Food & Agricultural Products Center • Adding Value to Oklahoma

Annual Report 2006

Division of Agricultural Sciences and Natural Resources • Oklahoma State University

Global and Local Oil, Oilseed, and Biodiesel-Related Activities

See page 6

Food & Agricultural Products Center
Annual Report 2006

Adding Value to Oklahoma

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About the cover...

The FAPC has expanded its involvement in oil, oilseed, biodiesel, and biofuel activities in the state and will further its technical support to the industry by building a pilot-scale oilseed-crushing, oil-refining, and biofuel-processing system within the FAPC.

Table of Contents

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A Message to Our Stakeholders

The FAPC is a research and development and business and technical assistance resource for the food and agricultural industries. This 96,000-square-foot stand-alone building has animal harvesting, food manufacturing, grain milling, sensory profiling, food microbiology, and analytical laboratory facilities. The FAPC has conference facilities and applications laboratories for demonstration and prototype testing. It is a state-of-the-art facility and is available to you.

In 2006, the FAPC was active in more than three new client projects per week, and about 22 of our projects were associated with major grant and contract research projects that were supported by more than $1.2 million of extramural funds. The FAPC offered more than 25 business, marketing, food safety, and technical training sessions to more than 500 attendees.

The FAPC operated in 2006 with nine faculty members, nine professional staff members, and three full-time clerical staff members and made significant contributions in value-added processing in horticultural products, meat products, wheat and other small-grain products, forest products, and oilseed products.

Additionally, significant food industry and agribusiness support was given for process engineering, food safety, agricultural economics, business planning and market development, food manufacturing, food sensory technology, food harvest and processing technology, quality manufacturing, and media and communications support.

The FAPC made significant contributions to the food and agricultural industries. Real economic impact was made on the Oklahoma economy by expanding the direct and indirect food industries, providing jobs, and enhancing manufacturing revenue in Oklahoma. More than 25 start-up businesses were launched in Oklahoma through work of the FAPC.

Business has been strong in Oklahoma and in America for the 2006 business year. Predictions are continued strength and growth for the 2007 business year. The continued "word" for business is innovation. This word can be defined as appropriate for a particular business, but regardless of how it is defined, it is really "fleshed out" as understanding customer needs and meeting those needs.

The FAPC is prepared to help you understand your customers' needs, help you develop a plan, and develop products that meet those needs. As you read through this Annual Report, note the projects that are discussed. These are examples of what we can do with you. Call (405) 744-6071 or e-mail any one of the specialists, and let us help you grow your business.

Dr. J. Roy Escoubas
FAPC Director
roy.escoubas@okstate.edu
Dec. 8, 2006

Food & Agricultural Products Center

About the FAPC

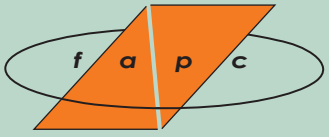
The purpose of the FAPC is to help develop successful value-added enterprises in Oklahoma; to bring the products, the jobs, and the dollars back home. The FAPC will bridge the gap that sometimes exists between academics and the private sector by offering large and small businesses, producers, and entrepreneurs access to faculty and staff with expertise in business and technical disciplines. The FAPC also offers pilot processing facilities, research laboratories, and outstanding educational programs.

Vision

The Oklahoma Food and Agricultural Products Research and Technology Center has programs, projects, and activities that support innovation and growth of the food and agricultural business sectors of Oklahoma, increase food safety for consumers, assist in the development of students for careers in the Oklahoma food industry, and support and enhance the impact of the center on the state, region, and nation.

Mission

Discover, develop, and deliver technical and business information that will stimulate and support the growth of value-added food and agricultural products and processing in Oklahoma.

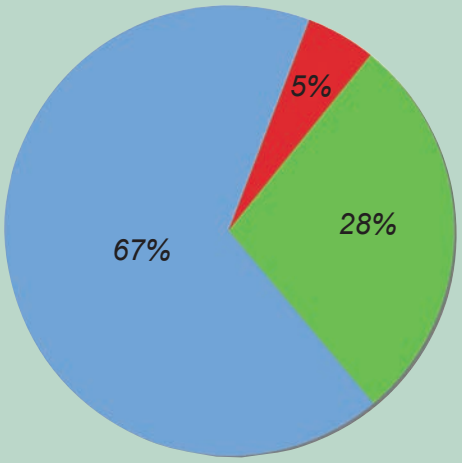


Adding Value to Oklahoma

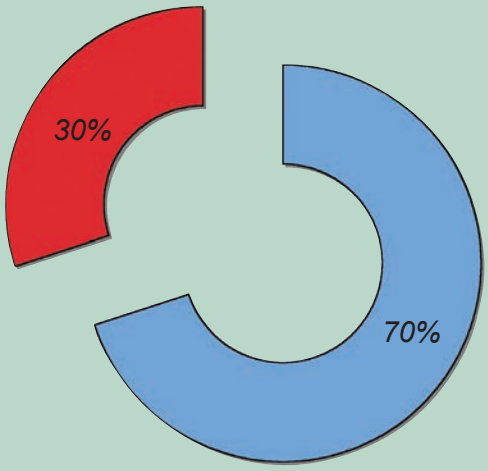
2006 Financial Highlights

Total Working Funds	***$3,145,870***
State-Sourced	$2,917,908
Fee-Based Sourced	$227,962
Total State-Sourced Funds	**$2,917,908**
Research Funds, State of Oklahoma	$2,111,718
Extension Funds, State of Oklahoma	$806,190
Total Fee-Based Funds	**$227,962**
Conference Income	$21,693
Small Project Product Development Income	$77,931
Pilot Plant Processing Income	$128,338
Grants and Contract Research Funding	**$1,200,500**
Total Available Funds	**$4,346,370**
State-Sourced Funds	$2,917,908
Fee-Based Funds	$227,962
Grants and Contract Funds	$1,200,500
Description of Funds	
State-Sourced Funds	67%
Fee-Based Funds	5%
Grants and Contracts Funds	28%
Disposition of Funded Activities	
Research and Product Development Activities	70%
Outreach Activities	30%
Disposition of Budgeted Resources	
Salaries and Benefits	76%
Maintenance and Operational Funds	8%
Facility and Equipment Expense Funds	11%
Small Projects Development Funds	4%
Market Development Funds	1%
Description of Fee-Based Activities	
Conferences and Training Programs	10%
Pilot Plant Processing Programs	56%
Small Projects and Applied Development Projects	34%
Donations	***$155,266***
Endowed and Non-Endowed Cash Donations	$35,118
Gift-In-Kind Donations	$120,148

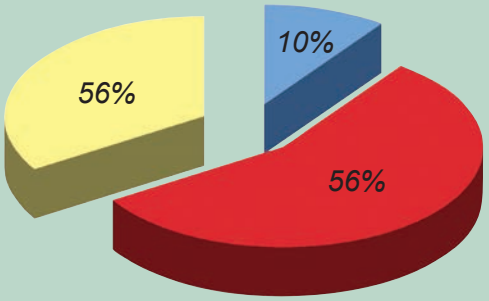
Description of Funds



Disposition of Funded Activities



Disposition of Fee-Based Activities



An Update on Glo Oilseed, and Biodies

By Nurhan T. Dunford, F

The edible oil and oilseed industries have faced a number of issues during the last decade, including a prevailing belief that there are unhealthy implications of any oil or fat in the diet of the consuming public. In fact, oils and fats are essential for human growth and health when consumed as a part of a balanced diet. Edible oil quality has traditionally been defined by taste, odor, and color, but today, nutritional composition of these products is being emphasized. The U.S. dietary guidelines recommend limiting the total fat intake to 30 percent of total calories of which no more than 10 percent should be saturated fat. The latest dietary guidelines stress the importance of "a diet that is low in saturated fat and cholesterol and moderate in total fat," reflecting the emphasis on reducing "saturated fat" intake more than "total fat" intake in the human diet. These recommendations lead to new market opportunities for vegetable oils, which tend to have significantly lower amounts of saturated fats than those of the animal origin.

In September 2004, the U.S. Food and Drug Administration approved a "qualified health claim" to be used by food processors on products to reflect a reduced risk of coronary heart disease for conventional foods containing omega-3 fatty acids. A qualified health claim for a conventional food must be supported by credible scientific evidence. The health claim states "supportive but not conclusive research shows that consumption of highly unsaturated long chain omega-3 fatty acids may reduce the risk of coronary heart disease." The FDA recently approved a qualified health claim for canola oil. The claim, which canola oil bottlers and makers of eligible products may use on labels, states:

"Limited and not conclusive scientific evidence suggests that eating about 1 ½ tablespoons (19 grams) of canola oil daily may reduce the risk of coronary heart disease due to the unsaturated fat content in canola oil. To achieve this possible benefit, canola oil is to replace a similar amount of saturated fat and not increase the total number of calories you eat in a day. One serving of this product contains [x] grams of canola oil."

More recently, the FDA issued a final regulation requiring the labeling of trans fats on packaged foods effective Jan. 1, 2006. This decision was based on results showing diets high in trans fatty acids may have adverse effects on both LDL (bad cholesterol) and HDL (good cholesterol) levels. Food processors now face the challenge of maintaining functionality, balancing nutrition, optimizing taste and cost, and sustaining adequate shelf-stability in products reformulated with no-trans or low-trans fats.

On the bio-based energy front, the biodiesel industry is growing and has become a significant demand-shifter in the vegetable oil industry. It is estimated global biodiesel production and consumption will reach 40-50 million metric tons (MMT)/year by 2020. In 2004-2005, oilseed production increased by 47 MMT (14 percent) due to a large increase in soybean production. Driven by strong increase in demand from the biofuel industries and further growth in usage for edible purposes, increases in oilseed production in recent years are well above the average growth for the last 20 years (about 4 percent). Global use of vegetable oil is estimated to grow about 6

bal and Local Oil, el-Related Activities

APC Oil/Oilseed Chemist

percent annually through 2010. Canola is anticipated to benefit the most from this growth. Canola seed production and crushing is expected to increase 300 percent during the same period. Currently, world supplies of vegetable oils are still ample due to current record stocks. However, a widening production deficit is expected for the next years. According to recent forecasts, oil supplies will rise by about 95 MMT to meet a demand increase of about 100 MMT by 2020.

What does all this mean for the Oklahoma agricultural and food industries and the Oklahoma economy? The national issues and opportunities directly impact food oils and oilseed producers, processors, and entrepreneurs here in the state. Producers Cooperative Oil Mill, established in 1944, is the largest oilseed processor operating in Oklahoma. PCOM has produced cottonseed oil, which has been the preferred frying oil because it contains enough saturated fatty acids to make it relatively stable without partial hydrogenation, as well as enough unsaturates to make it a healthy oil. The issues that have come out in popular media and newspapers, such as Frito Lay announcing its switch from cottonseed oil to lower saturated fats (sunflower) and the drive for elimination of trans fats from foods, generated the opportunity and urge for PCOM to explore value-added product development prospects. The FAPC is working closely with PCOM in its efforts to develop PCOM branded oil and meal-based value-added products to meet current market and consumer demands and diversify its product lines.

Further, there is a great interest in growing canola as a rotation crop for wheat farmers in Oklahoma, and it is expected canola acreage will continue to increase in the state. One processor in Okeene, Okla., is crushing canola and another group, Oklahoma Farmers and Ranchers Energy Enterprise, is expecting to build a larger oilseed processing facility in another location in Oklahoma. The FAPC has been providing technical and market support to these groups.

Recently, it was announced that the Oklahoma Soybean Association received a USDA value-added grant to examine the feasibility of a soybean crushing facility to be built in Oklahoma. Sunflower also is gaining interest among farmers as a potential oilseed crop for Oklahoma. Peanut growers in the state are considering peanut oil production options.

Expansion in biodiesel production activities in Oklahoma is evident, certainly reflected by attendance at the Oklahoma Governor's Biofuel Conference and at the latest Biodiesel Workshop held at the FAPC. Currently, there are two biodiesel production facilities with more than 2 million gallons/year production capacity operational and two other plants are under construction in the state. There are a number of individuals and entrepreneurs producing or interested in producing biodiesel at a small scale as well. In most cases, these small processors and producers do not have the technical and economic knowledge necessary to evaluate the efficiency and feasibility of their operations.

The FAPC has responded to technical and market-related questions and requests for assistance coming from its constituents. The FAPC has expanded its involvement in oil, oilseed, biodiesel, and biofuel activities in the state and will further its technical support to the industry by building a pilot-scale, oilseed-crushing, oil-refining, and biofuel-processing system within the FAPC. The FAPC also is expanding its analytical capabilities to meet the stakeholders' requests for quick/nondestructive oilseed analysis and standard biodiesel quality tests.

The FAPC would like to invite its stakeholders to get involved in this process and voice ideas, comments, and needs in regard to capacity and type of unit operations they would like to see at this facility in the FAPC.

The FAPC is committed to supporting the establishment of strong oil and oilseed-processing and biodiesel-production industries in Oklahoma.

Agribusiness Economics

Analytical Chemistry

Business Planning & Marketing

Cereal Chemistry

Food Engineering

Horticulture Processing

Food Microbiology

Muscle Science

Oil/Oilseed Chemistry

Pilot Plant

Product Development

Quality Control & Assurance

Value-Added Wood Products

The FAPC strives to ensure a profitable future for Oklahoma's food and fiber processors by necessitating a constant and intensive review of changes in both industry characteristics and markets.

Economic Feasibility of a Producer-Owned Oilseed Processing Facility

Objective

The objective was to examine the state's potential to support a canola-crushing facility in western Oklahoma with the end products being canola oil, for either human consumption or biodiesel, and canola meal, for livestock feed rations.

Approach

The following data-collection steps and analysis methods were employed:

- Detailed equipment and operating costs/parameters were collected and used to develop economic models for plants using three oil-extraction technologies: solvent extraction, extruder-expeller, and a steam pre-treatment expeller system.
- The feasibility of each oil-extraction method also was evaluated with the addition of a food-grade oil-refining and/or biodiesel-refining system.
- U.S. Department of Agriculture Farm Service Agency data of acreage by farm, farm tract, field within tract, planted acreage, and intended use of that crop (e.g., grain production, grazing, and/or hay or silage) for the years 1990-2004 were collected and used to estimate the crop adoption rate for canola. Production budgets (USDA Economic Research Service) and wheat/canola comparisons were used to estimate the extent to which wheat acres in a given county (up to 25 percent) would convert to wheat/canola rotations under various conditions.
- Periodic market data for all considered oilseed crops (USDA) and utility costs were collected and used to estimate profitability and input risk for each model.
- Time series market data for the associated oils (crude and refined), meals, and biodiesel also were collected and used to determine profitability and marketing risks for each model.

Benefits

The adoption of a winter canola presents two benefits to Oklahoma farmers: (1) a rotational crop that allows traditional wheat acres to break disease and weed patterns and (2) the opportunity to produce and possibly own a facility that will process an oilseed that is suited for western Oklahoma. Because the United States imports most of the canola processed for oil and meal from Canada, consumers could benefit from increased availability of a certified heart-healthy oil, and livestock feeders could benefit from increased availability of high-protein meal in the Southern Plains.

Canola oil also could be utilized as a feedstock for new and proposed biodiesel refining facilities in Oklahoma.

Economic Impact

If pursued, the development of a canola-crushing facility in a western Oklahoma community could generate in excess of 30 new jobs, which would provide direct and indirect impacts in a community.

Continuing Work

Further research into the possibility of processing multiple oilseeds, in addition to canola, and the impacts on financial projections of operating such a "switch plant" is underway. Additionally, newer, small-scale refining techniques are being considered, as are their impacts on the plant's ability to market a consumer-ready niche oil.

Publications

This project has resulted in a paper at the 2006 Western Agricultural Economics Association Conference in Anchorage, Ark. Another paper is being prepared for submission to an agricultural economics journal.

Funding

The project was funded by a contract with the Oklahoma Farmers & Ranchers Energy Enterprise LLC, which received funding to pursue this project through a USDA Value-Added Development Grant.

Collaborators

Dr. Rodney Holcomb, FAPC Agribusiness Economic Specialist, was the principal investigator for this project. Other collaborators included Dr. Philip Kenkel, Agricultural Economics Professor and Fitzwater Cooperative Chair; Dr. Nurhan Dunford, FAPC Oil/Oilseed Chemist; and Dr. Mike Dicks, Agricultural Economics Professor.

- Agribusiness Economics
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- Product Development
- Quality Control & Assurance
- Value-Added Wood Products

The FAPC offers analysis of food products to assist processors and entrepreneurs. From aflatoxins to beef jerky to food colorants to vanilla analysis, the FAPC strives to serve the various disciplines within the food and agricultural industries.

Determination of Cholesterol and Fatty Acid Composition in Lambs

Objective

The objective of this study was to compare the fatty acid composition, including the content of conjugated linoleic acid (CLA) isomers, and cholesterol in *m. longissimus lomborum (LL)* and *m. semimembranosus (SM)* muscles from Katahdin (KK) and Suffolk (SS) and their crossbred Katahdin x Suffolk (KS) and Suffolk x Katahdin (SK) lambs. This objective is pertinent with the fact that the contents of different fatty acids and production of CLA would be different among breeds because lipid metabolism is breed/feed specific.

Approach

The study includes the *m. LL* and *m. SM* muscles from the Suffolk lamb breed (one of the most popular in the United States), Katahdin lamb breed (increasing in popularity in the southern states for the easy care), and their crossbred lambs. Six lambs per breed group were pasture raised, and two months prior to harvest, lambs were fed a high concentrate diet and were slaughtered at 248 ± 4 days of maturity. Total fat, CLAs (in particular cis-9, trans-11 C18:2), cholesterol, saturated fatty acids, monounsaturated fatty acids, and omega-6/omega-3 ratios were determined by gas chromatography with a flame ionization detector.

Benefits

The fat of lamb, as in other ruminants, is characterized by low content of polyunsaturated fatty acids and high content of saturated fatty acids, a factor that may increase the risk of cardiovascular disease. Fortunately, it has been shown in recent years that food products derived from ruminants are a rich, natural source of CLAs. CLA fatty acids, a group of positional and geometric isomers of conjugated linoleic, are believed to have several important physiological functions. Some CLA health benefits include:

- Anti-carcinogenic capabilities (reduction of tumor proliferation)
- Modulation of the immune system
- Anti-obesity effects
- Anti-diabetic properties

Economic Impact

In recent years, consumers have been looking at food not only as a means of satisfying hunger or to provide basic nutrition, but also as a way to optimize health (functional food). Many studies have evaluated the effects of the CLA isomers, which have been proven to have nutritional advantages. The preliminary results have shown the higher CLA concentration and better omega-6/omega-3 ratio of the KK lamb breed positively influenced the fatty acid composition of the crossbred KS and SK lambs, which could suggest that the Kathadin breed may be useful in crossbreeding for U.S. lamb production.

Publications

As a result of this research, a poster was presented at the 2006 FAPC Research Symposium. An abstract has been written for an American Society of Animal Science meeting, and a manuscript is in preparation.

Funding

The FAPC provided funding for this project.

Collaborators

Dr. Guadalupe Davila-El Rassi, FAPC Analytical Chemist, was the principal investigator for this project. Other collaborators included Veneta Banskalieva, FAPC Research Assistant; Renee Albers-Nelson, FAPC Research Specialist; Christopher Roy, undergraduate student; Miriam Velasco, graduate student; and Dr. Mike Brown, U.S. Department of Agriculture.

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Muscle Science

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The FAPC can assist any Oklahoma community by providing information, tailoring workshops to meet specific needs, and assisting in a variety of business and marketing areas.

Stanfield's Secret Seasoning

Objective

The primary objective of this project was to assist Steve Stanfield and his wife, Pam, in commercializing their family seasoning recipe for retail grocery store sales.

Approach

Steve is a culinary chef by professional occupation and during the years has used his secret seasoning in restaurants and country clubs to distinguish his entrees that include beef, pork, lamb, veal, and seafood. Steve attended the FAPC Basic Training Workshop in March and decided to pursue his life-long ambition of selling his unique seasoning in retail stores.

As a local chef, Steve had the opportunity to provide his catering services for several storeowners and purchased many of his products from their stores. He used his secret seasoning in many of the items he served at those functions and started to promote his product as something that would sell in their stores. Several of those storeowners encouraged Steve to pursue his product and to contact them when it was ready to be placed on the grocery store shelves.

Benefits

The potential benefit for consumers is to have available for purchase at their local grocery at a very competitive price a unique, multi-purpose seasoning that will compliment any type of food they might prepare for their families. Steve has several other seasoning blends to extend his product line, which could result in state, regional, and national opportunities for sales and distribution.

Economic Impact

Stanfield's Secret Seasoning is already in the six Crest Food Stores in the Oklahoma City market, and more than 200 cases have been purchased in the first two months since the initial rollout of the product. This project has created two full-time jobs for Steve and has increased the production operations at Cedar Hill Foods in Edmond, Okla. This company is currently co-packing the seasoning for Steve. The client is making a profit on the product and is now ready to introduce a second seasoning, which is Lemon Basil.

Continuing Work

At the present time, a means of state and regional distribution through Associated Wholesale Grocers in Oklahoma City and Value Merchandisers in Memphis, Tenn., which is a specialty food distributor owned by AWG, is being decided. Samples have been sent to each buyer, and meetings will be held in Kansas City and Memphis.

Funding

The client was able to fund this project through his existing catering business.

Collaborator

Jim Brooks, FAPC Business Planning and Marketing Specialist, was the principal investigator for this project.

Introduction of a New Line of Cottonseed Lawn Products

Objective

The primary objective of this project was to introduce a line of cottonseed-based value-added lawn-care products to the home-improvement market.

Approach

To begin the process of introducing a new line of cottonseed lawn care products, it was important to know what consumers hope to gain from using lawn fertilizers and mulches. The FAPC partnered with Producers Cooperative Oil Mill and OSU to determine which characteristics of cottonseed are most beneficial in promoting lawn growth and maintenance. Products will be formulated, using cottonseed hulls as a foundation, to meet market desires. These products will be branded and packaged to compete in the current market.

Benefits

Cottonseed growers and PCOM stakeholders will benefit from the new income stream and decreased risk through product diversification.

Economic Impact

This project represents a potential million-dollar expansion of PCOM's business, three to five new products at launch with potential line extensions, new jobs, increased revenues to cotton growers through new market sales, and product diversification.

Continuing Work

Nutrient analysis and growth research on various grasses and flora are being continued. The next steps include branding, packaging, production, and launch.

Funding

This project was funded by PCOM and the Oklahoma Agriculture Enhancement and Diversification Board. Funding for further related stages is being sought from the U.S. Department of Agriculture and OCAST.

Collaborators

Corey Stone, FAPC Business Planning and Marketing Specialist, was the principal investigator for this project. Collaborators included Jim Brooks, FAPC Business Planning and Marketing Specialist; Nurhan Dunford, FAPC Oil/Oilseed Chemist; Mandy Gross, FAPC Communications Specialist; and Dr. Janet Cole, Department of Horticulture and Landscape Architecture Professor.

GO Organic™

Objective

The primary objective of this project was for John's Farm, of Fairview, Okla., to diversify sales and marketing of its organic wheat to include value-added wheat and organic beef products.

Approach

John and Kris Gosney have successfully grown and marketed whole organic wheat berries, as well as natural beef, at farmers' markets and health-food stores in the Oklahoma City metro area. They contacted the FAPC asking for assistance in marketing and development of packaged organic whole-wheat flour, other organic whole-wheat products, and organic beef products. To cover the expenses associated with the marketing and development of value-added products, the Gosneys applied for and were awarded a Farm Diversification Grant from the Oklahoma Department of Agriculture, Food, and Forestry. The FAPC has assisted with several facets of their operation. FAPC cereal scientists have evaluated the quality of their wheat. Nutrition Facts have been provided, and their label has been reviewed to evaluate FDA compliance. Advice regarding cold storage construction has been provided. Additionally, the FAPC has assisted with market planning and writing the Farm Diversification Grant.

Benefits

The demand for natural and organic foods continues to grow at a rate of more than 25 percent, making it the fastest-growing segment in the food industry. Consumers will benefit by having available to them convenient and healthy food options that are grown and produced locally. Additionally, diversification can lead to the survival and success of the Gosney's family farm. As they continue to be successful, their activities will have a direct, as well as an indirect, impact on their local economy, especially western Oklahoma.

Economic Impacts

John's Farm, marketing organic beef under the brand Cattle Tracks™ and wheat products under the brand GO Organic™, has successfully become the first organic farm and ranch operation registered by both the ODAFF and the U.S. Department of Agriculture organic certification programs. Currently, two jobs are maintained. Increased revenue will follow the successful marketing of the organic beef and organic wheat products.

Continuing Work

This project will come to completion as John's Farm evaluates the success of its recently launched new organic beef and wheat value-added products. The expected project completion date is December 2007.

Funding

In addition to the funding from the ODAFF Farm Diversification Grant, the client provided funding.

Collaborators

Chuck Willoughby, FAPC Business Planning and Marketing Specialist, was the principal investigator for this project. Other collaborators included Dr. Timothy Bowser, FAPC Food Engineer; Darren Scott, FAPC Sensory Specialist; and Dr. Patricia Rayas, FAPC Cereal Chemist.

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FAPC specialists focus on the food and agricultural uses of hard red and white winter wheat and understanding the physicochemical basis that contributes to the end-user quality of wheat.

Endosperm Protein Synthesis During Grain Development

Objective

The primary objective of this project was to identify the proteins synthesized in wheat endosperm during the grain-filling stage.

Approach

Extracts of enriched endoplasmic reticulum and Golgi complex were extracted from wheat endosperm tissue at different development stages representing early, mid, and mature endosperm. The tissue extracts were prepared by low-speed centrifugation for separation of large particles followed by high-speed centrifugation using sucrose gradient, two phase partitioning, and Western blot for identification of standard proteins found in the endoplasmic reticulum and Golgi complex.

Fractions of smooth and rough endoplasmic reticulum were separated from a microsome extraction. Two-dimensional electrophoresis was used for separating the proteins followed by peptide mass fingerprinting for identification of the proteins using Matrix-Assisted Laser Desorption/Ionization-Time of Flight Mass Spectrometry. Qualitative identification of the expressed proteins from the enriched fractions of the two organelles will shed light on the secretory pathway of the endosperm wheat proteins. Comparison of storage proteins related to end-user quality also will be conducted. All these analyses will be done on samples from early, mid, and mature grain-filling stages.

Benefits

The wheat industry will directly benefit from this project. The information can be used by wheat breeders for selecting improved varieties and by basic cereal chemists to further understand possible relationships of events related to the environment and the biosynthesis and expression of proteins.

Economic Impact

The expected outcome from this project is a direct impact on the understanding of endosperm proteins that are relevant for the control of the metabolic pathways and of their relationship to endosperm proteins important in the functionality of wheat. The information gained will contribute to the selection process of improved wheat varieties.

Continuing Work

Researchers have completed the first step of developing the methodology needed to obtain enriched-organelle fractions from wheat endosperm tissue. The project focuses on a subset of proteins from enriched fractions of endoplasmic reticulum and Golgi complex. The identification of all the proteins expressed during different grain-filling stages is a comprehensive goal that cannot be completed by one laboratory. Multinational research groups are working on similar projects. The wheat genome is presently largely incomplete, and only a fraction of the wheat proteins are known. The completion of this project will require a more comprehensive knowledge of the proteins from wheat and related cereals.

Publications

As a result of this research, a doctoral dissertation has been published.

Funding

The Oklahoma Wheat Commission, Oklahoma Wheat Research Foundation, and Oklahoma Experiment Station provided funding for this project.

Collaborators

Dr. Patricia Rayas, FAPC Cereal Chemist, was the principal investigator for this project. Other collaborators included Mohamad El-Osta and Fadi Al-Jorf, graduate students.

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The FAPC helps Oklahoma's food and agricultural processors solve problems and achieve competitive advantage, leading to sustained economic growth, new jobs, and improved food safety and quality through better engineering.

Extracting Pectin from Watermelon Rind

Objective

The primary objective of this project was to compare pectin yield and quality when using traditional acid extraction versus enzyme extraction.

Approach

The project involved the use of both acid and enzyme hydrolysis methods for extraction of pectin from watermelon rind. Acid-extraction methods utilized were similar to those currently commercially used in the extraction of pectin from citrus waste. This involves extraction in 1.0 M nitric acid at 90 degrees Celsius for 45 minutes to 1 hour, followed by centrifugation, precipitation, and a series of alcohol washes. Parameters, which were varied for highest pectin yield in the watermelon, included process temperature, pH, type of acid, and extraction time. For the enzyme extractions, purified enzyme preparations, which were shown to be successful in pumpkin and apple pomace were tested, as well as some commercially available enzyme cocktails containing primarily cellulases and xylanases. Parameters, which were varied, included enzyme loading, pH, and buffer concentration and type. Using the most successful conditions for each, the acid and enzyme extractions were compared for highest pectin yield.

The purity of pectin was analyzed by determining the anhydrogalacturonic acid content using the m-Hydroxydiphenyl method. Galacturonic acid residues are the basic units of pectin molecules. The quality of pectin was measured by determining the degree of methoxylation of the galacturonic acid residues, which is the percentage that are esterified with methanol.

Benefits

The long-term goal of this project is to develop a watermelon biorefinery, where second-class melons would be harvested and their entire biomass used to make an array of value-added products. Products derived from the watermelon rind, such as pectin, are an important component in the biorefinery because the rind of the melon constitutes about 30 percent of the total melon mass. To make the process viable, the pectin product would be one of several different products developed from each component of the watermelon biomass. The ability to process an entire watermelon crop would eliminate the large volume of wasted melons left in the field each year.

Economic Impact

The development of a watermelon biorefinery could represent tremendous economic impact for watermelon growers, creating a market for the large volume of low-quality melons that go unutilized each year. In addition, the development of such a processing plant could have a significant positive impact on rural agricultural economies.

Continuing Work

This project, as originally defined, is completed. There is more work to do in optimization of the process and economic evaluation of its potential.

Publications

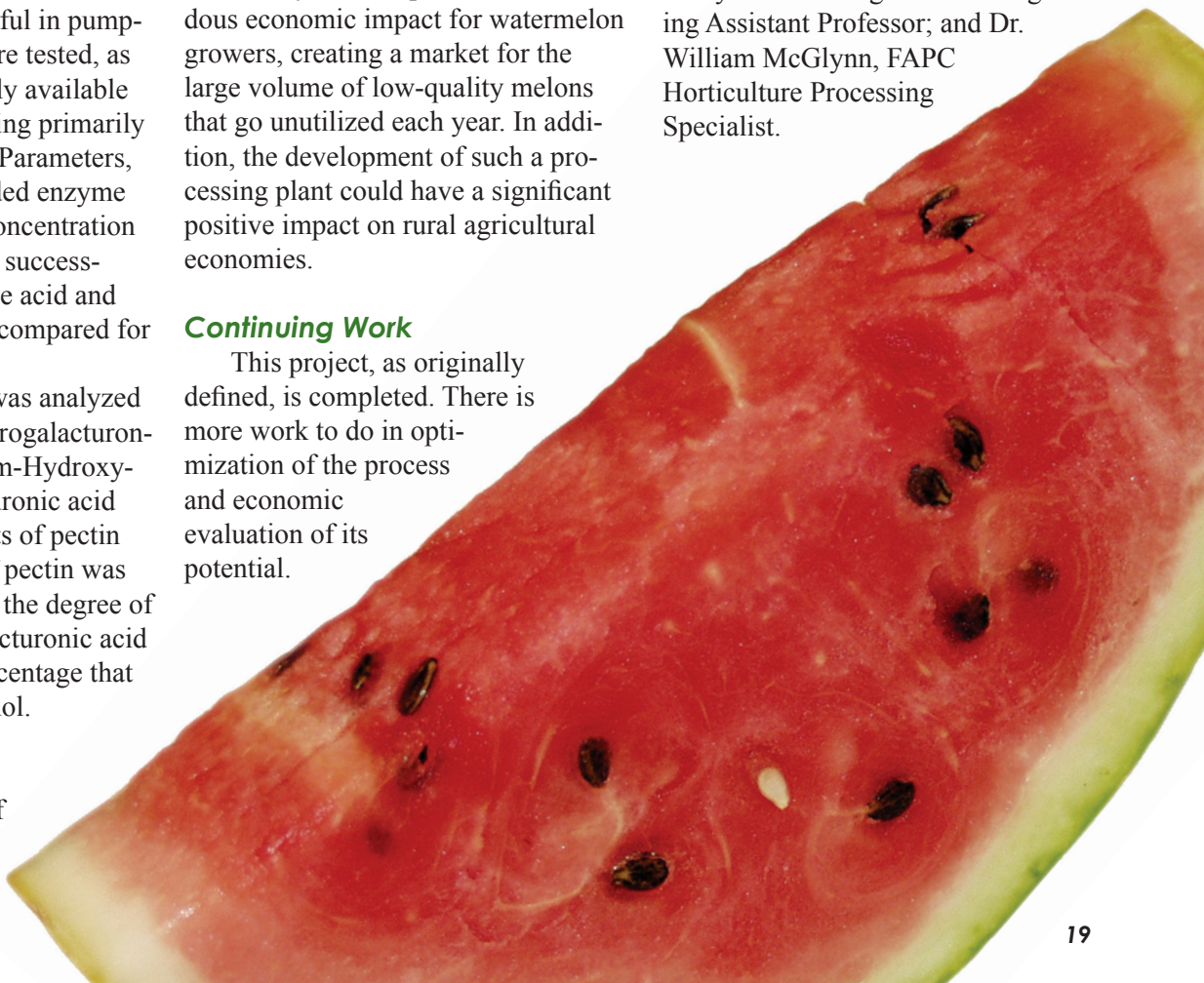
A master's thesis has been published as a result of this research.

Funding

The National Watermelon Promotion Board provided funding for this research.

Collaborators

Dr. Danielle Bellmer, FAPC Food Engineer, was the principal investigator for this research. Other collaborators included Mary Campbell, graduate student; Dr. Neils Maness, Horiticulture and Landscape Architecture Professor; Dr. Andrew Mort, Biochemistry and Molecular Biology Regents Professor; Dr. Mark Wilkins, Biosystems and Agricultural Engineering Assistant Professor; and Dr. William McGlynn, FAPC Horticulture Processing Specialist.



Low-Cost Clean-In-Place Unit for Small and Very Small Meat Processors

Objective

The objective of this project was to develop, build, and test an inexpensive (less than $4,500 total installed cost) single-pass Clean-In-Place system for small and very small meat processors.

Approach

The concept was to develop an inexpensive, reliable, and simple CIP system that can facilitate equipment and product-contact surface cleaning for small and very small meat processors. Processors are able to build the CIP unit themselves, using off-the-shelf components that are readily available. The CIP unit is a single-use system (cleaning chemicals and rinse solutions are not saved for reuse) with capacity to clean vessels up to 12 feet in diameter and all instrumentation necessary for cleaning process verification.

Benefits

The potential benefits from the development of the CIP are numerous: improved product safety and sanitation, improved safety for personnel (less contact with cleaning chemicals), saved energy and chemical costs, reduced labor requirements, and reduced equipment-repair expenses.

Economic Impacts

The CIP system can benefit possessors in the following ways: safer product, fewer loss-time accidents and injury, lower energy and water bills, lower labor costs, and lower maintenance costs for equipment.

Continuing Work

Final testing is under way, and project reporting will follow.

Publications

As a result of this product development, construction and operation plans for the CIP system, an FAPC fact sheet, and an *FAPC FLASH* will be published.

Funding

The U.S. Department of Agriculture Food Safety and Inspection Service Cooperative provided funding for the project.

Collaborators

Dr. Timothy Bowser, FAPC Food Engineer, was the principal investigator. Ben Smith, undergraduate student, was also a collaborator.

The FAPC is committed to helping Oklahoma's producers and processors of horticultural products provide nutritious, delicious, and convenient food products to consumers everywhere.

- Agribusiness Economics
- Analytical Chemistry
- Business Planning & Marketing
- Cereal Chemistry
- Food Engineering
- **Horticulture Processing**
- Food Microbiology
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- Value-Added Wood Products

Extracting Value from Winery Waste Streams

Courtesy of Redland Juice Co.

Objective

The objective of this study is to help Oklahoma wineries realize greater profits by turning their waste-stream liabilities into assets.

Approach

The first priority for FAPC researchers is to screen winery waste for antioxidant activity, antimicrobial activity, and total carbohydrate value. These three analyses were chosen because they allow researchers to identify the presence of components of significant potential value in the waste stream. The first phase will be focused on method development and will likely involve modifications of existing methods. Sample preparation techniques may include ultra high-speed centrifugation, supercritical fluid extraction, and aqueous and organic solvent fractionation.

Antioxidant activity will be evaluated using the Oxygen Radical Absorbance Capacity assay, a well-recognized method commonly used to measure antioxidant activity in fruit and vegetable products. Antimicrobial activity will be tested using a modification of a method that is used to evaluate microorganism resistance to antibiotics in animal and human health laboratories. For carbohydrate analysis, standard techniques will be used.

To date, samples of winery waste from the 2006 harvest have been collected, packaged, and frozen for subsequent analyses. Basic analyses have been completed, and testing of various sample preparation techniques is underway.

Benefits

Researchers expect to develop methods to identify and isolate high-value compounds, such as antioxidants and antimicrobials from winery waste. These methods will be used as models to develop screening techniques for waste streams from other processing operations. This will benefit the processing industry as a whole. In addition, the compounds identified will be investigated for their possible uses in foods. These compounds could be employed to create safer and healthier foods for all consumers.

Economic Impact

This project may substantially impact the profitability of wineries in Oklahoma and ultimately other fruit and vegetable-processing operations as well. If successful, this project will allow processors to reduce waste disposal costs or even earn a profit from what is now a significant liability.

Continuing Work

This project is still in the beginning stages. We will be continuing work on this project during the next one to two years.

Publications

Although nothing has been published yet, researchers expect journal articles, theses, and fact sheets to result from this project.

Funding

The Oklahoma Agricultural Experiment Station and the FAPC have provided funding for this project. Oklahoma wineries also have provided support.

Collaborators

Dr. William McGlynn, FAPC Horticulture Processing Specialist, is the principal investigator for this project. Other collaborators include Dr. Danielle Bellmer, FAPC Food Engineer; Dr. Christina DeWitt, Animal Science Assistant Professor; Dr. Neils Maness, Horticulture and Landscape Architecture Professor; Dr. Nurhan Dunford, FAPC Oil/Oilseed Chemist; Dr. Peter Muriana, FAPC Food Microbiologist; and Yannis Oikonomakis and Leenalitha Panneerseelan, graduate students.

One of the main focuses of the FAPC is to help Oklahoma's value-added businesses and processors in the area of microbial food safety from farm to table.

- Agribusiness Economics
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- Value-Added Wood Products

Lactobacilli as Probiotics, Biopreservatives, and Producers of Nutraceuticals

Objective

The primary objective of this project was to select a culture of lactobacillus having potential for use as a probiotic or dietary supplement for dogs.

Approach

The need to control pathogenic microorganisms in the intestinal tract of dogs is a growing concern. There is interest in using probiotics, such as species of *Lactobacillus*, to help control canine intestinal infections. For successful use as a probiotic, the bacterial species should be of canine intestinal origin since these species exhibit host specificity.

Serial dilutions of freshly voided dog feces were plated on Lactobacillus Selection agar to isolate the cultures. Isolates were identified based on Gram stain, catalase test, and fermentation patterns using API 50 CH kits. All potential isolates were compared for bile resistance based on relative ability to grow in broth containing 0.3 percent oxgall, the ability to inhibit *Salmonella* Typhimurium in associative broth cultures, and the production of reuterin.

Of the isolates of lactobacilli isolated, *Lactobacillus reuteri* was the dominant species. However, some cultures of *Lactobacillus acidophilus* also were isolated. We found variations among the isolates of *L. reuteri* and *L. acidophilus* with respect to bile tolerance. In general, isolates of *L. reuteri* appeared to be more bile resistant than were isolates of *L. acidophilus*. There were also variations in the ability to inhibit growth of *S.* Typhimurium. Some isolates of *L. reuteri* produced reuterin while others did not. The selected isolate, *L. reuteri* X-18 was tested and found to be stable in a commercial frozen dog food stored at minus 200 degrees Celsius for at least five weeks.

Benefits

Potential benefits for consumers are dietary supplements for their dogs, which can improve or maintain the health and nutrition of their animals. The probiotics may improve digestion in the animals and/or help control intestinal infections. Some pathogens that might occur in the intestinal tract of dogs also could cause problems with humans, thus control of these organisms in the animal can result in reduced chances of similar infections in human handlers.

Economic Impacts

The potential economic impact of this project is the availability of a probiotic for use as a dietary supplement for dogs. Since it was isolated from a healthy dog, the probiotic is more likely to function well in a dog since these organisms tend to exhibit host specificity. Those on the market today do not mention the source of the probiotic. Thus, the manufacturers that use the one(s) isolated in this study know they are using one that has been selected for the potential to provide the best benefits in dogs.

Continuing Work

Experiments need to be done to show the efficacy of the probiotic in dogs. This would involve feeding trials, which might include challenges with enteric pathogens.

Publications

As a result of this research, a master's thesis has been published, a journal article has been submitted, and a conference paper has been presented.

Funding

Funding for this research came from three sources: the Oklahoma Agricultural Experiment Station, the Sitlington Endowment, and Royalty Funds from Intellectual Properties.

Collaborators

Dr. Stanley Gilliland, FAPC Food Microbiologist, was the principal investigator. Sandra McCoy, FAPC Research Specialist and graduate student, was also a collaborator.

Microbial Validation of Replacement of Chemical Preservatives by Natural Preservatives in Vegetable Dips

Objective

The primary objective of this project was to achieve microbial stability in several premium vegetable-dip formulations for six weeks of shelf life.

Approach

Allison's Gourmet Kitchens asked the FAPC to help find a replacement system for chemical preservatives in its new line of vegetable dips to be marketed as "preservative free" or "natural preservatives." The FAPC identified Danisco, an ingredient manufacturer that provided several potential natural antimicrobials. Allison's Gourmet Kitchens then made two dip products with and without the antimicrobials.

FAPC researchers analyzed the dip products weekly for aerobic plate counts, lactic acid bacteria, and yeast and molds. Although bacteria in the control samples and in one ingredient sample grew to high levels, another ingredient combination worked effectively. Researchers then started a Phase II shelf-life trial. Allison's Gourmet Kitchens made four other dip products that were tested for the same organisms, as well as for coliform bacteria, and again the data was identical to the first round of testing (all testing was done in triplicate replications).

Benefits

The success of this project reinforces the FAPC's ability to help Oklahoma companies be competitive and successful with perishable food items. Allison's Gourmet Kitchens is marketing this as a premium dip product and, based on testing results, has signed up four supermarket chains in the Southwest to carry the product. The company is marketing for the high-end, educated consumer who does not want chemical preservatives and is thinking "natural." The products use "natural antimicrobials" that are themselves made by microorganisms and demonstrate how natural fermentative processes are capable of producing effective products.

Economic Impact

Allison's Gourmet Kitchens of Moore, Okla., has expanded its manufacturing capacity. The company just finished building a large add-on building to the existing building and will be moving in January 2007. The six new dips that researchers worked on are just the beginning, and the company is going to need to hire more workers and staff to help with an additional product launch planned for 2007.

Continuing Work

FAPC researchers have just finished the last of the Phase II shelf-life project. Data from the project has been given to the client, and report delivery is all that remains for project completion.

Publications

Results of this research will be included in a doctoral dissertation.

Funding

Allison's Gourmet Kitchens funded the natural antimicrobial project. However, the FAPC funded the extended testing of its own antimicrobial.

Collaborators

Dr. Peter Muriana, FAPC Food Microbiologist, was the principal investigator for this project. Other collaborators included Sunita Macwana, graduate student; Dr. William McGlynn, FAPC Horticulture Processing Specialist; Darren Scott, FAPC Sensory Specialist; and Dr. Guadalupe Davila-El Rassi, FAPC Analytical Chemist.

- Agribusiness Economics
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- Horticulture Processing
- Food Microbiology
- **Muscle Science**
- Oil/Oilseed Chemistry
- Pilot Plant
- Product Development
- Quality Control & Assurance
- Value-Added Wood Products

The FAPC works toward the development of an outstanding research program emphasizing the chemical or biochemical aspects of further processing of livestock, poultry, and aquatic muscle, as well as other food-producing species for value-added products.

Oklahoma-Texas Meat Processors Association

Objective

The primary objective of this project was to be a service provider to the Oklahoma-Texas Meat Processors Association.

Approach

The OTMPA is an association of small and very small meat processors, located mostly in Oklahoma and Texas. The association's general objective is to provide its membership with an opportunity to assemble as a unit and discuss, learn, and exchange ideas, issues, and solutions they face in their industry.

Contributions by the FAPC may be best described as daily functions, as teams within the FAPC provide numerous services to the association. Some contributions include regulatory compliance assistance, processing/technical advice, economic analyses of the industry, hosting the association's annual convention, organizing and executing the annual cured meats competition, and providing service on the board of directors for the association.

Additionally, the FAPC assists by representing the association within its national charter, the American Association of Meat Processors. The OTMPA as a group and as individual members regularly access assistance from FAPC personnel for support.

Benefits

Like most businesses, the membership of OTMPA faces difficult challenges daily. The support given by the FAPC may help these businesses continue to survive, grow, improve, and become more competitive.

Economic Impact

Faculty at OSU conducted a survey of mostly small and very small meat-processing establishments, and operational data from 1983 to 2000 was compared. The report indicated the percentage of responding meat-processing establishments that employ fewer than 5 employees severely increased from 1983 to 2000. This decrease in employee numbers, coupled with drastic changes in meat-processing regulations, has placed additional burdens on meat-processing establishments; yet, they continue to thrive. Many of these establishments are members of the OTMPA, and their ability to address quick changes in regulation, policy, and consumer demand are made possible through the efforts of the FAPC.

Continuing Work

Until the OTMPA fails to exist as a viable entity, the FAPC will continuously provide services that meet its own mission and objectives.

Publications

The FAPC is currently acting as the publisher and editor of the bi-monthly OTMPA newsletter. Work has been initiated to establish and maintain a Web site for the association.

Funding

Both the FAPC and the OTMPA have provided funding for this project.

Collaborators

Jake Nelson, FAPC Value-Added Meat Processing Specialist, was the principal investigator. Other collaborators included David Moe, FAPC Pilot Plant Manager; Dr. Rodney Holcomb, FAPC Agribusiness Economic Specialist; Kyle Flynn, FAPC Meat Plant Manager; Jason Young, FAPC Quality Management Specialist; and numerous graduate and undergraduate students that have interest in meat processing and meat science. The service provided by the FAPC would not be the service it is without the excellent help provided by these students.

- Agribusiness Economics
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- Value-Added Wood Products

The FAPC strives to enhance the nutritional and economic value of plant-based materials and oils/oilseeds through innovative processing.

Stabilization of Heart-Healthy Edible Oils

Objective

The objective of this study was to examine the oxidative and thermal stability of omega-3 oils from marine and plant sources and to develop novel oil-stabilization techniques.

Approach

New studies continue to support the growing body of evidence that polyunsaturated fatty acids, specifically omega-3 fatty acids, provide numerous health benefits. Prevention of heart disease, hypertension, Type II diabetes, and renal disease and aiding brain development and growth are a few of the many health benefits of omega-3 fatty acids that are reported extensively in the medical literature.

Incorporation of omega-3 oils into food products is challenging because of their thermal and oxidative instability, which results in deterioration of flavor, increased risk of rancidity, and reduced shelf life. Fish, flax, microalgae, and canola oil samples were evaluated for their oxidative and thermal stability in this study. A Thermogravimetric Analyzer was used to determine thermal stability of oil samples both under nitrogen and oxygen atmospheres as a function of initial decomposition temperature (Tonset). Activation-energy and oil-degradation curves for each oil sample were generated. Oxidative stability of the oil samples was evaluated by using rancimat tests. Correlation equations derived from temperature vs. induction time curves were used to describe oxidative stability of each oil. Induction time and Tonset temperature of the oil samples varied depending on the oil source and presence or absence of the antioxidants. Both rancimat and TGA tests showed the same stability trends for the oil samples evaluated in this study (fish and canola were the least and most stable oils, respectively). Natural plant extracts such as oregano and wheat germ oil and grape and coffee extracts were evaluated for their efficacy to improve stability of omega-3 oils. Oregano and wheat germ oil were very effective in increasing the oxidative stability of oils examined in this study.

Benefits

In 2004, the U.S. Food and Drug Administration announced a qualified health claim that "conventional foods including fortified foods" containing long chain omega-3 fatty acids reduced the risk of cardiovascular heart disease. The FDA announcement caused a spur in the industry development of omega-3 fortified foods. Understanding the kinetics and mechanism of thermal degradation and the oxidative stability of omega-3 oils is crucial for development of oil-stabilization techniques, process control, and establishment of standards for food applications. Development of advanced oil-stabilization techniques will help to incorporate omega-3 oils in various food products and improve shelf stability of the products.

Economic Impact

Findings of this study will help the food industry to develop new heart-healthy omega-3 oil-containing shelf-stable products.

Continuing Work

Currently, FAPC researchers are working on novel oil-encapsulation techniques. Pressurized carbon dioxide, sonication-aided drying, and nano-emulsion techniques are being studied to develop shelf-stable omega-3 oils in emulsions and powder form.

Publications

As a result of this research, an *FAPC FLASH* and fact sheet have been published, and an invited oral presentation has been given.

Funding

The funding for this project was provided by Hatch Funds.

Collaborators

Dr. Nurhan Dunford, FAPC Oil/Oilseed Chemist, was the principal investigator. Other collaborators included Amogh Ambardekar and Jerrad Legako, graduate students.

- Agribusiness Economics
- Analytical Chemistry
- Business Planning & Marketing
- Cereal Chemistry
- Food Engineering
- Horticulture Processing
- Food Microbiology
- Muscle Science
- Oil/Oilseed Chemistry
- **Pilot Plant**
- Product Development
- Quality Control & Assurance
- Value-Added Wood Products

The FAPC Pilot Plant facilities were designed with the needs of the Oklahoma food and agricultural products processing industries in mind; therefore, the facilities can accommodate all levels of the industry.

Tulsa State Fair Lamb and Goat Harvest and Carcass Evaluation

Objective

The primary objective of this project was to conduct carcass inspection to help ensure the Tulsa State Fair maintains the integrity and high standard of ethics that are expected from Oklahoma's youth livestock programs.

Approach

After the lambs were harvested, third-party evaluators examined the carcass for the presence of adulteration. Upon inspection, no adulterations were found.

Benefits

This project was beneficial in that it ensured a safe and wholesome product is reaching the consumer.

Economic Impact

This project ensured that Tulsa State Fair exhibitors were raising and showing a live product that then could be turned into a wholesome and marketable meat product.

Funding

The Tulsa State Fair provided funding for this project.

Collaborators

Kyle Flynn, FAPC Meat Plant Manager, was the principal investigator for this project. Other collaborators included Dr. Brad Morgan, Animal Science Associate Professor; Rusty Gosz, Extension Youth Livestock Specialist; Dr. Gerald Fitch, Animal Science Professor and Extension State Sheep Specialist; Dr. Gretchen Hilton, Animal Science Assistant Professor; and Dr. Deborah VanOverbeke, Animal Science Assistant Professor.

Pilot Processing for Oklahoma Industry

Objective

The primary objective of this project was to support a new product-development effort for a large Oklahoma food processor.

Approach

The mission of the pilot-processing facility at the FAPC is adding value to existing and new Oklahoma food and agricultural product processors. This is done by providing a facility and personnel to assist in development, scale-up, and evaluation of new products, ingredients, and technologies. The current client has had an ongoing relationship with the FAPC during the past few years and is an example of how a company can utilize the pilot plant to achieve specific business objectives. In addition, the client has not had to invest in specialized facilities, can process smaller batches, and does have to tie up production lines for initial testing. They have invested in personnel to coordinate projects, visit the FAPC to assist and monitor results, and coordinate start-up at their production plants.

A typical project is scheduled after contact by the client. Recipes and objectives are provided for review and/or recommendations from the FAPC. Ingredients are ordered, and a processing time slot is scheduled. Upon completion, samples are evaluated by company marketing and other personnel. Follow-up may include additional testing and the decision not to go further or to continue the path toward new-product introduction.

Benefits

Consumers are provided with additional choices of convenient, branded food products. The industry benefits from continued growth and success of Oklahoma food-processing facilities.

Economic Impact

Processing initial new-product concept samples at the FAPC has resulted in cost savings for the client. The company has continued to expand Oklahoma processing facilities, in part, due to success of new products and/or improved existing product lines.

Continuing Work

This project is ongoing with pilot processing assistance provided as scheduled.

Funding

The client and the FAPC provided funding for this project.

Collaborators

Dave Moe, FAPC Pilot Plant Manager, was the principal investigator for this project. Chuck Willoughby, FAPC Business Planning and Marketing Specialist, and Jake Nelson, FAPC Value-Added Meat Processing Specialist, were also collaborators.

The FAPC assists Oklahoma's small processors and entrepreneurs with the scale-up and reformulation of products.

- Agribusiness Economics
- Analytical Chemistry
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- Food Engineering
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- Muscle Science
- Oil/Oilseed Chemistry
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- **Product Development**
- Quality Control & Assurance
- Value-Added Wood Products

Formulation of Just-Add-Water Custard

Objective

The primary objective of this project was to develop custard that could be quickly and easily prepared.

Approach

The client currently manufactures a variety of dry-mix products, as well as imports many other shelf-stable foods and ingredients. In response to customer requests, the client needed to expand the roster of products to include just-add-water custard. Prototypes were formulated and tested until a custard with the desired characteristics was achieved.

Benefits

The client is able to manufacture and market a new product, while consumers are able to purchase and enjoy a product that is fast and easy to prepare.

Economic Impact

Potential economic impacts are expanded markets and increased revenue for the client.

Collaborators

Darren Scott, FAPC Sensory Specialist, was the principal investigator for this project. Dr. William McGlynn, FAPC Horticulture Processing Specialist, was also a collaborator.

The FAPC is committed to helping Oklahoma's producers and processors incorporate quality management into their operations.

- Agribusiness Economics
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- **Quality Control & Assurance**
- Value-Added Wood Products

Bedre Chocolates Food Safety, Sanitation, and Quality Assistance

Objective

The primary objective of this project was to help Bedre Chocolates understand and meet the criteria established in the NSF-Cook & Thurber - Food Safety, Quality, and Security Expectations and Criteria for Food Processing Facilities.

Approach

Belinda Morse of Bedre Chocolates contacted the FAPC in April 2006. Belinda was in a new quality manager position at Bedre Chocolates, and customers were requesting Bedre Chocolates complete a third-party food safety and sanitation audit. Belinda and her management team chose the NSF-Cook & Thurber audit criteria. The criteria for the NSF-Cook & Thurber audit are extensive, and several pre-requisite programs need to be established to meet these criteria.

Through phone calls, e-mails, and one trip to visit Belinda at Bedre Chocolates, Belinda was able to meet the audit criteria on the first audit. After the audit, there were several items that needed improvement but were much less extensive than the initial preparation for the audit.

Listed below are examples of a few of the model programs with which the FAPC was able to help Bedre Chocolates:

- HACCP
- Sanitation Standard Operating Procedures
- Supplier Program
- Microbiological Program
- Recall and Trace Program
- Metal-Detector Program
- Allergen Program
- Pest-Control Program

Courtesy of Bedre Chocolates

Benefits

Consumers of Bedre Chocolates' products will benefit from the food safety and sanitation programs that have been established. These programs assure a safe and clean food product for the consumer.

Bedre Chocolates will benefit from customers recognizing the efforts of good food safety and sanitation. Customers will, therefore, have more confidence that products packaged at Bedre Chocolates have been packaged within a clean and safe environment.

Economic Impacts

The quick response of the FAPC helped Bedre Chocolates pass the audit the first time, which is not always an easy task. Audits can be fairly expensive, ranging from $800 to $2,000, depending on the length of stay by the auditor. Bedre Chocolates is now able to satisfy customer requirements and to keep customers, as well as be equipped and organized for the potential customers that want co-packers with established food safety and sanitation programs.

The FAPC is concerned with the physical and mechanical properties of wood products and value-added wood composites.

- Agribusiness Economics
- Analytical Chemistry
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- Food Microbiology
- Muscle Science
- Oil/Oilseed Chemistry
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- Product Development
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- Value-Added Wood Products

Mechanical Properties and Surface Characteristics of Colombian Wood Composites

Objective

The primary objective of this research was to determine the mechanical properties and surface quality of commercially manufactured wood composites in Colombia.

Approach

The mechanical properties and surface roughness characteristics of commercially manufactured particleboard, hardboard, and overlaid particleboard panels were evaluated.

Patula pine (*Pinus patula*) and mixed hardwood species were used as raw material for particleboard and hardboard panels. Average modulus of elasticity (MOE) and modulus of rupture (MOR) of the particleboard panels were 2,481 MPa and 16.89 MPa, respectively. Hardboard samples had 28 percent higher MOE values than those of particleboard panels. Overall, mechanical properties of the panels were not statistically different from each other ($p<0.1$). A skid-type profilometer with diamond stylus of 5 µm tip radius and 90-degree tip angle was employed for the experiment. Roughness average (Ra), average maximum height of the profile (Rz), and maximum roughness depth (Rmax) were used to evaluate quantitatively surface characteristics of the specimens. Particleboard panel type C had the smoothest surface with average values of 4.15 µm, 35.24 µm, and 50.06 µm for Ra, Rz, and Rmax, respectively. It was found that no statistically significant difference ($p<0.1$) existed among the values of all three parameters, taken both parallel and perpendicular to sandmarks of particleboard panels. Hardboard samples had relatively lower roughness values with superior surface characteristics as compared to those of particleboard samples.

Benefits

Based on the findings in this study, such quantitative values can be used as a quality control tool to improve overall panel characteristics in Colombia.

Publications

A manuscript has been submitted to the *Journal of Composite Material* and is under review.

Funding

The FAPC and the Universidad Distrital Francisco Jose de Caldas, Bogotá, Colombia, provided funding for this project.

Collaborators

Dr. Salim Hiziroglu, FAPC Value-Added Wood Products Specialist, was the principal investigator for this project. Santiagio Zarate, visiting scientist from the Universidad Distrital Francisco Jose de Caldas, Bogotá, Colombia, was also a collaborator.

Industry Advisory Committee

Front Row:

Dr. J. Roy Escoubas - FAPC Director
Mr. Virgil Jurgensmeyer - J-M Farms
Ms. Jill Stichler - Redland Juice Company
Dr. Charles Nichols - Davison & Sons Cattle Company
Mr. John Griffin, Secretary - Griffin Food Company
Mr. John Williams - Chef's Requested Foods

Back Row:

Mr. Roger Ediger - Mitchell & DeClerk
Dr. Robert Whitson - OSU Division of Agricultural Sciences and Natural Resources
Mr. Tommy Kramer - Durant Industrial Authority
Mr. Gary Crane - Ralph's Quality Meats
Mr. Bill Wiley, Vice Chair - Oklahoma Refrigerated Services
Dr. Clarence Watson - Oklahoma Agricultural Experiment Station

Not Pictured:

Mr. John Bailey, Chair - The Schwan Food Company
Mr. Danny Dupree - Bar-S Foods Company
Mr. David McLaughlin - Advance Food Company
Mr. David Howard - Unitherm Food Systems
Mr. Bob Collins - Cooperative Ginners Association of Oklahoma
Mr. Rodger Kerr, Past Chair - Southwest Technology Center
Mr. Gary Conkling - Producers Cooperative Oil Mill

FAPC Faculty & Professional Staff

"This year gave me the opportunity to help several existing and proposed food processing businesses, plus work continues on the development of a regional wheat-marketing program."

Rodney Holcomb, Ph.D.
Agribusiness Economic Specialist
114 FAPC
rodney.holcomb@okstate.edu

Research Projects - 4
Extension Projects - 17
Key Projects
- Topped Pizza Facility Enterprise Development
- Quality Preferences for Latin American Millers Purchasing Oklahoma Hard Red Winter Wheat
- Food Industry Trends for Oklahoma and Surrounding States

"Functional foods continue to play an important role in Oklahoma and our program."

Guadalupe Davila - El Rassi, Ph.D.
Analytical Chemist
315 FAPC
guadalupe.davila_de_el_rassi@okstate.edu

Research Projects - 3
Extension Projects - 16
Key Projects
- Development of Programs for the Implementation of ISO 17025
- HPLC Determination of (+) and (-) Gossypol in Cottonseed Meal
- Determination of TBAR Values in Dip Mixtures

"In 2006, we have seen several of our smaller companies grow in sales and market share, and our research assistance to many of the larger companies in the state has grown more than any other year."

Jim Brooks
Business Planning & Marketing Specialist
143 FAPC
jim.brooks@okstate.edu

Research Projects - 4
Extension Projects - 36
Key Projects
- Mo Betta Meats
- Denim's Candy
- Producers Cooperative Mill

"2006 was a year during which many FAPC clients turned the corner from start-up businesses to viable food companies."

Corey Stone
Business Planning & Marketing Specialist
116 FAPC
corey.stone@okstate.edu

Research Projects - 1
Extension Projects - 38
Key Projects
- Marketing a Line of Pre-rimmed Margarita Glasses
- Introduction of a Retail Pasta Sauce to Foodservice
- Product Line Expansion for Existing Retail Barbecue Sauce Company

"This year has been full of new and exciting challenges as our small business program and work with medium- to large-size companies continues to grow."

Chuck Willoughby
Business Planning & Marketing Specialist
141 FAPC
chuck.willoughby@okstate.edu

Research Projects - 2
Extension Projects - 37
Key Projects
- My Bigmama's Pies & Cobblers
- Fruity Delights Beverage Drink
- Upper Red Fork Innovations

"Learning how proteins expressed in wheat endosperm during grain filling stages might be important in understanding fundamental metabolic pathways related to gluten proteins."

Patricia Rayas, Ph.D.
Cereal Chemist
107 FAPC
pat.rayas_duarte@okstate.edu

Research Projects - 5
Extension Projects - 5
Key Projects
- Understanding Intrinsic Properties of Wheat Gluten Proteins
- Developing Security to U.S. Commercial Grain Storage and Transportation Systems
- Development of Whole-Grain Products

"During 2006, the FAPC held its second annual Media Day, which resulted in increased media coverage of FAPC projects, services, and clients."

Mandy Gross
Communications Specialist
144 FAPC
mandy.gross@okstate.edu

Research Projects - 1
Extension Projects - 40
Key Projects
- FAPC Media Day
- FAPC Promotional Videos
- *fapc.biz* Quarterly Magazine

"In 2006, we set out to help demonstrate the wisdom in Louis Pasteur's words: 'Wine is the most healthful and most hygienic of beverages.'"

William McGlynn, Ph.D.
Horticulture Processing Specialist
112 FAPC
william.mcglynn@okstate.edu

Research Projects - 6
Extension Projects - 35
Key Projects
- Establishment of an FAPC Enology Laboratory
- Studying the Effect of Maturity on Lycopene-Bearing Structures in Watermelon Tissue
- Development and Implementation of a Vanilla Extract Quality Assurance Program

"Incredible growth in the food industry has led to an increased emphasis on continuous improvement in 2006, and we are working to fulfill the need."

Timothy Bowser, Ph.D.
Food Engineer
110 FAPC
bowser@okstate.edu

Research Projects - 5
Extension Projects - 40
Key Projects
- Rita Rims
- Mobile Chicken Processing Unit
- Matador Foods

"Another year closer to sustainable, renewable energy."

Danielle Bellmer, Ph.D.
Food Engineer
108 FAPC
danielle.bellmer@okstate.edu

Research Projects - 6
Extension Projects - 6
Key Projects
- Sorganol: In-field Production of Ethanol from Sweet Sorghum
- Conversion of Biomass to Ethanol
- Use of Immobilization Techniques to Produce Riboflavin

"This has been a very fast-moving year, and yet, we have made significant progress in the areas of microbial food safety and in the selection and characteristics of probiotics."

Stanley Gilliland, Ph.D.
Food Microbiologist
111 FAPC
stan.gilliland@okstate.edu

Research Projects - 2
Extension Projects - 0
Key Projects
- *Lactobacilli* as Probiotics, Biopreservatives, and Producers of Nutraceuticals
- Food Safety: Farm to Table, USDA/CSREES Special Food Safety Research Grant

"The presence of Listeria monocytogenes in meat-processing facilities can be a 'sticky situation' (pun on our studies identifying strongly adherent strains of L. monocytogenes)."

Peter Muriana, Ph.D.
Food Microbiologist
109 FAPC
peter.muriana@okstate.edu

Research Projects - 5
Extension Projects - 6
Key Projects
- Electrolyzed Water as a Sanitizing Agent
- Molecular Analysis and Application of Peptide Antimicrobials
- Characterization of Adherence to Surfaces by *Listeria monocytogenes*

"The FAPC is committed to supporting development of a strong oil, oilseed, and biodiesel industry in Oklahoma."

Nurhan Dunford, Ph.D.
Oil/Oilseed Chemist
103 FAPC
nurhan.dunford@okstate.edu

Research Projects - 5
Extension Projects - 15
Key Projects
- Wheat Biorefinery System
- Effect of Conventional Breeding and Genetic Modifications on Flavor of Oklahoma Grown Peanuts
- Biodiesel Workshop

"2006 - a year of professional transition."

Jacob Nelson
Value-Added Meat Processing Specialist
106 FAPC
jacob.nelson@okstate.edu

Research Projects - 6
Extension Projects - 30
Key Projects
- Ground Beef Shelf-Life Determinations
- Alternative Flavor Components Effect on Enhanced Beef Case-Life
- Fortification of Ground Beef with Docohexanoic Acid

"2006 was the 'year of the sauce.'"

David Moe
Pilot Plant Manager
204 FAPC
david.moe@okstate.edu

Research Projects - 5
Extension Projects - 48
Key Projects
- Scale-up of New Specialty Pickle
- Planning a Facility for an Intranet-Based Food Business
- Process Improvement – Pet Food Products

"Happy to be a new member on staff at FAPC."

Kyle Flynn
Meat Pilot Plant Manager
205 FAPC
kyle.flynn@okstate.edu

Research Projects - 3
Extension Projects - 2
Key Projects
- National Cattlemen's Beef Association Product Development
- HACCP Workshops
- Field Days

"A year of professional development."

Scott Grumbles
Meat Pilot Plant Assistant Coordinator
203 FAPC
scott.grumbles@okstate.edu

Research Projects - 9
Extension Projects - 0
Key Projects
- Oklahoma Youth Expo
- Katahdin Sheep
- National Beef Quality Audit

"The FAPC continues to adapt and change so that it can face new challenges."

Darren Scott
Sensory Specialist
101 FAPC
darren.scott@okstate.edu

Research Projects - 2
Extension Projects - 32
Key Projects
- Process Evaluation of Rita Rims
- Nutritional Labeling of Salsa

"My experience as an examiner for the Oklahoma Quality Award helped me become conscious that organizations, including the FAPC, have a greater duty than meeting product quality and customer satisfaction."

Jason Young
Quality Management Specialist
102 FAPC
jason.young@okstate.edu

Research Projects - 0
Extension Projects - 34
Key Projects
- Matador Processing
- Ralph's Packing Co.
- Thompson's Red River Jerky

No Picture Available

"I will be working at Shizuoka University, Japan, under Japan Society for the Promotion of Science fellowship during the first part of my one-year sabbatical leave starting July 1, 2006."

Salim Hiziroglu, Ph.D.
Value-Added Wood Products Specialist
303G Ag Hall
hizirog@okstate.edu

Research Projects - 2
Extension Projects - 1
Key Projects
- Manufacturing Medium-Density Fiberboard Panel from Bamboo and Rice Straw in Thailand

Food & Agricultural Products Center

- Business & Marketing Assistance
- HACCP & Food Safety Training
- Total Quality Management
- Technical Assistance
- Pilot Plant Facilities

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