hort. Soc., 118:437-440 (2005)

Compares common methods of sanitizing fruit surfaces with peroxyacetic acid product in terms of reducing the microorganism populations on the surfaces of citrus fruit. These surface organisms can cause post harvest problems in storage and transit resulting in an unmarketable fruit.

971. Partitioning Taste from Aromatic Flavor Notes of Fresh Tomato (*Lycopersicon esculentum*, Mill) to Develop Predictive Models as a Function of Volatile and Nonvolatile Components

E.G. Abegaz, K.S. Tandon, J.W. Scott, E.A. Baldwin and R.L. Shewfelt
For: Postharvest Biol. Technol., 34(3): 227-235 (2004)

Consumers are dissatisfied with fresh tomato flavor, thus necessitating studies on flavor notes and chemical components in tomato. In this study, sensory and chemical measurements were made on six breeding lines and four supermarket fresh tomato products. The sensory method, of two types tested, that showed the best correlation to sugars, acids and aroma compounds was one where taste and aroma determination were separated by the use of nose clips by the panel.

972. HPLC-MS Analysis of Coumarins and Furanocoumarin Dimers in Immature Grapefruit

John A. Manthey

For: Proc. Fla. State Hort. Soc., 118: 429-436 (2005)

Grapefruit juice contains compounds that influence the metabolism of prescription drugs in humans. These compounds are termed the furanocoumarins. This study investigated the occurrence of these compounds in very young immature grapefruit sampled over two seasons. This study showed that these compounds fluctuated widely during early fruit development. An understanding of the progression of the biosynthesis of the furanocoumarins in developing grapefruit will play an important role in mediating the levels of these compounds through plant breeding and genetic engineering.

973. Aromatic Profiles of *Thymus hyemalis* and Spanish *Thymus vulgaris* Essential Oils by GC-MS/GC-O

K.L. Goodner, K. Mahattanatawee, A. Plotto, J.A. Sotomayor and M.J. Jordán

For: Industrial Crops and Products, 24:264-268 (2006)

Two species of thyme (*Thymus hyemalis* and *Thymus vulgaris*) vary greatly with regards to chemical composition. Shrubs were harvested at five different maturation stages during the plant vegetative cycle. Analyses were conducted on each maturation stage. A total of 96 (*hyemalis*) and 52 (*vulgaris*) aromas were detected with the 27 (*hyemalis*) and 26 (*vulgaris*) most important reported here. Three previously unreported compounds are detailed in this study.

974. Seasonal Variation of *Thymus hyemalis* Lange and Spanish *Thymus vulgaris* L. Essential Oils Composition

M.J. Jordán, R.M. Martinez, K.L. Goodner, E.A. Baldwin and J.A. Sotomayor

For: Industrial Crops and Products, 24:253-263 (2006)

Two species of thyme (*Thymus hyemalis* and *Thymus vulgaris*) vary greatly with regards to chemical composition. Shrubs were harvested at five different maturation stages during the plant vegetative cycle. Analyses were conducted on each maturation stage to determine essential oil composition in each species and at each maturation stage. This technique identified 99 and 98 components in *T. hyemalis* and *T. vulgaris* essential oils, respectively. There were changes in the composition of the essential oil during the maturation process, which could be useful to processors wishing to maximize the content of specific chemical compounds.

975. Review of Wax-Based and Other Coatings for Fruits and Vegetables

Anne Plotto and Brian Baker

For: IFOAM, 7:1-5 (2005)

The application of coatings on fruits was reviewed for the purpose of evaluating the potential use of organically produced commodities.

976. Modulation of Cholesterol and Triacylglycerol Biosynthesis by Citrus Polymethoxylated Flavones
John A. Manthey and Elizabeth M. Kurowska
For: Potential Healthy Benefits of Citrus, ACS Symposium Series 936, Bhimanagouda S. Patil, Nancy D. Turner, Edward G. Miller and Jennifer S. Brodbelt, Editors, American Chemical Society, Washington, DC, Chapter 14, pp. 186-198 (2006)

Special compounds in orange peel called polymethoxylated flavones, have been shown in a series of studies to lower blood serum cholesterol and triglycerides. As experiment with hamsters showed that these compounds were effective in lowering the bad low-density lipoprotein (LDL) - cholesterol, and triglycerides. Other experiments showed that these actions were do to at least three mechanisms. These mechanisms involved the inhibition and transport of key parts of the LDL molecule. Another mechanism involved the activation of an important cell signaling molecule in liver cells which control lipid formation. Additional mechanisms by which polymethoxylated flavones act to prevent cardiovascular disease are discussed.

977. Shelf-life Versus Flavour-life for Fruits and Vegetables: How to Evaluate this Complex Trait
Elizabeth A. Baldwin, Anne Plotto and Kevin Goodner
For: Stewart Postharvest Review, 3(1):1-10 (2007)

This review covers the effect of harvest maturity and postharvest handling techniques on fresh fruit and vegetable flavor quality. Fresh produce is often stored or displayed commercially for as long as the commodity appearance is acceptable. This external quality (appearance) can last longer than internal quality characteristics such as flavor. While external quality drives initial sales, repeat purchases are based on internal quality factors including texture and flavor. Flavor is a complex trait and techniques for both instrumental and sensory analysis of flavor detailed in the review.

978. Hydrolysis of Grapefruit Peel Waste with Cellulase and Pectinase Enzymes
Mark R. Wilkins, Wilbur W. Widmer, Karel Grohmann and Randall G. Cameron
For: Bioresource Technology, 98:1596-1601 (2006)

Grapefruit juice processors generated approximately 500,000 tons of grapefruit peel waste in 2003/04. Most of this waste was dried and fed to cattle at a loss for the processors. Grapefruit peel waste can be broken down with pectinase and cellulase enzymes to sugars that can be used to make ethanol, a renewable fuel that can be added to gasoline. This study tested several different enzyme loadings and pH levels to determine which were best for producing sugars. Loadings of five mg pectinase protein/g peel solids and one mg cellulase protein/g peel solids produced the most sugars. Optimum pH for hydrolysis was pH 4.8. Less ethanol can be potentially produced from grapefruit peel waste than from Valencia orange peel waste because grapefruit peel waste has greater moisture content.

979. Optimizing the Use of Hydorlytic Enzymes to Facilitate Peeling of Citrus Fruit
Mohamaed A. Ismail, Huiquin Chen, Elizabeth A. Baldwin and Anne Plotto
For: Proc. Fla. State Hort. Soc., 118:400-402 (2005)

Peeling of Citrus fruit using food-grade enzymes creates a healthy red-to-eat product that is ideal fo school lunch programs, airline cuisine, or a healthy snack. Optimizing the enzyme peeling process is important for a consistent high quality product. This study analyzed treatment of citrus fruits with different food-grade commercial enzymes, accompanied by hot water dips for the most efficient peeling of both oranges and grapefruit. It was found that grapefruit require less enzyme and that hot water incubation was helpful.

980. Changes in Enzyme-Assisted Peeling Efficiency and Quality of Fresh 'Valencia' Orange and of Stored 'Valencia Orange and 'Ruby Red' Grapefruit
Mohamaed A. Ismail, Huiquin Chen, Elizabeth A. Baldwin and Anne Plotto
For: Proc. Fla. State Hort. Soc., 118:403-405 (2005)

Peeling of Citrus fruit using food-grade enzymes creates a healthy red-to-eat product that is ideal fo school lunch programs, airline cuisine, or a healthy snack. Optimizing the enzyme peeling process is important for a consistent high quality product. This study analyzed the peelability of oranges and grapefruit over the harvest season and after storage. Also analyzed were the effects of storage on flavor of the peeled citrus segments.

981. The Use of Stir-bar Sorptive Extraction (SBSE) for Analytical Food Analysis
Kevin L. Goodner and Jinhe Bai
For: Proc. Fla. State Hort. Soc., 119:379-382 (2006)

Three experiments were conducted to explore aspects of using stir-bar sorptive extraction (SBSE) for food analysis. First is a basic examination of calibration curves using SBSE. Second, the viability of using SBSE to simplify long distance collaboration. Lastly, the possibility of inserting the stir bars inside of immature fruit and determining fruit maturity markers was examined.

982. Taste Panels Evaluate Quality of Five University of Florida Strawberry Selections
Anne Plotto and Craig Chandler
For: Proc. Fla. State Hort. Soc., 119:308-311 (2006)

Five promising selections from the University of Florida's strawberry breeding program were compared with the industry standard 'Festival' in consumer panels. Several of the selections were rated equal to, but not higher than, 'Festival' for appearance and/or flavor in the first panel. However, in the second panel, FL 00-51 exceeded 'Festival' for appearance and flavor; FL 01-116 exceeded 'Festival' for appearance but was not significantly different than 'Festival' for flavor; and FL 99-164 equaled 'Festival' for both appearance and flavor.

983. Edible Coatings and Other Surface Treatments to Maintain Color of Lychee Fruit in Storage

Anne Plotto, Jan Narciso, Elizabeth A. Baldwin and Nithiya Rattanapanone
For: Proc. Fla. State Hort. Soc., 119:323-331 (2006)

Lychee is a tropical fruit with a very attractive red skin (pericarp), but the pericarp turns brown quickly after harvest, reducing the fruit attractiveness. Treatments were performed in Florida and Thailand, as dip treatments of the fruit to reduce browning. Acidic treatments that included antioxidants worked better than acids or antioxidants alone. Polysaccharide coatings increased decay development. Some hydrophobic coatings such as sucrose fatty acids, and a carnaub wax fine film had a favorable effect on decay reduction, but not so much on browning reduction. Decay was mostly due to the pathogen of anthracnose, and future effort will be directed towards reducing decay in the field.

984. Enzyme-Peeling of Valencia Oranges for Fresh-Cut Slices

Sumona Pinnavaia, Elizabeth A. Baldwin, Anne Plotto, Jan Narciso and Emilio Senesi
For: Proc. Fla. State Hort. Soc., 119:335-339 (2006)

Oranges that are peeled using natural enzymes that digest the peel or infiltration of water without enzymes result in an-to-eat product. However, commercialization of this system has not been successful. One reason is that the enzyme keeps digesting the fruit tissue, making it softer and causing juice leakage. Another reason is the perception that this method of infiltration could result in higher microbial counts in the fruit tissue. This research tested some further treatments to both inhibit residual enzyme peeling on softening and juice leakage. Results showed that juice leakage was minimal, and that even though the cut fruit slicker were softer, they were preferred in an informal sensory evaluation. Microbial counts were not higher than with manual peeling.

985. The Isolation of Minor-Occurring Furanocoumarins in Grapefruit and Analysis of Their Inhibition of CYP 3A4 and P-Glycoprotein Transport of Talinolol from Caco-2Cells

John A. Manthey, Kyung Myung, Susanne Mertens-Talcott, Hartmut Derendorf, Veronika Butterweck and Wilbur Widmer
For: Proc. Fla. State Hort. Soc., 119:371-375 (2006)

This study includes the isolation and partial characterization of 11 new compounds. A number of these compounds were also shown to be inhibitors of enzymes involved in the grapefruit/drug interactions, and so these compounds contribute to the overall interaction produced in humans. This work is important in understanding the scope of potential chemical structures involved in these important food/drug interactions.

986. Analysis of the Phenolic Compound in Longan (*Dimocarpus longan* Lour.) Peel
Somkit Jaitrong, Nithiya Rattanapanone and John A. Manthey
For: Proc. Fla. State Hort. Soc., 119: 371-375 (2006)

Longan fruit is a tropical fruit that has a very short shelf life, and compounds this problem, this fruit also readily shows chilling injury when stored at low temperatures. This chilling injury is expressed in a browning of the peel, and this browning is dependent on the phenolic compounds in the peel. An investigation was made to characterize some of the main classes of phenolic compounds in longan fruit peel. This investigation found 3 classes of phenolic compounds, including flavones, ellagic acid conjugates, and hydroxycinnamates. This work will help us understand the biochemical changes that occur in the peel of chilling injured longan fruit.

987. On the simulation of enzymatic digest patterns: The fragmentation of oligomeric and polymeric galacturonides by endo-polygalacturonase II
Jonathan J. Hunt a, Randall Cameron b, Martin A.K. Williams
For: Biochimica et Biophysica Acta, 1760:1696–1703 (2006)

A model to predict the degradation of pectin by a fungal enzyme has been tested and found to accurately describe the degradation of large pectin fragments. The model is based solely on the interaction energy between the enzyme and substrate. The model has potential applications for predicting functional properties of enzyme treated biopolymers such as pectin or other polysaccharides. It will also be useful for structural mapping of complex biopolymers and describing the relationship between polymer structures and resulting functionalities.

987. Using a Mass Spectrometer Library Matching System to Identify Citrus and Other Food/Non-Food Products
Kevin L. Goodner and Vanessa R. Kinton
For: Proc. Fla. State Hort. Soc., 119:383-387 (2006)

A method that identifies products based on a composite mass spectrum using standard chemical library searching functions is presented. This technique requires fewer analyses, doesn't require advanced statistical knowledge, and uses widely known tools. A library of 54 products were generated, and 17 unknowns were tested against the library. Fifteen of the 17 unknown samples were correctly identified within the top two rated library matches. This level of correct matching is encouraging, suggesting that this technique could be used on a larger scale for product identification.

988. GC-Olfactometry with Solid Phase Microextraction of Aroma Volatiles from Heated and Unheated Orange Juice
R. Rouseff, R. Bazemore, K. Goodner and M. Naim
For: *Headspace Analysis of Food and Flavors: Theory and Practice*, Rouseff, R.L. and Cadwallader, K.R., Editors, Plenum: New York, Chapter 8 pp. 101-112.

A solventless headspace volatile extraction technique was combined with GC-olfactometry (GCO) to examine changes in aroma active volatiles when orange juice was heated.

989. Preharvest Peroxyacetic Acid Sprays Slow Decay and Extend Shelf Life of Strawberries
J.A. Narciso, E.A. Baldwin, A. Plotto and C.M. Ference
For: *HortScience*, 42(3):617-621 (2007)

Strawberries are a very perishable fruit with significant postharvest decay and short shelf life. Postharvest handling of the fruit usually leads to increased injury and subsequent decay, therefore, strawberries are harvested and packed right from the field. Any treatment to reduce strawberry decay would be most compatible with current harvest and handling practice if done in the field. In this study preharvest spraying of strawberries with the sanitizer peroxyacetic acid (hydrogen peroxide and acetic acid) resulted in reduced postharvest decay and extension of shelf life. This sanitizer is soon to be approved for organic market and is a good alternative to fungicides.

990. Surface Treatments and Edible Coatings in Food Preservation
Elizabeth A. Baldwin
For: *Handbook of Food Preservation, Second Edition*, M. Shafiur Rahman, Editor, CRC Press, Boca Raton, FL, Chapter 21, pp. 477-507 (2007)

Currently, edible coatings and films are commonly used on many commodities such as candies, fresh fruits and vegetables, and processed meats. New research seeks to expand and improve coatings technologies and materials to further enhance food stability and quality. Other surface treatments for foods include application of antioxidants, acidulants (or other pH-control agents), fungicides, preservatives, and mineral salts.

991. Polymethoxylated Flavones and Other Phenolic Derivates from Citrus in Their Inhibitory Effects on P-Glycoprotein-Mediated Transport of Talinolol in Caco-2 Cells

Susanne U. Mertens-Talcott, Whocley Victor de Castro, John A. Manthey, Hartmut Derendorf and Veronika Butterweck
For: J. Agric. Food Chem., 55:2563-2568 (2007)

There are proteins in the intestine that are involved in pumping out foreign compounds. One of these main "transport" protein is call P-glycoprotein (P-gp). The transport activity of this proteins can be blocked by lipids, and so the transport by P-gp was measured in the presence of a number of lipid-like compounds in citrus termed the polymethoxylated flavones. Results of this study show that these polymethoxylated flavones are powerful inhibitors of P-gp, and thus may influence the transport by P-gp, and thus may affect the bioavailability of certain foreign compounds, i.e. medications, etc., in humans.

992. On the Simulation of Enzymatic Digest Patterns: The Fragmentation of Oligomeric and Polymeric Galacturonides by Endo-polygalacturonase II
Jonathan J. Hunt, Randall Cameron and Martin A.K. Williams
For: Biochemica et Biophysica Acta, 1760:1969-1703 (2006)

A model to predict the degradation of pectin by a fungal enzyme has been tested and found to accurately describe the degradation of large pectin fragments. The model is based solely on the interaction energy between the enzyme and substrate. The model has potential applications for predicting functional properties of enzyme treated biopolymers such as pectin or other polysaccharides. It will also be useful for structural mapping of complex biopolymers and describing the relationship between polymer structures and resulting functionalities.

993. Compositions and Methods of Treating, Reducing and Preventing Cardiovascular Diseases and Disorders with Polymethoxylated Flavones
Najla Guthrie, Elzbieta Maria Kurowska, John A. Manthey and Robert M. Horowitz
For: U.S. Patent # 6,987,125

Compositions and methods for the treatment, reductions and/or prevention of cardiovascular diseases and disorders are described. Individuals at high risk for developing or having cardiovascular disease or disorder may be treated with an effective dose of polymethoxyflavone including limocitrin derivatives, quercetin derivatives, naturally occurring polymethoxyflavones, tocotrienols and mixtures of these compounds.

994. Demethylation of a Model Homogalacturonan with a Salt-independent Pectin Methylesterase from Citrus: I. Effect of Ph on Demethylated Block Size, Block Number and Enzyme Mode of Action

Randall G. Cameron, Gary A. Luzio, Kevin Goodner, Martin A.K. Williams
For: Carbohydrate Polymers 71:287–299 (2008)

A model homogalacturonan (HG) was used to produce a demethylated series by reacting it with a citrus salt-independent pectin methylesterase (PME) at pH 4.5 and 7.5. Liberated demethylated blocks (DMB) were separated and quantified. A significant increase in maximum and average size of released DMBs was observed between 80% and 70% DM at pH 7.5 and between 70% and 60% at pH 4.5. A multiple-attack mechanism with a degree of processivity (p) of $p = 1$ at pH 4.5 and $p = 10$ at pH 7.5 modeled the observed shorter fragments well, while in all cases the amount of larger fragments detected was more successfully described by a single-chain mechanism.

995. Demethylation of a Model Homogalacturonan with the Salt-independent Pectin Methylesterase from Citrus: Part II. Structure–function Analysis

Gary A. Luzio and Randall G. Cameron
For: Carbohydrate Polymers 71:300-309 (2008)

Citrus peel is largely composed of pectin, a water soluble polysaccharide. Polysaccharides are typically sold based on their rheological properties such as viscosity. With pectin, rheology can be controlled by the manner or patterns in which this polysaccharide is deesterified using enzymes or chemical conditions. The difficulty is the lack of assay that can reveal these patterns of deesterification. This study has revealed new insights into how the pectins can crosslink with calcium to produce unique products such as suspension aids.

996. Flavor and Other Quality Factors of Enzyme-peeled Oranges Treated with Citric Acid

Simona Pinnavaia, Anne Plotto, Jan A. Narciso, Elizabeth A. Baldwin and Emilio Senesi
For: HortSci. 42(7):1644-1650 (2007)

Orange slices “ready-to-eat” are pre-peeled by scoring the whole fruit, then placing in a water or enzyme solution under vacuum to split the peel from the fruit. Peeled oranges are then cut into segments. The vacuum infusion of water or enzyme may present a risk of microbial contamination, and also, enzymes can modify the quality of cut slices. Citric acid was used to prevent any potential microbial contamination. Oranges that were vacuum infused in a citric acid solution had less contamination. Also, enzyme-peeled oranges that were later dipped in citric acid had lower microbial counts. Flavor was not changed by citric acid. However, enzyme infusion resulted in softer slices for ‘Valencia’ oranges, which were preferred to water-infused slices by a 20-member taste panel. Enzyme infusion also improved appearance of ‘Hamlin’ slices, according to the panel. In addition, enzyme infusion increased the amount of methyl butanoate and methanol volatiles, but taste panel did not perceive any changes in flavor from that increase.

997. Diversity of Fruit Quality Characteristics in *Capsicum frutescens*

Robert L. Jarret, Elizabeth A. Baldwin, Brian Perkins, Kelly Guthrie and Rod Bushway

For: HortScience 42(1):16-19 (2007)

The genus *Capsicum* contains a number of species that are cultivated. One of these, *Capsicum frutescens*, is known as the Tabasco pepper and is used in the preparation of sauces and as a condiment. The USDA genebank in Griffin, GA contains numerous lines of *Capsicum frutescens* from countries in North, Central, and South America, and elsewhere. This study examined the diversity present in forty of these *C. frutescens* lines for characteristics that affect the physical appearance of the fruit, such as length, width and weight. Also examined were characteristics that affect the taste of the mature fruit, including the concentrations of various carbohydrates (reducing sugars) and organic acids. The results of the analyses indicated an approximately 4- to 14-fold range in the parameters evaluated. These data indicate that sufficient variability for fruit quality characteristics is present within this collection of lines to provide the basis for the selective enhancement of Tabasco pepper for specific quality attributes.

998. *Aspergillus niger* Metabolism of Citrus Furanocoumarin Inhibitors of Human Cytochrome P450 3A4

Kyung Myung, John A. Manthey and Jan A. Narciso

For: Appl. Microbiol. Biotechnol. 78:343-349 (2008)

Furanocoumarins are a class of aromatic compounds found in plants. There are three major furanocoumarins in grapefruit that interfere with drug uptake, and they are 6', 7'-epoxybergamottin (EB), 6', 7'-dihydroxybergamottin (DHB) and bergamottin (BM). Until now there was no information on biotransformation of grapefruit furanocoumarins by microorganisms. Thus, we studied the biotransformation of furanocoumarins by fungi and found that *Aspergillus niger* can metabolize the furanocoumarins into bergaptol-5-sulfate, a novel final product. In addition, the fungus had a capability of metabolizing non-grapefruit furanocoumarin, xanthoxol, into xanthotozol-8-sulfate. This will provide new insights into how fungi can metabolize some grapefruit and non-grapefruit furanocoumarins and perhaps alleviate the drug uptake problem.

999. Binding of furanocoumarins in grapefruit juice to *Aspergillus niger* hyphae

Kyung Myung, John A. Manthey and Jan A. Narciso

For: Appl. Microbiol. Biotechnol. 78:401-407 (2008)

In this study, we report a capability of *Aspergillus niger* (food grade fungus) in absorbing furanocoumarins (FCs) in grapefruit juice (GFJ). From a fermentation, we found that most of polar FCs were disappeared in GFJ for 4 days, leading to a question if the FCs were actively transported into the fungus. Interestingly, most of disappeared FCs was found to be absorbed to the autoclaved (heat-killed) fungal material. The level of the FCs removal was proportional to the amount of autoclaved fungus we added in GFJ. Our results would be helpful in understanding the interaction of the fungus with FCs and providing a possible industrial application for FCs-reduced GFJ production.

1000. Effect of Edible Coatings and Other Surface Treatments on Pericarp Color of Thai Lychee Cultivars

Nithiya Rattanapanone, Anne Plotto and Elizabeth Baldwin
For: Fla. State Hort. Soc. 120:222-227 (2007)

Lychee is a non-climacteric subtropical to tropical fruit of high commercial value on the international trade market. This fruit, however, is highly perishable due to rapid loss of bright red peel color which turns brown within 24 to 28 hours after harvest. This paper represents ongoing research aimed at testing methods to preserve the red color of lychee fruit peel to replace using sulfur dioxide treatments due to consumer health concerns.

1001. A New Composite Coating Containing HPMS, Beeswax, and Shellac for 'Valencia' Oranges and 'Marisol' Tangerines

Maria-Llanos Navarro-Tarazaga, Marin Bernadita Pérez-Gago, Kevin Goodner and Anne Plotto
For: Fla. State Hort. Soc. 120:228-234 (2007)

Commercial waxes (coatings) used for citrus include carnauba and shellac, which provide an attractive shine to the fruit, but are not necessarily made of 100% food grade ingredients, or ingredients that would be considered acceptable for organic food. This study presents two experiments designed to optimize the formulation of an experimental coating was made of hydroxypropylmethylcellulose (HPMC), bee's wax, shellac, oleic acid (a lipid) and glycerol (a plasticizer). The optimum performance was with a formulation where the HPMC:glycerol ratio was 1:2, with 8% solids content. Another experimental formulation made with a mixture of polyethylene and candelilla wax gave the best results in terms of fruit quality in storage.

1002. Distribution of Aroma Volatiles in a Population of Tangerine Hybrids

Pauline Kerbiriou, Anne Plotto, Kevin Goodner, Elizabeth Baldwin and Fred G. Gmitter, Jr.
For: Fla. State Hort. Soc. 120:267-275 (2007)

Breeding programs in Florida focus on fruit quality in addition to horticultural performance. While orange juice volatile composition has been well studied, little is known about volatiles in tangerines. This study was undertaken to identify the volatiles present in tangerine juice, to find relationships between hybrids regarding their volatile composition, and to investigate the influence of parentage and harvest date on volatile composition. In total, more than 200 volatiles were identified in the 45 hybrids harvested over the season. The statistical analyses by Cluster Analysis allowed grouping of samples based on volatile composition. Samples having sweet oranges in their genetic background were particularly rich in esters, which are volatiles known to impart a fruity note to orange juice.

1003. Testing Efficiencies of Postharvest Decay Controls
J.A. Narciso
For: Fla. State Hort. Soc. 120:276 (2007)

There are ever increasing numbers of antimicrobial compounds available as treatments to extend shelf-life of minimally processed fruits and to control post harvest decay on fresh market fruit. Most microorganisms are controlled by specific compounds or groups of compounds and to ascertain which compounds would be useful on a specific organism requires screening many different antimicrobials. A small, moist chamber system was developed which allows for rapid evaluation of many compounds and their efficiencies to control a specific organism or group of organisms.

1004. Spectral Characteristics of Grapefruit Peel Oil Furanocoumarins and Coumarins
Thais B. Cesar and John A. Manthey
For: Fla. State Hort. Soc. 120:295-298 (2007)

Consumption of grapefruit juice will cause an interference in the proper metabolism of certain prescription drugs. This interference is called "grapefruit/drug interaction". The compounds responsible for this interaction are furanocoumarins. In the present study, 10 new furanocoumarins were isolated and their chemical structures were preliminarily characterized by several analytical methods, including UV, infrared, and mass spectral analysis. The results suggest that these compounds represent a new class of furanocoumarins in grapefruit juice.

1005. A Preliminary Investigation of Furanocoumarin Metabolism by *Aspergillus niger*
Kyung Myung, John A. Manthey and Jan A. Narciso
For: Fla. State Hort. Soc. 120:299-303 (2007)

There are compounds called furanocoumarins in grapefruit juice that cause the grapefruit/drug interactions in humans. Metabolism of the grapefruit furanocoumarins by organisms has not been studied. In this study we carried out fermentation experiments using several fungi. Among them, *Aspergillus niger* showed a capability of metabolizing these grapefruit furanocoumarins. As a result, new metabolites were found along with a detection of the presence of novel enzymatic activities in the fungus. This will contribute to an understanding of furanocoumarin related enzymes in the metabolic pathways.

1006. Rheological Investigation of Pectin Deesterified Using Salt-independent Pectin Methylesterase from Citrus

Gary A. Luzio and Randall G. Cameron

For: Fla. State Hort. Soc. 120:304-309 (2007)

Pectin is a water soluble polysaccharide and polysaccharides are generally sold based on rheological properties such as viscosity or other properties such as suspension. Suspension aids, a target application, can be subjected to intermittent shearing forces and studying the effects of shearing is of importance. This research examines in greater detail the suspension and properties of pectin using a "gel-in-place" procedure, where one can examine suspension before and after shearing the sample. The optimum level of calcium ion and pectin concentration required for forming the suspension aid was determined using this new procedure.

1007. Economic Analysis of Ethanol Production from Citrus Peel Waste

Weiyang Zhou, Wilbur Widmer and Karel Grohmann

For: Proc. Fla. State Hort. Soc. 120: 310-315 (2007)

Ethanol production from citrus peel is attractive in Florida. Each year, the citrus industry produces 3.5 million tons of citrus peels, which are currently dried and sold as cattle feed at a loss. Advances have recently been made that have given rise to the potential of a new process for making fuel ethanol from citrus peel waste. The economic impact of citrus ethanol on the citrus industry is assessed and found favorable. The estimated production cost of citrus ethanol is approximately \$1.23/gallon. Commercial production of citrus ethanol is economically feasible. Ethanol production from citrus peel could increase juice producers' revenues, lower limonene emissions and create more job opportunities in Florida.

1008. Assessment of Sensory and Chemical Characteristics of Several Selections of Strawberries Over a Period of 2 Years

Celine Jouquand, Anne Plotto and Craig Chandler

For: Berry Vegetable Times, 2:4-7 (2008)

'Festival', the main cultivar grown by the large commercial strawberry farms in Florida, can produce firm, attractive and sweet fruit with a strong aroma. However, 'Festival' has low yields in early December and the overall flavor of its fruit tend to be low in March. New selections are being evaluated as potential complements to 'Festival' in December and March.

1009. Discrimination of Mango Fruit Maturity by Volatiles Using the Electronic Nose and Gas Chromatography

Marc Lebrun, Anne Plotto, Kevin Goodner, Marie-Noelle Ducamp and Elizabeth Baldwin

For: Postharvest Biol. Technol. 48: 122-131 (2008)

In this study, mango fruit, harvested at different stages of green maturity, were analyzed for their aroma volatile production which was related to their quality after ripening. It was found that fruit harvested later had better quality in terms of higher sugar and aroma levels after ripening. Since the aroma volatiles were different for the different harvest maturities, these volatiles could be used to determine if the mango was ripe enough to harvest.

1010. Organic vs Conventionally Grown Rio Red Whole Grapefruit and Juice: Comparison of Production Inputs, Market Quality, Consumer Acceptance, and Human Health-Bioactive Compounds

Gene E. Lester, John A. Manthey and Béla S. Buslig

For: J. Agric. Food Chem. 55:4474-4480 (2007)

Claims that organic produce is better tasting and more nutritious than non organic (conventional) produce are largely unsubstantiated. This is due to a lack of rigor in matching common production variables of both production systems. When all common production variables were matched in a production systems comparison on commercially-grown conventional and certified-organic red-fruited grapefruit, conventional fruit was found to be better colored, higher in lycopene, less tart, lower in the bitter principle naringin and were better testing than organic. Whereas, organic fruit had a commercially preferred thinner peel, was higher in vitamin C (citric acid) and sugars, and lower in the drug interactive bergamottin compounds and the negative health compound nitrate.

1011. Practical Retention Index Models of OV-101, DB-1, DB-5 and DB-Wax for Flavor and Fragrance Compounds

K.L. Goodner

For: Lebensm.-Wiss. U.-Technol., 41:951-598 (2008)

High quality regression models of gas chromatographic retention indices were generated for four different column types. The models were generated using a second order equation including the cross product utilizing two easily obtained variables, boiling point and the log octanol-water coefficient. Additionally, a method for determining outlier data (the Goodner Outlier Determination (GOOD) method) is presented that is a combination of several outlier tests and is less prone to discarding legitimate data.

1012. Interaction of Volatiles, Sugars, and Acids on Perception of Tomato Aroma and Flavor Descriptors

E.A. Baldwin, K. Goodner and A. Plotto

For: Journal of Food Science, 73(6):S294-S307 (2008)

U.S. tomatoes have been losing market share to greenhouse grown fruit from Canada and hybrids from Mexico. Flavor is part of the problem. This study looks at the effect of sugars, acids and aroma compounds spiked into tomato puree using a trained sensory panel to better understand what drives perception of descriptors of tomato flavor. This information will be useful to breeders and genetics who are working to improve tomato flavor.

1013. The Citrus Flavonoids Hesperetin and Nobiletin Differentially Regulate Low Density Lipoprotein Receptor Gene Transcription in HepG2 Liver Cells

Brian Morin, LaNita A. Nichols, Katherine M. Zalasky, J. Wade Davis, John A. Manthey and Lené J. Holland

For: J. Nutrition 138:1274-1281 (2008)

Citrus Flavonoids, particularly those termed the “polymethoxylated flavones”, have been shown to lower LDL cholesterol and serum triglycerides in animal studies. Detail biochemical studies have been done to uncover the mechanisms by which these beneficial effects occur. The mechanisms occur through the activation of specific and powerful activators for human liver cells.

1014. Simultaneous saccharification and Fermentation of Citrus Peel Waste by *Saccharomyces cerevisiae* to Produce Ethanol

Mark R. Wilkins, Wilbur W. Widmer and Karel Grohmann

For: Process Biochemistry, 42:1614-1619 (2008)

Prior to fermentation, citrus peel waste was pretreated with a process to remove peel oil which inhibits microbial fermentation of sugars in this material into produce ethanol. Experiments were then performed where limonene was added back to the peel in order to determine the threshold amounts of limonene which cause inhibition of fermentation using *Saccharomyces cerevisiae*. Enzyme loadings of hydrolysis enzymes, necessary to liquefy the citrus waste to facilitate handling, were also varied to determine their effect on ethanol yields. Ethanol yield was significantly reduced when limonene concentrations were greater than 0.33% (v/v). Ethanol production was also significantly reduced when enzyme loadings (IU or FPU/g peel dry solids) were below 24.9, pectinase; 0.022, cellulase; and 13, beta-glucosidase.

1015. Further Characterization of a Furanocoumarin-free Grapefruit Juice on Drug Disposition: Studies with Cyclosporine

Mary F. Paine, Wilbur W. Widmer, Susan N. Pusek, Kimberly L. Beavers, Anne B. Criss, Jennifer Snyder and Paul B. Watkins
For: *Amer. J. Clin. Nutr.*, 87:863-871 (2008)

Grapefruit juice (GFJ) can increase the absorption of certain drugs by inhibiting an intestinal enzyme naturally present in the human intestine which deactivates a portion before they can be absorbed. We recently established furanocoumarins as the mediators of the interaction between GFJ and felodipine, one drug that is affected, using a "furanocoumarin-free" (FC-free) GFJ. Because the juice from Seville sour orange, which contains several of the major furanocoumarins as GFJ, produced an interaction with felodipine but not cyclosporine, we hypothesized that the FC-free GFJ might not remove the interaction potential with cyclosporine. After comparing absorption of cyclosporine in individuals following consumption of orange juice, GFJ, and the FC-Free GFJ, GFJ was found to significantly affect cyclosporine absorption compared to the orange juice control while the FC-free GFJ did not. This led to the conclusions that furanocoumarins also mediate the GFJ-cyclosporine interaction, with the most plausible mechanism involving the combined inhibition of enteric CYP3A4 and P-gp. It also seems prudent to repeat the Seville OJ-cyclosporine interaction with a larger sample size.

1016. Odour and Flavour Thresholds for Key Aroma Components in an Orange Juice Matrix: Esters and Miscellaneous Compounds

Anne Plotto, Carlos A. Margaria, Kevin L. Goodner and Elizabeth A. Baldwin
For: *Flavour and Fragrance J.*, 23:398-406 (2008)

This study presents the method and results of threshold values of compounds important for orange juice flavor obtained by using a deodorized orange juice matrix as the dilutant instead of water. When the concentration of volatile compounds is above their threshold value, the compounds are deemed to contribute to the food flavor. Since the threshold varies if it is measured in water or in the juice, more accurate values are obtained by measuring thresholds in juice. The threshold values provided by this research are directly applicable by the industry in comparison with the current values that are published in water.

1017. A Sensory and Chemical Analysis of Fresh Strawberries Over Harvest Dates and Seasons Reveals Factors that Affect Eating Quality

Céline Jouquand, Anne Plotto, Kevin Goodner and Craig Chandler
For: *J. Amer. Soc. Hort. Sci.*, 133(6):859-867 (2008)

'Festival' is the main cultivar grown by the large commercial strawberry farms in Florida. It produces firm and attractive fruit in January and February, but the quality decreases in March. New selections from the University of Florida are developed to complement 'Festival'. In this paper, the components of eating quality of the new strawberry selections were studied, together with the harvest date impact on their chemical and sensory characteristics. Taste panels were performed in 2006 and 2007 with five University of Florida new strawberry selections and two new Australian varieties.

1018. Removal of Furanocoumarins in Grapefruit Juice by Edible Fungi
Kyung Myung, Jan A. Narciso and John A. Manthey
For: J. Agric. Food Chem., 56:12064-12068 (2008)

Furanocoumarins are active components in grapefruit-drug interactions. This study looks at potential use of edible fungi to remove furanocoumarins in grapefruit juice. In this study, the four edible fungi tested showed effectiveness in absorbing furanocoumarins in grapefruit juice. This information is useful for further studies on food binding to remove furanocoumarins.

1019. Effect of Harvest Maturity on Quality of Fresh-cut Pear Salad
Jinhe Bai, Pinshan Wu, John Manthey, Kevin Goodner and Elizabeth Baldwin
For: Postharvest Biol. Technol., 51:250-256 (2009)

Pear quality is problematic if pears are harvested early enough to be firm, they lack flavor, but if harvested later, they are thought to be too soft for shipping and handling and especially for processing into a fresh-cut product. This research compares two harvest maturities, commercial and a later harvest where the pear is more ripe and soft, for the purpose of a fresh-cut product for a fruit salad. Results showed that the later harvested fresh-cut pear was preferred by panelists, despite being softer, due to its superior flavor.

1020. Anti-inflammatory Activity of an Orange Peel Polymethoxylated Flavone, 3',4',3,5,6,7,8-Heptamethoxyflavone, in the Rat Carrageenan/Paw Edema and Mouse Lipopolysaccharide-Challenge Assays
John A. Manthey and Philip Bendele
For: J. Agric. Food Chem., 56:9399-9403 (2008)

A compound from orange peel was evaluated for its ability to combat inflammation in two animal studies. These studies showed that when this compound was injected into rats and mice, it was very effective in lowering inflammation, but when given orally, this compound showed no activity. The reason for this latter lack of activity may be due to the conversion of the original compound into inactive derivatives bound to sugar acids.

1021. Variability for Free Sugars and Organic Acids in Capsicum chinense
Robert L. Jarret, Terry Berke, Elizabeth A. Baldwin and George F. Antonios
For: Chemistry & Biodiversity, 6:138-145 (2009)

Two hundred and sixteen unique varieties of pepper (*Capsicum chinense*) were grown in the field and their fruit were subsequently harvested and analyzed for the concentrations of various sugars and acids that are believed to contribute to the sweetness and/or sourness of pepper fruit. Great variation was found for the concentrations of these compounds in the mature fruit of this species. The data presented suggests that selection for varieties of pepper with defined sugar/acid profiles could result in varieties with unique flavor attributes and the germplasm analyzed in this study could serve as a source of genes effecting fruit taste.

1022. Effects on Flavor

Charles F. Forney, James P. Mattheis and Elizabeth A. Baldwin

For: Modified and Controlled Atmospheres for the Storage, Transportation, and Packaging of Horticultural Commodities, Yahia, Elhadi M., CRC Press, Boca Raton, FL, Chapter 7, pp 119-158 (2009)

The flavor of fresh fruits and vegetables is an important factor in determining quality and consumer satisfaction. However, there is often dissatisfaction among consumers concerning the flavor of fruits and vegetables. First time purchases are usually based on appearance and firmness, but repeat buys are dependent on internal quality and traits such as texture and flavor. The loss/lack of flavor following postharvest handling, storage, and marketing of fresh fruits and vegetables often precedes the loss of visual quality, which has been reported for both whole and fresh-cut fruits and vegetables. Ensuring good flavor is critical to encourage increased consumption, which is important for human health and well being as well as strengthening and expanding markets for the horticultural industry. Postharvest flavor change can be affected by many preharvest as well as postharvest factors. However, the impact of postharvest technologies on product flavor is not always appreciated nor are the biochemical and genetic mechanism regulating flavor understood.

1023. Pome Fruit

Jinhe Bai, Robert K. Prange and Peter M.A. Toivonen

For: Modified and Controlled Atmospheres for the Storage, Transportation, and Packaging of Horticultural Commodities, Yahia, Elhadi M., CRC Press, Boca Raton, FL, Chapter 12, pp 267-285 (2009)

This chapter describes the beneficial influences of controlled atmosphere (CA) and modified atmosphere (MA) on the major quality deterioration, physiological disorders and diseases of pome fruits, and the problems resulting from improper atmosphere conditions. It discusses the interactions between 1-methylcyclopropene (1-MCP) and CA/MA. It also covers the proper fruit maturity and the specific requirement of gas composition by different cultivars.

1024. Fla. 8153 Hybrid Tomato; Fla. 8059 and Fla. 7907 Breeding Lines

John W. Scott, Elizabeth A. Baldwin, Harry J. Klee, Jeffrey K. Brecht, Stephen M. Olson, Jerry A. Bratz and Charles A. Sims

For: HortScience, 43(7):2228-2330 (2008)

Tomato flavor quality has long been a complaint of consumers. This paper announces the release of a Florida tomato 'Tasti-Lee' that was selected, not only for horticultural characteristics and disease resistance, but also for flavor quality and high lycopene, the red plant pigment, in fruits and vegetables, such as tomato. Thus this new tomato variety has a nice appearance with deep red flesh, health benefits and good flavor.

1025. Optimization of Strawberry Volatile Sampling by Direct Gas Chromatography Olfactometry

Celine Jouquand, Craig Chandler, Kevin Goodner and Anne Plotto
For: Proc. Fla. State Hort. Soc., 121:260-264 (2008)

When doing flavor research, there is no perfect way of extracting samples for analyzing aroma volatiles. This paper presents a simple method to choose the sample extract with the odor profile closest to the sample. This method can be used by flavor chemists to optimize their sample extract before analysis by gas chromatography.

1026. Effect of Early Detection Huanglongbing on Juice Flavor and Chemistry

Anne Plotto, Elizabeth A. Baldwin, T. Greg McCollum, Jan A. Narciso
For: Proc. Fla. State Hort. Soc., 121:265-269 (2008)

Huanglongbing (HLB) is an emerging disease that is affecting Florida citrus industry. Anecdotal reports mention that trees affected with the disease produce fruit that impart off-flavor to the juice made of that fruit. In this experiment, juice made with fruit from trees affected with HLB at an early stage were tested against juice made with fruit from healthy trees. Panelists could perceive a difference between the two juices most of the time. Juice from HLB-affected trees tended to be sweeter than the control.

1027. Differences in Secondary Metabolites in Leaves from Orange (*Citrus sinensis* L.) Trees Affected with Greening Disease (Huanglongbing) (HLB)

John A. Manthey
For: Proc. Fla. State Hort. Soc., 121:285-288 (2008)

An emerging damaging disease termed Huanglongbing (HLB) in citrus has attracted a great deal of attention by the US citrus industry. There is a need to understand the effects of this disease on the chemical composition of leaves and fruit of affected trees. This study deals with an analysis of the changes in the chemical composition of HLB-affected leaves. Many of the compounds in orange leaves show strong fluctuations when influenced by this disease. These findings will help the US citrus industry understand the impacts of this disease on citrus trees, and ultimately on juice quality and taste.

1028. Effects of Laser Labeling on the Quality of Tangerines during Storage

Preeti Sood, Chris Ference, Jan Narciso, Ed Etxeberria
For: Proc. Fla. State Hort. Soc., 121:297-300 (2008)

Laser labeling is a new technology that serves to ameliorate many problems caused by the present system we have of using paper labels. Primarily there is less paper waste and damage to the fruit surface with adhesives. Also, in this age of security, a paper label and the information on it can be removed and/or adulterated but with a laser label, once it is on the peel it will not come off and cannot be changed. Because this is a new technology, this project addresses some of the potential problems that might occur with the use of a laser on a peel and this includes any increases in water loss and decay. We hope to show that there is little damage to the fruit and that the positive aspects of using a laser to label produce will be enough to offset any minor difficulties.

1029. Developments in Ethanol Production from Citrus Peel Waste
Weiyang Zhou, Wilbur Widmer and Karel Grohmann
For: Proc. Fla. State Hort. Soc., 121:307-310 (2008)

Over the past 20 years, fuel ethanol from agricultural waste has been studied extensively. Although much progress has been made, high production costs remain the major obstacles to commercial production of fuel ethanol from agricultural waste, such as wheat straw, sugarcane bagasse and corn stover. A new process, developed by USDA/ARS scientists and their partner Renewable Spirits, LLC, has given rise to the potential commercial production of ethanol from citrus peel waste. In this new process, limonene, a high value co-product, can be recovered from citrus peel, thereby lowering the production cost.

1030. Biosorption Properties of Citrus Peel Derived Oligogalacturonides, Enzyme-modified Pectin and Peel Hydrolysis Residues
Randall G. Cameron, Gary A. Luzio, Wilbur W. Widmer and Muhammad Iqbal
For: Proc. Fla. State Hort. Soc., 121:311-314 (2008)

A citrus processing industry priority is obtaining added value from fruit peel. Approximately one-half of each processed fruit is added to the waste stream. Peel residue mainly is composed of water (~80%), the remaining 20% (solid fraction) consists of pectin, soluble sugars, cellulose, proteins, phenolics, etc. Viewing these constituents in light of exploiting potential functionality and creating added value at the same time as diverting material away from the feed mill and the land fill, pectin provides enormous opportunity. To create a new technology centered on pectin structure and concomitant functionality, we have begun exploring methods to precisely engineer pectin structure and correlate it to function. A valuable pectin functionality, resulting from its polyanionic character, is its biosorption capabilities. In the past several years we have developed techniques and methods to enzymatically modify pectin structure, characterize these structural alterations and determine their effect on rheology and calcium sensitivity.

1031. Microwave Release of Pectin from Orange Peel Albedo Using a Closed Vessel Reactor System

Gary A. Luzio

For. Proc. Fla. State Hort. Soc., 121:315-319 (2008)

After removal of soluble sugars and other compounds by washing, citrus peel is largely composed of pectin, cellulose and hemicellulose. In order to utilize the greatest amount of citrus peel byproduct, it would appear reasonable that one or all three of these polysaccharides be converted into a useful industrial material. One of the components, pectin is relatively easy to modify using enzymes and has great utility in the food industry and other applications. Thus it appears reasonable to focus on the use of pectin for the maximum utilization of fruit peel for new products from peel. Modification and use of pectin in many applications requires the pectin to be a soluble form. Pectin is normally extracted using heat and strong acid conditions at 70°C. New microwave technology was presented which allowed for rapid heating and cooling of the extract temperatures in excess of 100°C. The quality and amount of pectin extracted using microwaves at 115°C was equivalent to that extracted under at 70°C using resistive heating except the extraction was performed 100 times faster. This data is important for the future development of a cost effective process for pectin extraction for industrial applications.

1032. Removal of Grapefruit Juice Furanocoumarins by Four Edible Fungi

Kyung Myung, Jan A. Narciso and John A. Manthey

For: Proc. Fla. State Hort. Soc., 121:320-321 (2008)

From our previous study, we observed that furanocoumarins in grapefruit juice bind to hyphae of *Aspergillus niger*. In this study, we tested whether four edible fungi can absorb furanocoumarins in grapefruit juice. We found that the four edible fungi can absorb furanocoumarins in grapefruit juice. It seems that the interaction between fungal hyphae and furanocoumarins in grapefruit juice occurs with all the fungi. These results would be useful in understanding the interaction and for potential industrial application for the production of furanocoumarin-reduced grapefruit juice using edible fungi. Some furanocoumarins in grapefruit juice interfere with drug uptake, and it could be advantageous to remove them.

1033. A Simple Method for Screening Antimicrobial Compounds with Application to Plant Disease and Fruit Quality

J.A. Narciso

For: Letters in Applied Microbiology, 48:548-553 (2009)

In order to find compounds that are effective against specific microorganisms, screening methods are undertaken. The majorities of these tests are accomplished in a petri dish using methods such as the disc assay or agar diffusion, and have no relation to the activity of the compound on the surface on which it will be applied. The method described in this paper takes these screens one step closer to in vivo studies by applying the experimental compound onto the surface to be protected, and not just in the petri dish, under aseptic and controlled conditions.

1034. Screening Citrus Rootstocks and Related Selections in Soil and Solution Culture for Tolerance to Low-iron Stress

William S. Castle, James Nunnallee and John A. Manthey
For: HortScience, 44(3):638-645 (2009)

Iron deficiency can severely impact citrus cultivation in high-carbonate soils. A greenhouse method had been previously developed by one of the authors (JAM) to detect tolerance to iron deficiency, and this new study applies this method to screen many different citrus rootstocks for iron deficiency tolerance. The effects of iron deficiency on plant growth characteristics and leaf color for these many rootstocks were monitored and correlated with the iron deficiency tolerances measured for these rootstocks. A wide range of responses and tolerances were observed and some possible taxonomic correlations were suggested by trends observed in this study.

1035. Combination of 1-Methylcyclopropene and Ethoxyquin to Control Superficial Scald of 'Anjou' Pears

Jinhe Bai, Xinhua Yin, Bruce D. Whitaker, Kristi Deschuytter and Paul M. Chen
For: HortTechnology, 19(3):521-525 (2009)

A 25 nL-L1 1-methylcyclopropene (1-MCP) application at 20°C for 24 hours on the day of harvest plus and ethoxyquin drench at 1000 µL L1 after 1, 7, 30 and 60 days (d) of cold storage controlled superficial scald of 'd'Anjou' pears stored in air at -1°C for 5 months. 1-MCP alone, or ethoxyquin alone applied after 1 d or 7 d storage at -1°C, adequately controlled scald for only 3 months, and delayed ethoxyquin application (30 or 60 d) did not control scald. The effects of 1-MCP and ethoxyquin on α -farnesene metabolism indicated that 1-MCP controlled scald by inhibiting α -farnesene synthesis and oxidation, whereas ethoxyquin worked only by inhibiting of α -farnesene oxidation.

1036. Laser Etching: A Novel Technology to Label Florida Grapefruit

Preeti Sood, Chris Ference, Jan Narciso and Ed Etxeberria
For: HortTechnology, 19(3):504-510 (2009)

Grapefruit has always been labeled with sticky paper labels that mar the fruit, stick to one another in storage and add to the landfill. These labels are easily removed and should there be a problem and the fruit need to be traced back to the grove, the information would be missing. The laser technology uses a CO₂ laser beam that etches into the first few outer cells of the fruit peel and leaves a mark containing information that cannot be peeled off, washed off or changed in any way. The information on the label is permanent. Etching into the fruit peel does not increase the entrance of food pathogens, postharvest pathogens or water loss if the laser label is covered with wax after etching. This is a new technology that would benefit Florida citrus growers.

1037. Pear Responses to Split Fertigation and Band Placement of Nitrogen and Phosphorus

Xinhua Yin, Jinhe Bai and Clark F. Seavert
For: HortTechnology, 19(3):586-592 (2009)

Nitrogen (N) and Phosphorus (P) applications reduced by 20% of the current broadcast application rates and fertigated in five equal split applications each season, can supply bearing pear trees with adequate N and P nutrition without resulting in any reduction in soil indigenous N and P supply. Shift from the current N and P management practice – single broadcast application on the soil surface to split fertigation showed significant beneficial effects on fruit size, reduction in fruit superficial scald, and increase in N and P fertilizer use efficiency. Band placement of N and P increases fruit size and reduces fruit superficial scald when compared with broadcast application, with soil disturbance caused by band placement. Overall, our results suggest that split N and P fertigation and band placement of N and P improve tree N and P nutrition, pear quality and storability, and the use efficiency of applied N and P is better relative to our current N and P management practice. We expect split N and P fertigation practices will be used in commercial pear production to reduce fertilizer costs, fertilizer application costs, soil compaction, and water pollution in the Mid-Columbia region of Oregon.

1038. Demethylation of a Model Homogalacturonan with a citrus Salt-independent Pectin Methylesterase: Effect of pH on Block Size and Number, Enzyme Mode of Action and Resulting Functionality

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The mode of action of the citrus pectin demethylating enzyme appears to have a variable degree of processivity, on average producing only relatively small demethylated blocks of pectin in a model system. The size of the demethylated blocks produced by the enzyme was dependent on the pH of the reaction buffer and the final degree of methylation. Similar block sizes could be introduced by manipulating both pH and endpoint degree of methylation so that an optimized process could be engineered to achieve the desired structural/functional property for predicted pectin polymers. Calcium sensitivity and rheological properties associated with functionality could be manipulated by the amount of demethylation and the pH at which it is conducted. This flexibility has the potential to eliminate potential problems that might be associated with undesirable pHs such as side reactions or corrosion. The ability to obtain the same end product under varying conditions may be very helpful for custom tailoring at pectin product for a commercial process.