FY 2015 Annual Report for National Program 306,
Quality and Utilization of Agricultural Products

Introduction

The USDA-ARS National Program for Quality and Utilization of Agricultural Products (NP306) initiated new research objectives in 2015 for the various research Projects. Scientists in NP306 continue to demonstrate impact the numerous and diverse areas of research that enhance the marketability of agricultural products, increase the availability of healthful foods, develop value-added food/ nonfood products, and enable commercially-preferred technologies for post-harvest processing.

In FY2015, NP306 initiated project plans that were developed from comprehensive stakeholder input gleaned from the NP306 national stakeholder SharePoint site. The site brought stakeholders and the NP306 research community together to prioritize the scope and direction of research in NP306 and to discuss current and future areas of impact for stakeholders. These efforts are documented online at: http://www.ars.usda.gov/research/programs/programs.htm?NP_CODE=306 and include: the ***Retrospective Review Panel Executive Summary*** and the ***FY2015-FY2020Action Plan*** for NP306 which went into effect in summer 2015.

The overarching goal of NP 306 is to conduct research that develops knowledge and enables commercially-viable technologies to:
(1) Measure and maintain/enhance post-harvest product quality,
(2) Harvest and process agricultural materials, and
(3) Create new value-added products.

By developing commercially viable technologies that maintain/enhance postharvest product quality and create new products, ARS Quality and Utilization of Agricultural Products research increases the demand for agricultural products and, therefore, benefits both agricultural producers and rural communities.

During FY 2015, 170 full-time scientists and 19 vacancies working at 17 locations across the U.S. actively engaged in ARS-led and cooperative research projects in NP306. The gross fiscal year 2015 funding for NP306 was $72.1 million.

The following scientists retired from the ranks in NP306:

Mr. **Marty Glynn**, Dr. **Michael A. Cotta**, Dr. **Maryann Taylor,** Dr. **Timothy Sanders,** and Dr. **Ronald Holser**.

The distinguished record of service of these scientists is recognized world-wide, and they will be missed.

The following scientists were hired into the ranks in NP306:

Dr. **Darrin Haagenson**, US Potato Lab, East Grand Forks, MN; Dr. **Sunghyun Nam**, Cotton, SRRC, New Orleans, LA; Dr. **Ephantus J. Muturi,** Entomology, NCAUR, Peoria, IL; Dr. **Jenni Firrman**, Dairy Unit, ERRC, Wyndmoor, PA.

The following scientists in NP 306 received prominent awards in 2015:

Dan Solaiman, Rick Ashby, and Nicole Crocker received 2015 FEB-Philadelphia, Gold Medal for Outstanding Scientific Accomplishment Group Award.

Ellie Brown, received Life Membership in the American Leather Chemists Association (ALCA), Special Recognition Award for distinguished service to the organization.

Maryann Taylor, (retired) received a "Special Recognition Award" bestowed by ALCA "In appreciation for her many years of distinguished service to the Association including publishing in the Journal; presenting papers at the Annual Conventions, serving as President as well as serving on numerous technical committees and the Editorial Board; the recipient of the Alsop Award, Fred O'Flaherty Service Award, and the Prize Paper Award; and serving as the IULTCS Delegate for many years."

Elizabeth Baldwin, Ft. Pierce, FL, received the" International Horticulturist Award" from the Chongqing Bureau of Foreign Experts affairs and the Chongqing Fruit Tree Research Institute, Chongqing, China for her work with the Chongqing Fruit Tree Research Institute on citrus flavor under a NFCA.

Elizabeth Baldwin (and co-authors, Jinhe Bai, Anne Plotto, and Sharen Dea of ARS) , Ft. Pierce, FL, received 3rd place "Sensors Best Paper Award 2015" in the Review Papers Group from the Journal "Sensors" for their paper entitled "Electronic noses and tongues: applications for the food and pharmaceutical industries".

Jinhe Bai, Ft Pierce, FL received an ARS HQ award: Embedding antimicrobial agents into edible coatings to maintain quality and safety of fresh-whole and fresh-cut fruits and vegetables (submitted July 1, 2015)

Tara McHugh, Albany, CA, Pacific West Area, ARS Research Leader of the Year, 2015.

Wally Yokoyama, Albany, Ca, American Chemical Society Food Chemistry Division Distinguished Service Award, 2015

Mendel Friedman, Albany, Ca, Western Association of Agricultural Experiment Station Directors Award of Excellence, and the Thomson Reuters Highly Cited Researcher Award, 2015.

Brian Condon, Vince Edwards, Doug Hinchliffe, Anthony De Lucca and Mike Reynolds, New Orleans, LA, Federal Laboratory Consortium, Southeast Region, Excellence in Technology Transfer (winner) for "Development of Greige Cotton Nonwoven Fabrics for Disposable Diapers", 2015.

Arland Hotchkiss, Wyndmoor, PA, received the Melville Wolfrom Award, Div. of Carbohydrate Chemistry (CARB), American Chemical Society (ACS). It was presented at the 2015 sprint National ACS Mtg for contributions to CARB and advances in carbohydrate chemistry.

Yaguang Lou, Beltsville, MD, received four awards: "Outstanding Vegetable Publication Award" from American Society for Horticultural Sciences (ASHS), August, 2015; "Volunteer Service Award from Institute of Food Technologists (IFT), Fruit and Vegetable Products Division, July, 2015; Co-PI on a NIFA grant award with a total of $4,584,535. The title of the proposal is "Sustaining the supply of high quality lettuce in changing technological and climatic environments"; and ARS-NEA Senior Scientist of the Year Award.

Tim Sanders, (retired) Raleigh, NC, was awarded one of the highest honors in the U.S. peanut industry: the American Peanut Council's Lifetime Achievement Award. This award, not given out every year, is reserved for individuals who have made exceptional long-term impact on the industry.
Steve Cermak and **Terry Isabel,** Peoria, IL, received the Federal Laboratory Consortium, Midwest Region, award for "Excellence in Technology Transfer" – Commercialization of Estolides as Biobased Engine Oil. October, 2015.
Victoria Finkenstadt, Peoria, IL, received the Distinguished Agriculture Alumni Award 2015, Purdue University, College of Agriculture, for Carbohydrate Chemistry; and the Illinois Heartland American Chemical Society Award: Chemist of the Year, 2015.

The quality and impact of NP 306 research was further evidenced in 2015 by the following:
353 refereed journal articles published
19 new patent applications and five new invention disclosures submitted
13 current cooperative research and development agreements with stakeholders
27 new material transfer agreements with stakeholders, and
34 new scientific technologies developed.

In 2015, NP 306 scientists participated in research collaborations with scientists in: Argentina, Australia, Austria, Belgium, Brazil, Canada, Central African Rep., Chile, China, Denmark, Egypt, Finland, France, Germany, Ghana, India, Ireland, Israel, Italy, Japan, Kazakhstan, Kenya, Korea (South), Malaysia, Mexico, New Zealand, Nigeria, Pakistan, Philippines, Russia, South Africa, Spain, Switzerland, Taiwan, Tajikistan, Tanzania, Thailand, Turkey, and United Kingdom,

NP 306 Accomplishments for FY2015

This section summarizes significant and high impact research results that address specific components of the FY 2012 – 2015 action plan for NP 306. Each section summarizes accomplishments of individual research projects in NP 306. Many of the programs summarized for FY 2015 include significant domestic and international collaborations with both industry and academia. These collaborations provide extraordinary opportunities to leverage funding and scientific expertise for USDA - ARS research by rapidly disseminating technology, which enhances the impact of ARS research programs.

This National Program is organized into two component areas:

Foods
Problem areas of research are:
Define and measure quality
New bioactive ingredients and functional foods
New and Improved Food Processing Technologies

Non-Foods
Problem areas of research are:
Develop new post-harvest technologies

Enable technologies for (1) expanding market applications of existing biobased products, and (2) producing new marketable non-food biobased products derived from agricultural products and byproducts, and estimate the potential economic value of the new products.

Component 1: Foods

A fruit-based, multi-component nutrient bar promotes weight loss and improves insulin resistance in clinical studies. Obesity is a major health-related issue related to poor diets in the United States with one in three adults considered obese. ARS scientists in Albany, California, in collaboration with the Children's Hospital Oakland Research Institute in Oakland, California, have developed a low-calorie, fruit-based snack bar fortified with micronutrients, fiber, and other critically healthy components that are deficient in a typical Western diet. In a clinical study where subjects ate two bars daily for 8 weeks without other changes in diet or exercise, the scientists reported results showing healthy changes in cardiovascular health, insulin resistance, inflammation, and obesity in adults. ARS has applied for a patent for this fruit snack bar, and are in discussions with companies interested in acquiring licensing agreements to commercialize the snack bar.

Innovative, rapid nondestructive detection of wheat seeds contaminated with fungi. Being able to select intact wheat seeds naturally free of fungal pathogens and toxins, such as Fusarium head-blight, the casual organism of vomitoxin (DON), would advance the development of lines resistant to DON. This is important to millers because the Food and Drug Administration strictly regulates the amount of DON allowed in flour-based foods. ARS scientists in Manhattan, Kansas, developed an automated, nondestructive, near-infrared light scanning scope that can detect the fungi causing DON, not only on the surface but within individual seeds. Because contamination-free seeds are intact, breeders using this technology can for the first time select seeds for use in developing DON-resistant wheat cultivars.

LED portable egg candling system and online data management software. Current commercial egg candling grading lights are no longer manufactured and were based on obsolete incandescent bulbs. The Agricultural Marketing Service (AMS) has requested that the AMS grading units be upgraded to new high intensity LED candling lights. ARS scientists in Athens, Georgia, have designed and developed both portable and stationary LED light grading systems, and engineered a computerized software system designed to specifically meet the needs of AMS for egg cracking detection. The software system was developed to monitor, collect, and process the egg cracking data, replacing current paper data forms, in real time and suitable for statistical and trend analysis. An ARS certification process is under development to ensure security of the Web server application software system. The scientists demonstrated the LED egg candling device for AMS graders and administrators, and received favorable responses, including immediate deployment for field tests. An industry manufactured LED egg candling system is under development based on this ARS technology.

Healthier, better flavored peanut butter using encapsulated peanut skins. Peanut processing plants, during the blanching operation, produce thousands of tons of peanut skins which become a waste management problem for processors who have asked ARS for a solution. Peanut skins are known to contain high levels of polyphenolic compounds, which are healthy antioxidants, but are also bitter tasting. ARS scientists in Raleigh, North Carolina, extracted peanut skin

polyphenolics and encapsulated them with food-grade maltodextrin, a sugar compound. These encapsulated peanut skins can be used to increase antioxidant bioactivity of other foods such as chocolate and peanut butter without adding a bitter flavor. ARS has initiated the patenting process for this technology and is pursuing the licensing of the technology with a pharmaceutical company.

A new imitation butter without trans- or saturated-fats. Many food products require structured fats, such as those provided by either trans- or saturated-fats for their desired melting characteristics, acceptable tongue-feel, sensory, and shelf-life. However, due to recent regulatory changes that eliminated trans-fats from foods, companies are under pressure to replace hydrogenated oils with saturated fats from imported palm oil. This has created an additional health problem: replacing trans-fats with saturated fats is not a healthful long-term solution. ARS scientists in Peoria, Illinois, have found a solution through the development of organo-gels, inexpensive, edible plant gels (waxes) that provide a solid structure to vegetable oils. To achieve the desired firmness in spreadable imitation-butter (margarine) required 75 percent less organo-gel to achieve the same spreadable firmness derived by partially hydrogenating (trans-fat) soybean oil. This technology can be used to replace expensive imported palm oil with soybean oil or other U.S.-produced plant oils, benefiting both the U.S. farmer and food-oil processing companies. Companies that make margarines and shortening have shown interest in using organo-gel in their products.

First-ever moisture meter detection of flowing grains, seeds, and nuts. Moisture content is arguably the most important factor in the sale and storage of grains, seeds, and nuts. However, current rapid electronic moisture meters on the market today only work on stationary, non-flowing materials because movement causes changes in bulk density and confounds the measurement. ARS scientists in Athens, Georgia, developed a microwave moisture measurement system that can reliably and independently sense both moisture and bulk density of flowing grains, seeds, and nuts. This moisture system is designed to use two microwave antennae, located on either side of the flowing grain stream. Tests with shelled corn, wheat, and soybeans of different moisture levels and of different flow rates proved that the system was as reliable and accurate as measures taken with stationary grain moisture/bulk density detection systems. This technology has been patented and licensed; however, additional interested industry and government users are being informed.

Litchi and acute encephalitis syndrome. Seasonal outbreaks of acute neurological illness with high mortality among young children occur annually in Bihar, the largest litchi growing region in India. Recently, the Indian National Centre for Disease Control, the U.S. Centers for Disease Control and Prevention (CDC) and ARS partnered to characterize the illness and determine the cause. ARS scientists in Albany, California, identified the toxic amino acids, hypoglycin A and methylenecyclopropylglycine (MCPG) for the first time in edible litchi arils. As a result of this collaborative research effort, litchi consumption and associated hypoglycin A/MCPG toxicity was confirmed as the cause of these outbreaks, and recommendations have been made to minimize litchi consumption among young children, ensure children have an evening meal throughout the outbreak season, and implement rapid glucose correction for children with suspected illness. These results have been reported in a manuscript that has been submitted to

The New England Journal of Medicine. The CDC reported 390 cases with a 31% mortality rate in 2014 and only 50 cases have been reported in 2015, with the litchi season nearing the end.

Structural characterization of a newly identified pecan allergen. Tree nut allergies and peanut allergy are often life threatening. The vicilin protein in numerous plant seeds (including hazelnut, walnut, pistachio and cashew) has been recognized as a food allergen. The gene for pecan vicilin was previously isolated. ARS researchers at Albany, California, and their collaborators at Stanford University, expressed and purified recombinant pecan vicilin from transformed E. coli bacterial cells. They identified it as a food allergen and determined the crystal structure of this allergen, for the first time, and confirmed that pecan vicilin is also a copper protein. The obtained information increased understanding of the allergencity of pecan and other foods as structural information is the basis for characterizing conformational epitopes.

Detection of unwanted pits in pitted cherries. Unexpected pits in pitted cherries are a potential health hazard. These pits are thus a nuisance for processors and consumers alike. ARS researchers in the Western Regional Research Center (WRRC) in Albany, California, have demonstrated the feasibility of using near infrared (NIR) spectroscopy as a basis for detecting pits and pit fragments in fresh pitted cherries. This technique identifies specific wavelengths that allow discrimination of cherries containing pits, thus providing the means to build optical sorters that can non-destructively detect pits and pit fragments at high speed in processing plant environments.

Different wheat varieties may taste different to humans. Currently, there are few means to efficiently identify wheat varieties that may be more appealing when used in whole-wheat foods. An ARS scientist in Pullman, Washington, in cooperation with Washington State University researchers, using a mouse model system, showed that grain of different wheat varieties differed dramatically in consumption preference. A large set of wheat varieties grown under a common environment were presented to mice in binary mixtures. Sequential comparisons were made in a statistical design that is similar to a single elimination tournament such as that used in basketball's "March Madness". A key result was the identification of the most preferred and the least preferred wheat varieties, designated "Yummiest" and "Yuckiest" (Y and y, respectively). The identification of these contrasting varieties are being used to conduct genetic mapping and can be used in human and instrumental sensory analysis.

Commercial scale validation of apple fruit superficial scald risk assessment test. Superficial scald is a peel browning disorder of apple that results in significant annual losses for the U.S. apple industry. Peel injury occurs soon after harvest but symptoms do not develop until 6-8 months later. Researchers at the ARS Tree Fruit Research Laboratory in Wenatchee, Washington, developed a simple chemical test that assesses the risk of superficial scald prior to symptom development. The test accurately assesses how the fruit is reacting to storage conditions with respect to progression of disorder development. Apples from storage rooms where relatively high risk is indicated by the test can then be managed to reduce disorder risk or at-risk fruit identified to be marketed well before symptoms develop. Use of the test could provide a value of $10 million U.S. dollars by avoiding losses due to disorder development, reduced use of postharvest chemicals, and marketing fruit later in the storage season when market value increases.

ARS scientists in Manhattan, Kansas, completed the annual Crop Quality Survey in which 602 individual and composite Hard Winter Wheats were evaluated for milling and baking quality. The resulting data was posted in real-time to a webpage managed by Plains Grain, Inc. as the harvest progressed; the data was also used by U.S. Wheat Associates in their final annual report for domestic and international export customers.

A method to alleviate symptoms of internal chilling injury in tomatoes. Chilling injury occurs when tomatoes are stored at temperatures below 10-13 °C, and aroma loss usually takes place before visual symptoms of chilling injury. ARS researchers at Fort Pierce, Florida, found that chilling such as 5 °C during 4-5 days extended shelf-life, did not induce visual defects but decreased aroma production including important aroma contributors in comparison with non-chilled tomatoes. Pre-chilling treatments with hot water dip or methyl salicylate fumigation substantially alleviated chilling-induced aroma loss. Application of heat treatments prior to low temperature storage is proposed to be an effective postharvest handling method to alleviate tomato chilling injury, hence offering the consumer tomatoes with better shelf-life and eating quality.

Colored rice bran as a treatment for diabetes. This past year the characterization of pigmented or colored rice bran extracts and their ability to stimulate in vitro glucose uptake in mouse adipocytes was completed. Improved glucose homeostasis is important for the treatment of Type II diabetes and prediabetes. ARS scientists at Southern Regional Research Center, in New Orleans, Louisiana, completed screening of 20 different varieties of rice (with and without cooking) and rice bran extracts for increased in vitro glucose uptake. Eight rice varieties, four red and four purple (black), have displayed stimulation of glucose uptake in apidocytes. These results point to specific rice varieties with potential for improving glucose imbalances in patients with Type II diabetes and prediabetes. Gene expression results established increased glucose transporter proteins (GLUT1 and GLUT4) within adopocytes are responsible for the higher glucose uptake observed.

Testing methods to reduce the allergenic capacity of peanut. ARS scientists at the Southern Regional Research Center in New Orleans, Louisiana, have determined that D-amino acids (glutamic and aspartic acids), when combined, can inhibit IgE antibodies responsible for an allergic reaction. Also, pulsed UV (ultraviolet) light was shown to reduce the allergenicity of whole peanut kernels. This research may find applications in the development of hypoallergenic peanuts and removal of IgE antibodies from human plasma, using pulsed light and D-amino acids, respectively.

Component 2: Non-Food

Inexpensive cotton wipes with hospital-grade disinfecting ability. To successfully disinfect surfaces contaminated with infectious microorganisms, quaternary ammonium salts or “quats” are necessary. Cotton wipes were previously not considered ideal for applying disinfecting quats because cotton fibers tightly hold onto quats. As a result, polyester and polypropylene wipes are currently used. However, these synthetic wipes are insufficient as they lack the necessary abrasiveness and strength needed to thoroughly scrub surfaces, and they slowly decompose in landfills. ARS scientists in New Orleans, Louisiana, co-formulated non-ionic surfactants and

electrolytes with 100 percent raw cotton, producing cotton wipes that release quats, while also being strong, abrasive, and easily biodegradable. These new disinfecting cotton wipes have received the Good Laboratory Practice efficacy testing registration from the Environmental Protection Agency. This registration allows these cotton wipes to be certified as hospital grade disinfectants for use in disinfecting surfaces of *Staphylococcus aureus* and *Pseudomonas aeruginosa,* and the cotton wipes are currently certified as killing vancomycin-resistant *enterococci* (VRE) and methicillin-resistant *Staphylococcus aureus* (MRSA). The wipes are to be promoted and marketed by ARS' research partner, Cotton Incorporated.

Improved, cotton-based, blood clotting wound dressings. The hemostatic activity of nonwoven cotton has demonstrated promise for use in first responder and battlefield dressings as a rapid blood clotting agent, and as an improvement over standard care dressings such a gauze. Use of cotton in battlefield dressings is compliant with the U.S. government mandating use of domestic cotton for Department of Defense materials. ARS scientists in New Orleans, Louisiana, using short-staple length (nonwoven) cotton increased its clotting ability by varying the fiber's surface polarity, content, composition and design, and showed that nonwoven cotton naturally produces low levels of hydrogen peroxide at levels superior to commercial wound dressings. This low-level hydrogen peroxide generation, following blood clotting, is correlated with enhancing cell regeneration, which is critical in promoting rapid wound healing. This ARS technology was developed in collaboration with H&H Medical, which will manufacture cotton-based wound dressings on an industrial scale.

Plant starch nanoparticles improves packaging films and lowers film cost. Currently, polyvinyl alcohol (PVOH) film has excellent properties that makes it practical for use in food packaging, textile sizing agents, paper coatings, and fibers. However, it is expensive to manufacture and slow to decompose in landfills. ARS scientists in Peoria, Illinois, have blended PVOH film with starch nanoparticles prepared from inexpensive plant starch using the economical commercial process of steam-jet cooking. It has been determined that incorporating up to 50 percent of starch nanoparticles into making PVOH films will not affect the breaking point of the films during stretching. Also, since starch biodegrades rapidly, incorporation of starch-based nanoparticles into PVOH films and other products prepared from PVOH will reduce the harmful buildup of these materials in the environment and reduce the cost of production by at least 30 percent.

New and Improved! - Cotton gin particulate emission factors. To comply with the air quality standards, regulatory agencies use emission factors in the U.S. Environmental Protection Agency's (EPA) AP-42 "Compilation of Air Pollutant Emission Factors" to develop facility construction and operating permits. Emission factors in AP-42 for total particulate and particles 10 micrometers and smaller have not been updated since 1996 and have very poor quality ratings. Additionally, in AP-42 there are no cotton gin emission factors for particulate 2.5 micrometers and smaller, EPA's main particulate of concern. Utilizing emissions data from a recent industry supported, national cotton gin sampling study and new EPA emission factor development and quality rating procedures, ARS researchers in Mesilla Park, New Mexico, collaborated with Oklahoma State University researchers in Stillwater, Oklahoma, to compile and submit 264 cotton gin stack sampling reports to EPA for review and inclusion in AP-42. To aid and expedite the review process, the researchers also completed and submitted with the

reports the regulatory agency review procedures for EPA. The research indicated that the new cotton gin emission factor quality ratings will be greatly improved over current ratings. Better, more representative emission factors will ensure that the U.S. ginning industry is more equitably regulated in the future. In collaboration with National Program 212: Air Quality.

Sustainable acoustic absorber produced from agricultural waste fibers. In collaboration with cooperators, ARS researchers in Lubbock, Texas, developed a process that allows for a novel all-natural high-density composite to be produced solely based on a chitinous polymer. The polymer is grown by a unique variety of fungi during its natural production of the mycelium. The mycelium-bound natural fiber is pressed at select temperatures and pressures causing the mycelium to hold the natural fibers in a compressed state similar to pressboard, plywood, or particle board. This new bio-product is environmentally friendly, bio-degradable, and completely free of VOC's and petroleum based resins. The new process is being used in the manufacture of high density acoustic absorbers such as ceiling tiles. Ceiling products are forecasted to be a $2.5 billion industry in 2018 with specialty ceiling products, such as acoustic absorbers, to reach $540 million. A variety of natural fibers have proven to provide a superior growth structure for the particular fungal species being utilized in the process.

Anti-corrosion biobased coating. ARS scientists in Peoria, Illinois, have demonstrated that an agriculturally sourced natural polymer can retard corrosion on metal surfaces. Corrosion is the number one cause of metal failure and subsequent economic losses to repair or replace damaged parts. In this case, the anti-corrosive polymer is also environmentally friendly compared to other anti-corrosion measures. Its production does not require additional capital expenditures because it can be produced in current industrial fermentation equipment. U.S. Patent No. 9,034,436 was issued May 19, 2015, for “Anti-Corrosion Coating Utilizing Bacterial Precipitated Exopolysaccharides.”

New vegetable-based skin care and food ingredients with a long shelf-life. To reduce reliance on fossil fuel-based cosmetics and food ingredients, new, sustainably processed, bio-based materials are needed to help in converting agricultural plants into high-value, long shelf life products with properties useful to humans. ARS scientists in Peoria, Illinois, developed an enzyme method to efficiently convert plant oils into high-value skin care and food ingredients with antioxidant and broad ultra-violet absorbing properties; and developed a lipid carrier system in which the ingredients are based. Previous commercial attempts to manufacture products containing fats and oils resulted in products that spoiled quickly, but this newly developed enzymatic method uses plant-derived antioxidants that greatly slow spoilage. The plant oil-based skin care and food ingredients are derived from cuphea, sunflower, and soybeans with antioxidant protection derived from the plants’ leaves. Suitable for use in several retail skin care formulations, this is one of several high-value, ARS plant oil-based cosmeceutical ingredients in development.

Guayule natural rubber quality. In collaboration with PanAridus, an Arizona guayule rubber company, ARS scientists in Albany, California, documented key quality parameters for production of solid bale guayule natural rubber provided to U.S. industry for product development. As reported by ARS scientists, guayule natural rubber, extracted by a solution process, met or exceeded industry standards for Hevea Technically-Specified Rubber (TSR20) for 2013-2015 production runs. Key indicators included rubber molecular weight, ash, dirt,

volatiles, and extractables. The data demonstrated that guayule natural rubber has consistent physical and chemical properties; a requirement for successful commercialization.

Biocoal from crop waste products. Waste products from crops provide a valuable renewable resource for fuels and bioproducts but are relatively expensive to transport due to their low density. Torrefaction (heating) of biomass has received interest as a method for producing a high density fuel as a drop-in replacement for coal. ARS scientists at the Western Regional Research Center in Albany, California, in collaboration with Renewable Fuels, Inc., demonstrated the use of torrefied crop waste from apple, grape, olive, tomato, walnut, and almond as a source of biocoal that had varying properties depending on the waste utilized. The results indicate that biocoal from crop waste could serve as a carbon neutral, renewable energy source and could be blended with fossil coal as a means to reduce net carbon dioxide (CO2) emissions.

Navy bean flour for gluten-free cakes. Dry beans have been available in the food supply predominantly as whole beans, either in dry or canned forms, and have the potential to substantially improve public health as they are high in fiber, protein, and many "short-fall" nutrients. Unfortunately, dry bean consumption and harvested acreage in the U.S. has declined as consumer-eating patterns have shifted away from home-prepared meals to ready-to-eat convenience and snack foods. The development of innovative applications for dry beans is needed to meet these challenges. Agricultural Research Service scientists in Peoria, Illinois, have utilized whole navy bean flour and its fine and coarse particle size fractions to partially or completely replace wheat flour in cakes. Replacement of wheat flour with whole bean flour significantly increased the protein content on the cake; cakes based on bean flour were softer than cakes made with wheat flour but had reduced springiness. Navy bean flour with protein content adjusted to the level of cake (wheat) flour has potential as a healthy alternative in gluten-free cakes with improved protein content.