

ARS Grape and Wine Industry Workshop
Quality Presentation
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It is a pleasure to be here this afternoon and have the opportunity to present to you some of the research that has been performed in ARS related to grape quality. One definition for grape quality is the intrinsic physical traits and chemical characteristics of grapes that result in exceptionally good grape products with high sensory appeal to consumers. In ARS much of the research on grape quality is overseen by National Program 306, entitled Quality Preservation, Characterization and Enhancement and New Processes, New Uses and Value-Added Foods. The mission of the unit that I lead, the Processed Foods Research Unit at the Western Regional Research Center in Albany, CA, is to enhance the marketability and healthfulness of agricultural commodities and processed products such as cereal grains, legumes, fruits and vegetables through food processing and biotechnology. We are located at one of four regional research centers in ARS and one of over 100 individual research locations in ARS.

One of the reasons why we are interested in improving grape and wine quality is to improve human health. WHO and FAO recently instituted a global initiative to promote consumption of fruits and vegetables stating that low fruit and vegetable intake is a key risk factor for obesity, heart disease, and cancer. The WHO attributes at least 2.7 million deaths a year to insufficient fruit and vegetable intake. Americans pay a staggering \$117 billion annually in health care costs associated with obesity related disease that results in 300,000 deaths annually. Today 85% of our nation's children and 60% of adults do not meet 5 A Day recommendations for fruits and vegetables. The USDA's Economic Research Service found that people who eat more servings of fruit each day have lower body mass indexes (BMI). The weak correlation between vegetable consumption and BMI was hypothesized to be due to the way most Americans eat vegetables: deep fried and topped with high fat dressings. Almost a quarter of all vegetables consumed by U.S. children are French fries. Ninety percent of Americans income spent on food goes to buy processed foods. Snack foods alone account for \$80 billion in sales; whereas, apples, oranges and bananas are only a \$4.5 billion industry. The American Dietetic Association states that one of the main barriers to consumption of fruits and vegetables is convenience. As school districts ban junk foods from vending machines, there is a serious need for healthy, convenient fruit and vegetable based alternatives.

Our research has focused on development of novel processing technologies that offer tremendous potential to improve delivery of fruits and vegetables to consumers. In particular we are interested in exploring the effects of processing on various phytonutrients in grapes and other fruits and vegetables in terms of their concentration and bioavailability. Sensory quality evaluations are also an important part of our program because we recognize the critical nature of sensory acceptability to the transfer of any technology into the marketplace.

The markets for fruits and vegetables are limited because traditional processing technologies are restricted to relatively few forms or styles. In addition high production

costs are common due to inefficient use of energy during processing. Seasonal hiring in the farm industry is costly due in part to requirements to pay employee benefits year round. These new processing technologies will facilitate extension of the harvest season because the fruits and vegetables could first be processed into stable ingredient forms and then further processed into final restructured foods during the remainder of the year. Utilization of fruit and vegetable purees as starting materials for these products enables complete utilization and less waste of harvested fruits and vegetables. New value-added markets from fruits and vegetables are needed to maintain and improve the economic vitality of the U.S. fruit and vegetable production industries in both national and international markets. These are some of the reasons why ARS is involved in fruit and vegetable quality and processing research.

We are fortunate at the Western Regional Research Center to have most of the basic tools necessary to perform research on adding value and improving grape quality through processing. We have a research and development facility that houses basic unit operations equipment for grinding, dehydration, forming, extrusion, juicing, molding, packaging and other processes. We also have a small animal research facility to perform nutritional evaluations. In addition our laboratories house basic analytical tools such as gas chromatography, mass spectrometry, liquid chromatography, near infrared spectrometry, electronic nose, colorimetry, spectroscopy, and sensory evaluation. Similar capabilities are available at other regional research centers in ARS.

One study that I would like to highlight that we performed several years ago investigated the use of near infrared transmittance spectrometry to evaluate raisin quality. This program was led by Charlie Huxsoll, who has since retired. Charlie developed this technique to the point where it could be used to predict raisin quality parameters such as moisture content, water activity, sugar content and acidity. The technique was evaluated by the raisin industry and is under consideration for implementation.

One important objective of the ARS is to transfer the technologies that we develop into commercialization. This is one mechanism by which our research can have impact. We collaborate with industrial cooperators, commodity organizations and Universities. One mechanism for collaboration with industrial partners is through Cooperative Research and Development Agreements. These agreements provide intellectual property protections to our cooperators. One CRADA that we have had was with Fiorini Ranch. We are working with them to find new value-added outlets for the peaches that they grow. Fiorini Ranch also grows grapes and recently introduced a next generation grape juice, Cabernet beverage. Another CRADA partner of ours, Innovative Foods, is also developing new grape products. They developed the line of flavored raisins using an infusion technology that we worked with them on. Victor Packing Company is now manufacturing these strawberry and other flavored raisins. These flavored raisins offer a value-added alternative to the traditional raisin and are particularly appealing to children.

Another project that our unit is involved in is a collaboration with Gorge Delights with whom we developed and licensed a technology to form 100% fruit health bars from pears and apples to add-value and create new markets for pears. In collaboration with ARS, the

industrial partner, Gorge Delights, licensed this technology and established a manufacturing facility for the bars two years ago in a plant in North Bonneville, WA, an area of high unemployment. Forty new jobs have been created. This grass roots effort of third generation pear growers has expanded beyond pears and into other fruits to enhance grower profitability and assist Americans in meeting their daily requirements for fruits through the development of healthy, convenient 100% fruit bars. The bars are available through grocery stores, as well as in the school lunch and commissary programs. In the future bars could be manufactured from grapes if desired.

Additional new processing technologies that we are investigating to add value and improve the quality of grape products include wine infused raisins for adults, vitamin infused raisins for U.S. and developing countries, use of ultrasound to improve the efficiency of infusion, and extrusion and forming of raisin sticks.

Yet another grape quality related collaboration that we are involved in is a trust agreement with Roots of Peach. The objective of this research project is to develop novel processing techniques to improve the quality and safety of green kishmish bish raisins. Roots of Peace is implementing an international development project with Afghanistan funded by the United States Agency for International Development. The major goal of this project is to increase the income of Afghan farmers through agricultural improvements. Green kishmish bish raisins presently sell for 3 times higher than the price of traditional sun dried raisins, yet the process used to produce this value-added product remains poorly understood and as a result product quality is inconsistent. Development of novel processes to produce value-added, light green raisins, without the use of sulfur dioxide, fits within this project's mission. Meeting the objectives of this project will support both agencies interests and provide direct benefits to grape growers in both Afghanistan and the United States. Through increased understanding of the mechanism of color formation in raisins we hope to develop a new value-added process to manufacture green raisins (a new value added product) in the U.S. without the use of sulfur dioxide.

Wally Yokoyama, another scientist in my unit has performed research on the potential of grape skins to lower cholesterol. His work compared the cholesterol lowering effects of grape skins with those of cellulose controls. Grape skins were recovered from wine making and donated to this project by Gallo Winery. Wally worked with Charlie Shoemaker of the University of California, Davis on this project. His results showed that the LDL/HDL ratio was significantly lower, 1.7, in animals fed the grape skins compared to those fed the cellulose control, 2.3. A wine flavored grape fiber gel product was also prepared from the grape skins.

Future areas of research include further testing the hypothesis that the skin's function as a protectant will make it an excellent source of disease prevention compounds. We are also very interested in studying the effect of processing on the bioavailability of various phytochemicals. Preliminary studies indicate that grinding and other processes may increase bioavailability. The relative role of fiber, protein, and phytonutrients in skins for disease prevention and studies on the synergistic effects of various compounds will be

performed. Further development of novel, value added foods and processing technologies continues to be of interest. In addition comparison studies on the nutritional benefits of fresh versus processed grape products are needed. These are a few areas of research that we plan on investigating in the years ahead. In addition we welcome discussions on new areas of research that are of importance to the grape and wine industry in relation to quality.

Thank you very much for providing me with this opportunity. I would welcome any questions and look forward to have increased opportunities to interact with many of you in the grape and wine industry in the future.