ANNUAL 2010 REPORT

ROBERT M. KERR FOOD & AGRICULTURAL PRODUCTS CENTER

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About the Cover

Danielle Bellmer, FAPC food processing engineer, is determining the ease and efficiency of the conversion of soft drink waste to ethanol. See story on page 12.

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The Robert M. Kerr Food & Agricultural Products Center (FAPC) is a research, product development, business and marketing, and technical assistance resource for the food and agri-business industries in Oklahoma. This 96,000-square-feet stand-alone facility has animal harvesting, food manufacturing, sensory profiling, food research and microbiology, and analytical laboratory facilities. The FAPC has conference facilities and applications laboratories for demonstration and prototype testing. The FAPC has approximately 15,000 square feet of active research space, 16,000 square feet of active food processing space, 3,200 square feet of conference space, and 10,000 square feet of refrigerated and freezer space.

It truly is a state-of-the-art facility and is available to help you.

The FAPC has moved into its second decade of service to Oklahoma with 13 years of service. The FAPC has continued to contribute significantly to the Oklahoma economy, and the continuing impacts following the 10-year economic impact study has demonstrated the number of jobs in those companies assisted by the FAPC increased by 180 jobs and the annual sales revenue increased by $217 million.

In this reporting year, the FAPC operated with 10 faculty members, 13 professional staff members, 5 clerical staff members, and 7 technical staff members. The FAPC is proud of the diversity profiles of its faculty and staff, having 60 percent of its employees listed as "diverse" by the Oklahoma State University official Diversity Ledger.

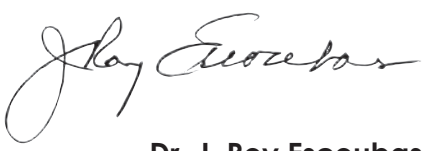
The economic impacts made by the FAPC were due to the hard work of its faculty and staff in value-added processing in all food-processing sectors of Oklahoma. Food processing support by the FAPC was primarily made in food processing engineering, food microbiology, food sensory analysis, food harvest and processing technology, total quality management, communications and media support, and finally, marketing and business management. In this reporting year, the FAPC trained and educated more than 800 industry clients and participated in more than 200 client projects.

The FAPC has an Industry Advisory Committee appointed by agencies of the state of Oklahoma, and meets with the FAPC twice per year. This team of industry executives provides oversight and leadership in activities and programs of the FAPC. This committee gives the FAPC a strong industry linkage to ensure programs and services are useful, effective, and the FAPC is accountable for its resources. The FAPC is truly grateful for the work and contributions of the Industry Advisory Committee.

This year, the chair of the committee is Mr. David Howard, president and CEO of Unitherm Food Systems in Bristow, Oklahoma; the vice chair is Mr. Paul Schatte, general manager and co-owner of Head Country Foods in Ponca City, Oklahoma; and secretary is Ms. Jill Stichler, owner of Willow Pond Vineyard and Redland Juice Company in Lexington, Oklahoma. The immediate past chair is Mr. John Williams, president of Chef's Requested Foods in Oklahoma City.

Current trends in Oklahoma and across America in food processing and food marketing are being driven by the retail and food service consumer base. These trends include food safety, food quality, locally grown foods, sustainability, convenience and cost. These consumer demands continue to create opportunity for food processors and food ingredient and equipment suppliers in Oklahoma. Oklahoma is positioned well geographically, and the food industry continues to make solid growth.

The FAPC is prepared and ready to assist the Oklahoma food processing and agribusiness industries to realize the growth that is available to them. Contact us and allow us to help you grow.



Dr. J. Roy Escoubas
FAPC Director

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 bridges 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.

Industry Advisory Committee

The Oklahoma State Legislature established the Industry Advisory Committee to serve as an advisory board for the FAPC. The 16-member committee is composed of Oklahoma agricultural and business leaders, and they are appointed by the highest positions of the Oklahoma state government. The committee assists, counsels, and gives leadership to the FAPC.

Members of the 2010-2011 Industry Advisory Committee include (left to right) Roy Escoubas, FAPC; John Griffin, Griffin Food Company; Tommy Kramer, Durant Industrial Authority; Virgil Jurgensmeyer, J-M Farms; David McLaughlin, Advance Food Company; David Howard, Unitherm Food Systems (IAC Chair); Allen Mills, Reasor's Incorporated; Jill Stichler, Redland Juice Company (IAC Secretary); Dick Davis, Agri-Services, Oklahoma Department of Corrections; John Williams, Chef's Requested Foods (Past IAC Chair); and Rodger Kerr, Southwest Technology Center. Not pictured are Danny Dupree, Bar-S Food Company; Gary Conkling, Producers Cooperative Oil Mill; Gary Crane, Ralph's Packing Company; Paul Schatte, Head Country Bar-B-Q (IAC Vice Chair); Bill Wiley, BC Solutions LLC; and Robert Whitson, OSU's Division of Agricultural Sciences and Natural Resources.

Foundation Focus

The FAPC Foundation Focus Program is designed to enable the center to accomplish its mission with increased financial support from private donors. With these funds, the FAPC is able to focus on delivering even greater economic impact to Oklahoma as it continues to serve the state's value-added agricultural industry. The FAPC would like to recognize the following 2010 donors:

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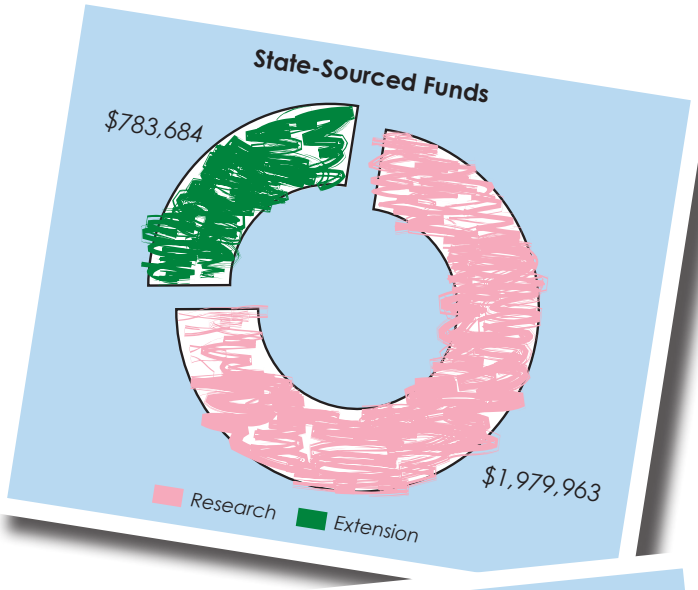
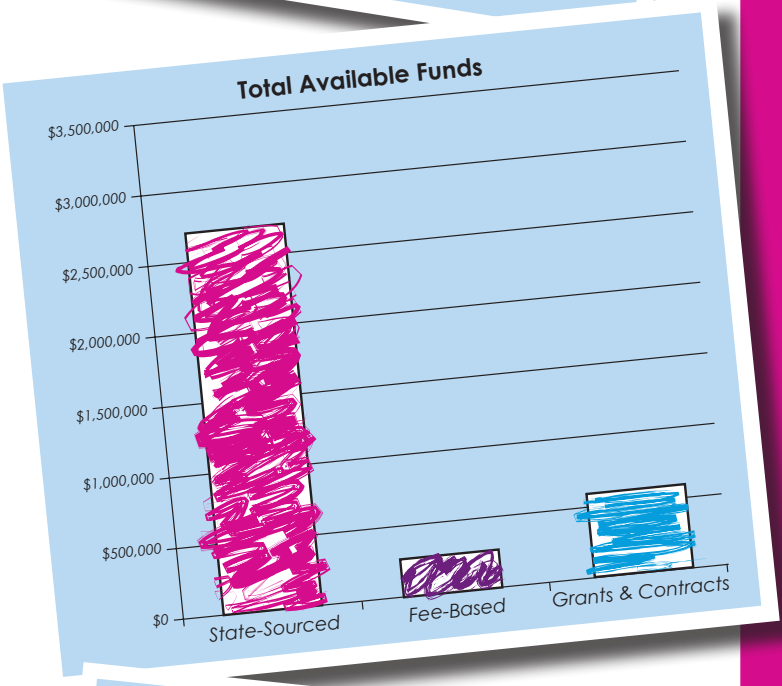
Chuck & Susan Willoughby
Kylee Willard
Jason Young

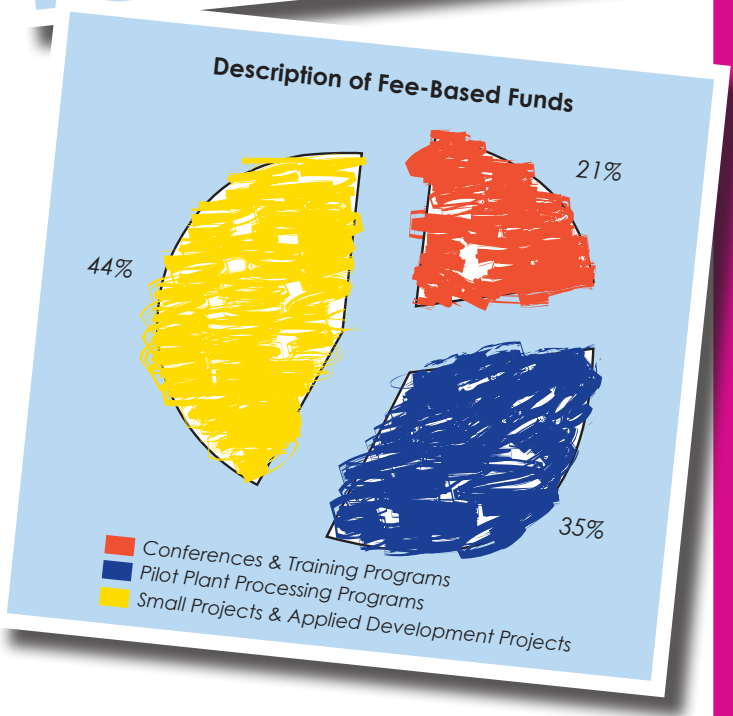
Working Funds	**$3,091,898**
State Sourced	$2,763,647
Fee-Based Sourced	$ 328,251
State-Sourced Funds	**$2,763,647**
Research	$1,979,963
Extension	$ 783,684
Fee-Based Funds	**$ 328,251**
Conference & Training Accounts	$ 70,552
Small Projects & Applied Development Accounts	$ 113,503
Pilot Plant Processing Accounts	$ 144,196
Grants & Contract Research Funding	**$ 628,157**
Total Available Funds	**$3,720,055**
State-Sourced Funds	$2,763,647
Fee-Based Funds	$ 328,251
Grants & Contracts Funds	$ 628,157

Description of Funds	
State-Sourced Funds	74%
Fee-Based Funds	9%
Grant & Contract Funds	17%
Disposition of Funded Activities	
Research & Product Development	72%
Outreach Activities	28%
Disposition of Budgeted Resources	
Salaries & Benefits	92%
Maintenance, Operational, & Facility	5%
Small Projects & Market Development	3%
Description of Fee-Based Funds	
Conferences & Training Programs	21%
Pilot Plant Processing Programs	35%
Small Projects & Applied Development Projects	44%

Foundation Focus	**$ 28,847**
Endowed & Non-Endowed Gifts	$ 26,831
In-Kind Gifts	$ 2,016







OKLAHOMA FOOD COOPERATIVE MEMBERSHIP SURVEY

Objective

The objective of this survey was to determine the needs and expectations of Oklahoma cooperative members in assisting the Oklahoma Food Cooperative (OFC) in strategic planning.

Approach

The OFC grew from humble beginnings to an organization comprised of more than 2,500 customer members and more than 150 supplier members in just a few years. Each type of member joined the OFC for different reasons: the customer members for access to locally grown and locally-processed foods or the supplier members to have an additional market outlet for their goods. Each type of member was presented with an online survey to ascertain their reasons for joining and maintaining their activity in the cooperative, their attitudes toward and opinions about the OFC's current operating structure, the share of their food purchases (customers) or gross sales (suppliers) associated with the cooperative, and actions they would like to see the cooperative take in the future.

Benefits

The OFC has rapidly grown and is recognized as the single largest entity promoting the marketing of locally-grown food products in Oklahoma. Furthermore, the OFC has served as the template for 12 similar organizations in other states and one cooperative organization in Canada. Gaining a better understanding of the OFC membership, their reasons for joining the OFC, and their hopes for the OFC's future will prove valuable to similar efforts across the U.S.

Economic Impact

Since inception, the OFC has relied heavily upon volunteers to coordinate product orders and deliveries. However, the rapid growth of the OFC has required the organization to expand the number of order drop-off sites around the state. As a result, in the past year, the OFC hired its first paid employee to manage operations. The cooperative continues to grow. With growth comes the need for strategic planning, which includes examining options of more frequent order deliveries and the potential for OFC storefronts. These possibilities could result in the OFC hiring additional employees and taking on more supplier members. Additional opportunities generated by OFC's growth such as joint marketing and distribution could further expand the economic impact of the cooperative.

Continuing Work

The survey is currently being completed. An analysis of the responses will be prepared and submitted to the OFC's board of directors. A case study of the OFC also is currently being prepared.

Publications

No publications have been released at this time. The OFC case study was presented at the Southern Agricultural Economics Association conference in February 2011 in Corpus Christi, Texas.

Funding

The Charles B. Browning Endowment solely funded this project.

Collaborators

Dr. Rodney Holcomb, FAPC agricultural economist, was the principle investigator. Phil Kenkel, professor and Fitzwater Endowed Chair for Cooperative Studies, department of agricultural economics, was a collaborator.

FATTY ACID COMPOSITION INCLUDING CIS-9, TRANS-11 CLA OF COOKED GROUND LAMB

Objective

The objective of this project was to examine the impact of broiling, a common culinary practice for ground meat, per se on the fatty acid composition of ground lamb of two different muscles with special emphasis on conjugated linoleic acid (CLA). Meat composition and the physicochemical properties undergo significant changes during heat treatment. Fat content and fatty acid composition (FAC) are among the factors mostly affecting the final quality of meat products. Questions arise such as what happens with the content of health beneficial *cis*-9, *trans*-11 CLA–"good fat," as well as with its precursor-vaccenic acid and polyunsaturated fatty acids during different cooking procedures?

Most studies in the literature mainly described the FAC of raw meat and fewer provide information of the effect of cooking temperatures on the health-promoting fatty acids such as CLA and ω-3 polyunsaturated fatty acids. Investigation of the CLA content is of special interest with respect to lamb, considered to be the richest in CLA when compared to meat from other ruminants and meat from no-ruminants.

Approach

To achieve the objective, ground samples were prepared from trimmed and deboned stakes of m. *Longissimus lumborum*, and m. *Semimembranosus* from Suffolk x Katahdin crossbred lambs, raised on forage at the experiment station in El Reno, Oklahoma.

The patties were broiled in a conventional oven at 205°C for 6.15 minutes on each side to an internal temperature of 71°C using the FAPC facilities. Until analysis, samples were kept at -20°C. Raw and cooked patties were analyzed for proximate and fatty acid composition by the FAPC analytical services team. Data was analyzed by mixed model least squares procedure with a linear model that included fixed effects of treatment (row versus cooking) and muscle type.

The results of this study show that broiling did not cause thermal degradation of the CLA levels and that a serving portion (100 g) of cooked lamb provides over 34 mg of CLA.

The information obtained could be useful to predict the CLA content from raw to cooked products.

Benefits

From the consumer point of view, it is important to have more information about this unique fatty acid in food products. *Cis*-9, *trans*-11 CLA is of much interest due to its anti-carcinogenic, anti-diabetogenic, anti-atherogenic, and other properties. By better understanding CLA health benefits, consumers could make smart food choices.

Economic Impact

The economic impact of this study includes the awareness of the beneficial health effects of CLA. Researchers and producers search for ways to enhance accumulation of CLA in animal tissues; therefore, they can produce naturally rich products in a competitive marketplace.

Continuing Work

These results are a motivation to continue the research and evaluate Oklahoma's value-added products (dairy, organic foods, etc.), while expanding research to FAPC branded products.

Publications

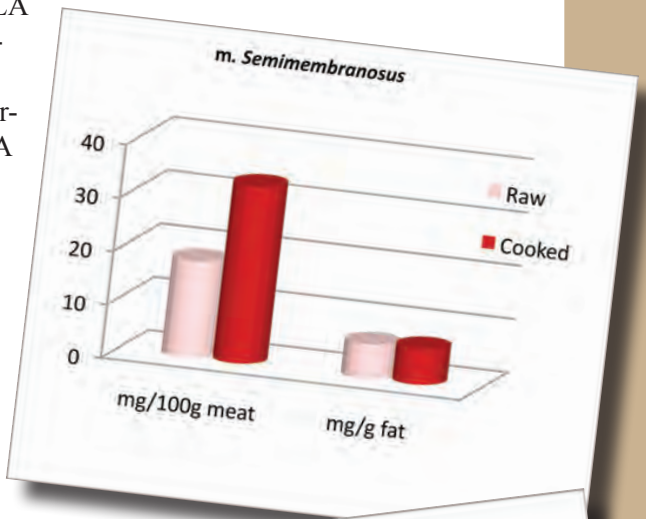
One poster presentation was given at the 2010 joint ADSA-CSAS-ASAS Meeting in Colorado on July 13, 2010.

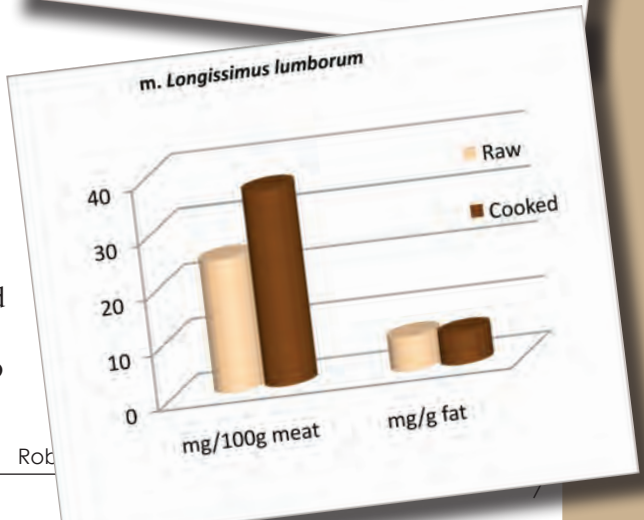
Funding

The FAPC provided funding for the analytical analysis of this project.

Collaborators

Dr. Guadalupe Davila El-Rassi, FAPC analytical services manager, was the principle investigator. Other collaborators included Dr. Veneta Banskalieva, FAPC analytical chemistry research specialist; and Dr. Michael Brown, USDA-ARS Grazinglands Research Laboratory, El Reno, Oklahoma.





VINYARD FRUIT & VEGETABLE COMPANY EXPANDS BUSINESS INTERESTS

Objective

The objective was to expand the existing business of fruit and vegetable processing to make acidified food products through an acquisition of a company located in southern Oklahoma that had been in business for 11 years.

Approach

The owners of Pepper Jo Farms, Randy and Jovita Black, decided to retire and sell their business located in Ardmore, Oklahoma. The business started by making salsa and relishes with the vegetables grown in their garden. As the business grew each year, Randy and Jovita started co-packing acidified foods for other companies. Randy and Jovita asked for assistance from the FAPC in finding a buyer who would continue co-packing for the established customer base.

Benefits

Vinyard Fruit and Vegetable Company proved to be the perfect fit to acquire the business. Pepper Jo Farms purchased most of its fruits and vegetables from Vinyard Fruit and Vegetable at the time of the decision to retire and sell the company.

At the time, Vinyard Fruit and Vegetable purchased a new warehouse and moved to the distribution center to Oklahoma City. This central location easily accommodated the equipment, package and supply items, and finished products. Many of the customers of Pepper Jo's were located in the Oklahoma City area. The new location saved customers valuable time in not having to drive to Ardmore to pickup their products. Vinyard Fruit and Vegetable hired and trained a supervisor for the manufacturing of the various products and to help clients scale up their items for production, for a nominal fee.

Vineyard Fruit and Vegetable also has the ability to purchase packaging and supply items in larger quantities benefiting the client's control over the cost of the products. All recipes are protected for the clients with a Mutual Confidentiality and Non-Disclosure Agreement.

Economic Impact

The new production room and continued growth of business in excess of 40 percent has provided four full-time positions and two part-time positions. An increase in the number of new items being produced to more than 12 in recent months also has been identified. Vinyard Fruit and Vegetable continue to work closely with the FAPC and graduates of the FAPC Basic Training program to provide co-packing opportunities for their products.

Continuing Work

Vinyard Fruit and Vegetable is currently considering the purchase of more automated filling equipment to increase production and accommodate more new clients. The company will be working with the FAPC to provide equipment options and more efficient ways to increase production.

Publications

To date there have been no publications, but an FAPC Flash has been published.

Funding

Vinyard Fruit and Vegetable Company provided funding for the acquisition of Pepper Jo Farms.

Collaborators

Collaborators included Jim Brooks, FAPC manager of business marking services and facilitator of the acquisition; Dr. Tim Bowser, FAPC food process engineer; Dr. William McGlynn, FAPC horticultural products processing specialist; Erin Johnson, FAPC business and marketing client coordinator; Andrea Graves, FAPC business planning and marketing specialist; and Chuck Willoughby, FAPC manager of business planning and marketing relations.

COMPARISON OF PROPERTIES OF WINTER WHEAT CULTIVARS AND BREEDER LINES

Objective

The objective of the project was to analyze the response of dough structure when subjected to different deformations and how the structure recovers. The study included capacity of dough to flow and recover when subjected to deformation forces (viscoelastic properties), extensibility properties, and gluten quantity of two sets of winter wheat dough samples used to predict the value of data obtained with analytical tools not presently used in routine analysis in the OSU breeder program.

Approach

The study analyzed the viscoelasticity and extensibility properties of dough from cultivars and breeders lines using three methods not commonly used in the routine evaluation of the performance of wheat cultivars. These methods have been used in cereal chemistry when sampling small numbers of dough products due to the extensive time involved, level of training of operator, and the cost of equipment. The Principal Component Analysis was applied to easily identify the similarity and differences of the wheat samples and the variables analyzed.

Benefits

Benefits of this study include better testing methods which translate to better predictions of wheat quality. Some methods describe the molecular size and interactions of gluten protein polymers. Better testing methods allow for accurate predictions of performance of wheat doughs.

Economic Impact

The economic impact of this project is the creation of ideas for improved testing methods. These methods provide data and procedures that can be refined and have potential for adapting future testing procedures. Additional benefits will come from the improvement of the information used in the selection of new wheat cultivars for Oklahoma and the winter wheat growing region.

Continuing Work

Information will be collected in multiple growing years, and maps of information will be compiled describing the overall variation of different breeder lines and cultivars for present selection and future comparisons.

Publications

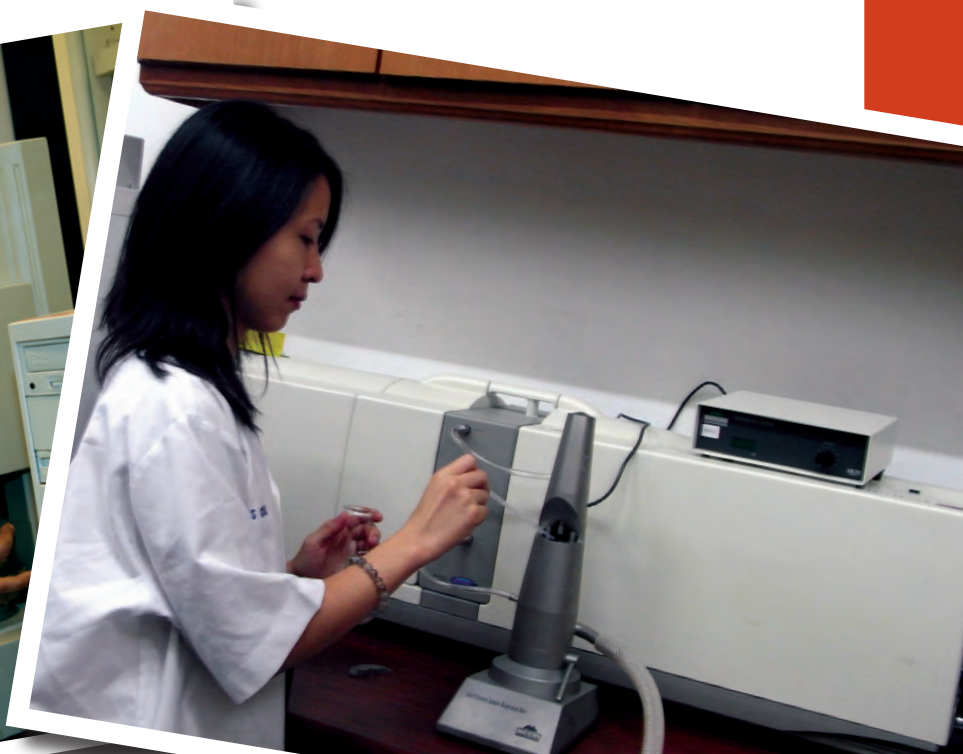
One master's thesis was published from research of this project.

Funding

Funding was provided from the Oklahoma Wheat Research Foundation and the Oklahoma Wheat Commission.

Collaborators

Dr. Patricia Rayas-Duarte, FAPC cereal chemist, was the principle investigator. Other collaborators included PauWei Yeap, FAPC food science graduate student; Dr. Brett Carver, wheat breeder; and Connie Shelton, OSU plant and soil sciences laboratory manager.



SOCIAL MEDIA TRAINING DEVELOPED TO HELP FOOD BUSINESSES

Objective

The objective of this project was to develop a half-day Social Media Training to help food companies better understand social media and how it can benefit businesses.

Approach

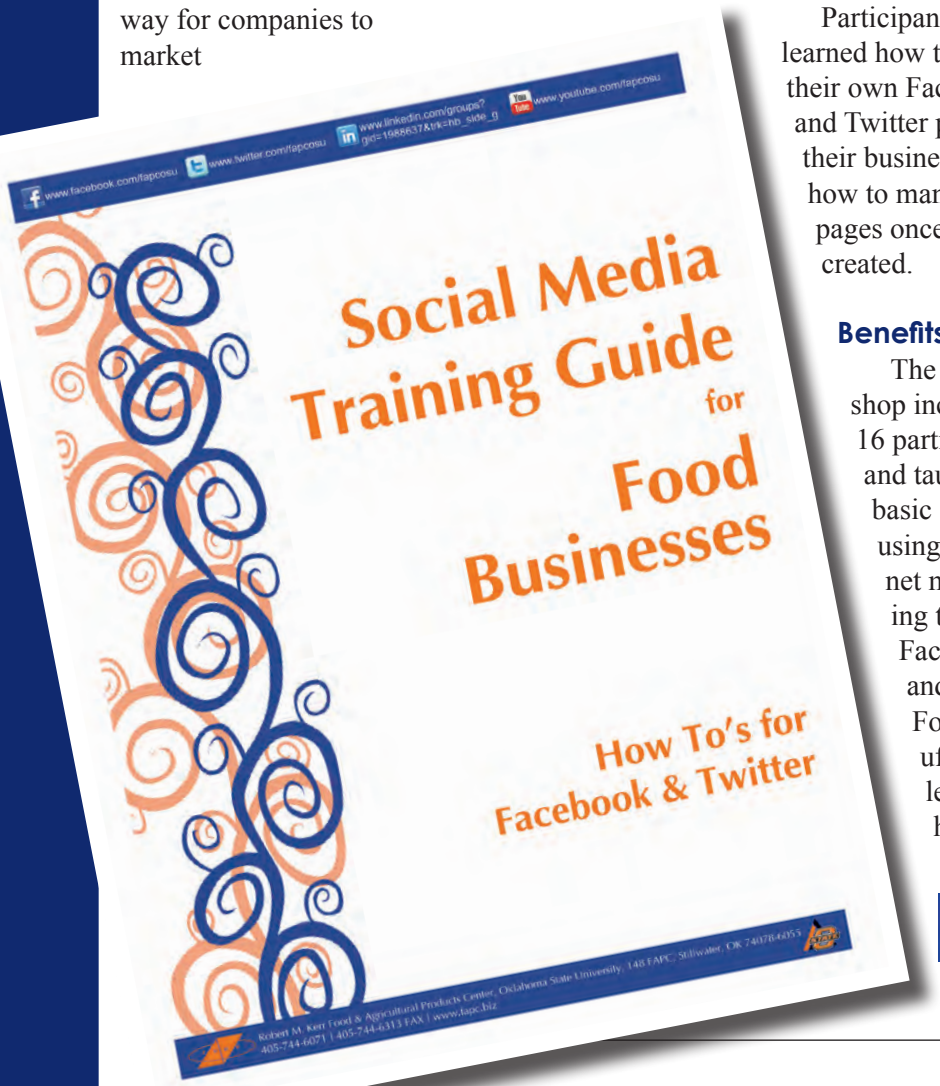
Many companies want to be involved in social media networks, but they do not know how to get started or what to do after they have joined. As a result, the FAPC held a Social Media Training on July 15, 2010. This training was designed to give step-by-step instructions and helpful information about using social media.

Using social media as a means of distribution and interaction is a useful way for companies to market themselves in addition to what they are already doing. Companies can reach new audiences through social media outlets; which in turn, can attract new customers.

Statistics from Nielsen Online show that by the end of 2008, social networking had overtaken e-mail in terms of worldwide reach. According to the study, 66.8 percent of Internet users across the globe accessed "member communities," compared to 65.1 percent for e-mail.

During the training, Bill Handy, visiting professor for OSU School of Media and Strategic Communications discussed the background of social media and why it is important for businesses.

Participants also learned how to set up their own Facebook and Twitter pages for their businesses and how to manage their pages once they are created.



Benefits

The workshop included 16 participants and taught the basic skills of using Internet marketing through Facebook and Twitter. Food manufacturers learned how they can use this growing avenue to broaden their marketing efforts.

Economic Impact

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 is helping small and start-up businesses develop a social media presence, which could result in new customers. Reaching new customers will increase sales for those businesses, which also could lead to more products and more jobs in Oklahoma.

Continuing Work

The FAPC would like to conduct this training again in 2011, as well as develop a more advanced training for those companies who are already participating in social media but still need some help continuing their efforts.

Publications

An FAPC Flash was published about the training. A Social Media Guide for Food Businesses booklet also was developed and distributed to participants of the workshop.

Funding

The participant registration fee of $50 provided funding for this project.

Collaborators

Mandy Gross, FAPC manager of communications services, and Andrea Graves, FAPC business planning and marketing specialist, were the primary investigators for this project.

SODIUM REDUCTION IN INJECTED FRESH BEEF

Objective

The objective of this project was to determine how purge was impacted when the levels of sodium chloride and sodium-based phosphates were altered in the injection brine.

Approach

Purge levels were predicted using Response Surface Modeling techniques. Typically, commercial brine formulations contain up to 3.6 percent NaCl and 4.5 percent sodium-based phosphates. Using these levels as maxima and 0 percent as minima, star points were then calculated for the brine formulation and evaluation. Star points represent the mid-point between maxima and minima values. Actual concentrations of salt and sodium-based phosphates used were reported.

In response, surface methods need at least two replications at each point and four replications at the center point. For this experiment, there were four replications at each point, and six replications at the center point. Select beef loins from carcasses aged 48 hours were injected with one of the nine possible brines. All brines contained the aforementioned amount of NaCl and Brifisol® 85 Instant.

The latter is a composite blend of sodium pyro-(di-) and polyphosphates. It is commonly used in industry because it is specially formulated to minimize streaking in raw injected beef and pork. The brines also contained one percent Herbalox seasoning HT-S. Injection was conducted in 4ºC cold room and brines were made to final temperature between 2-4ºC. After injection, the brines were sliced into steaks and placed into overwrap trays. Purge was measured after five days and a prediction equation was generated.

Benefits

The results of this study provide processors a visual of predicted fluid losses when salt and sodium-based phosphates are varied in the brine. The results also generated prediction equations for processors to utilize when calculating fluid loss. These tools give processors a picture of how the product performs when brine formulations are manipulated to lower sodium content.

Economic Impact

Loss of fluid in injected meat products is directly correlated with product performance in terms of palatability and desirability. In addition, loss of fluid also can impact final product price. These results give processors tools to predict fluid retention given formulation changes in NaCl or sodium-based phosphates. A clear understanding of what happens to the fluid (i.e. brine) injected into a meat product over time allows better estimation of processing costs.

Continuing Work

This project is completed. A final report has been submitted and is being prepared for publication.

Funding

Funding of this project was provided by the National Cattlemen's Beef Association and Proliant Meat Ingredients.

Collaborators

Dr. Christina DeWitt, FAPC food chemist, was the primary investigator on this project. Other collaborators included Brad Morgan, animal science professor; Carla Goad, statistics interim department head and professor, Xingqui Lou, director of technical department of Proliant Meat Ingredients Incorporated; Lin Koh, FAPC research specialist; Alisha Parsons, Lina Ramirez, Claudia Cerruto-Noya, Katie Hanger, Tanner Hopkins, Kacie George, David Hayden, and Austin Lowder, animal science graduate students; Shirley Mack, microbiology undergraduate student; Jordan Denton, Abbey Ankeman, and Zach Robertson, animal science undergraduate students.

FERMENTATION OF SOFT DRINK WASTE FOR ETHANOL PRODUCTION

Objective

The objective of this project was to determine the ease and efficiency of the conversion of wastes from soft drinks to ethanol.

Approach

Wastes from soft drinks contain 10 to 14 percent sugar, which is currently being disposed of at a cost to wastewater treatment facilities. The wasted carbohydrates can potentially be converted to fuel.

The goal of this project was to determine how easily waste from soft drinks could be fermented into ethanol. Important questions to be answered included:

- Will pH adjustment be necessary due to the low pH of most soda?
- Will nutrient addition be necessary?
- Are there other inhibitors present that may slow/stop the fermentation process?

The four common soft drinks chosen for the initial evaluation included Coke, Pepsi, Mountain Dew, and Sprite. In addition to being popular sodas, the selected products represented different potential inhibitors, such as varying levels of caffeine and different colorants.

A series of experiments were conducted to isolate the effects of the pH adjustment and nutrient addition. Soft drinks were fermented in 400 ml plastic containers using Superstart distiller's yeast. Varying levels of the pH adjustment were tested. The starting pH of most soft drinks is pH 2-3, which is not ideal for most yeast fermentations. Ammonium phosphate, a distiller nutrient, also was added at varying levels. Each fermentation batch was allowed to ferment for seven days then evaluated for ethanol content.

Results showed three of the four products produced nearly theoretical yields with little modification. In the presence of added nutrients, Pepsi, Coke, and Sprite produced high amounts of ethanol without pH adjustment. However, with no nutrient addition and no pH adjustment, very little ethanol was produced. The amount of ammonium phosphate required for complete fermentation was between 0.2 and 0.4 mg/ml.

In order to achieve high ethanol yields, Mountain Dew required pH adjustment in addition to nutrient addition. Further experimentation revealed that the preservative sodium benzoate was inhibiting the fermentation process. Sodium benzoate is not present in the other three sodas tested, but the inhibition could be counteracted with a pH adjustment.

The study has shown that with some minor additions, fermentation of soft drink waste is possible with high ethanol yields.

Benefits

The benefits of this project represent an opportunity for any bottling plant to reclaim value and reduce waste. Bottling plants generate a significant amount of liquid waste as a result of problems on the production line, improper packaging issues, or products that becomes outdated. The waste is typically sent to a municipal wastewater treatment plant for disposal. The waste soda contains carbohydrates, which have potential value if converted to a fuel.

Economic Impact

This project represents an opportunity to turn a waste stream into a valuable product for the processor, ultimately turning a liability into an asset. Waste disposal costs would be reduced with a new product created. Soft drink bottling facilities around the country, including the Pepsi bottling plant in Tulsa, Oklahoma, can potentially benefit from this work.

Continuing Work

The future work of this project will include an evaluation of numerous other soft drink products to see how easily their sugars can be fermented to ethanol. Also, a fermentation rate study will be conducted to determine the speed of the fermentation process. Various parameters, such as yeast inoculation level, will be evaluated to determine their effect on fermentation rate.

Publications

One undergraduate poster was completed for a poster competition at the annual ASABE Annual Meeting in 2010.

Funding

The FAPC provided funding for this project.

Collaborators

Dr. Danielle Bellmer, FAPC food processing engineer, was the principle investigator on this project. Other collaborators included Hasan Atiyeh, assistant professor of biosystems engineering; Flint Holbrook, biosystems engineering undergraduate student; and Jonathan Lim, biosystems engineering undergraduate student.

EVALUATION OF ANTIMICROBIAL INTERVENTIONS AGAINST E. COLI O157:H7

Objective

The objective of this project was to examine the efficacy of antimicrobials against *E. coli* O157:H7 (at manufacturer's recommended concentration) delivered by an automated spray delivery system built into the housing of a Ross Industry blade tenderizer.

Intact whole muscle meat cuts (i.e., steaks) are generally considered internally-sterile. However, USDA-FSIS has a concern for blade-tenderized beef that could possibly drag surface pathogens (*E. coli* O157:H7) into the interior of the beef that may not get killed if steaks derived from them are cooked and consumed as rare or medium rare. These kinds of tenderized beef products are considered "non-intact," and require a pathogen-reducing intervention to be applied.

Approach

Lean beef discs inoculated with a 4-strain cocktail of *E. coli* O157:H7 were used. The inoculated beef discs were placed on the conveyor belt of a commercial blade tenderizer. The discs were sprayed with the same pressure and delivery system used to sanitize the surface of beef suprimals prior to blade tenderization. Inoculated discs recovered from spray treatments were placed in sampling bags and mixed with plating diluent immediately (within 1 hour), after 1 day, 7 days, and 14 days. The results of these inoculated spray trials with lean discs are currently be used to evaluate the best-performing antimicrobial interventions by direct spray treatment of inoculated beef subprimals (10-12 pounds) that are subjected to blade tenderization. Internal beef cores are being recovered from the blade-tenderized inoculated subprimals to determine if antimicrobial interventions reduce the incidence of internal translocation of *E. coli* O157:H7 that may be on the surface of the beef pieces.

Benefits

The successful completion of the project should provide a method of reducing the risk of internalizing surface cells of the pathogen, *E. coli* O157:H7, that may exist on the surface of beef subprimals undergoing blade tenderization. By applying interventions that reduce the presence of pathogens that may be on the surface of meat, the risk of internalized for possible consumption by consumers can be reduced.

Economic Impact

This study anticipates reducing the risk of beef processors who use similar methods to tenderize beef subprimals consumed as steaks. Oklahoma has suffered the negative impact a recall of beef distributed from an Oklahoma processor associated with an outbreak of *E. coli* O157:H7 and attributed to the pathogen being internalized during blade tenderization.

Continuing Work

At this point, 14 antimicrobials that range in reduction of *E. coli* O157:H7 from 3-4 log reduction down to 0.2 log reduction have been evaluated. Initial focus has been on the best performing antimicrobials from the first phase to determine if they work as implied during actual tenderization trials using inoculated beef subprimals.

Funding

Approximately 10 different chemical suppliers of antimicrobial interventions funded this project. Ross Industries also has provided long-term use of automated blade tenderizer and spray system.

Collaborators

Dr. Peter Muriana, FAPC food microbiologist, and Dr. Brad Morgan, professor of animal science, served as the principle investigators on this project. Other collaborators included Jackie Eager, animal science graduate student; Brent Wellings, animal science graduate student; Jake Nelson, FAPC value-added meat processing specialist; Kalpana Kushwaha, FAPC post doc of food microbiology; and several graduate students of the food microbiology laboratory.

HEALTH-PROMOTING PROPERTIES OF BLACKBERRY WINES

Objective

The objective of this project was to investigate two commercial blackberry cultivars, Apache and Ouachita, commonly grown in the Midwest in order to evaluate the quality and antioxidant capacity of the berries, and also of juices and wines made from these cultivars.

Approach

Specific chemical properties of the berries, juices, and wines made from Ouachita and Apache berries were evaluated for total phenolic and total anthocyanin contents. These antioxidant compounds profoundly influence the flavor and color of both the fruit and the wines. Additionally, they affect the storage stability of the finished wines. Oxygen Radical Absorbance Capacity (ORAC) assays were conducted to measure the fruit and the wine's antioxidant activity. Qualitative tests such as pH, titratable acidity, and percent soluble solids were conducted to measure basic berry and wine quality. Sensory tests also were performed on whole berries to evaluate subjective impressions of quality.

Results showed that blackberries with higher in titratable acidity, pH, and soluble solids were more preferred for blackberry flavor. No consistent differences were seen between cultivars in quality or antioxidant capacity. However, there was an observation of a consistent decrease in antioxidant activity going from whole berries to juice to wine. Both cultivars were found suitable for wine production and the wine-processing technique did not significantly affect the antioxidant capacity of blackberry wines.

Benefits

A large amount of research has been conducted on the health benefits of grapes and grape products. Research has demonstrated the health-promoting properties of blackberries as well. However, little research has been done on blackberries that are suited to being grown in a Midwestern climate. More information on optimal production and processing techniques for blackberries in this region will serve to boost the production and consumption of value-added blackberry products. This will expand the blackberry market for small-scale growers and processors in the region. It also will benefit consumers, who will have a wider range of health-promoting blackberry products available to them.

Economic Impact

There is a large amount of interest from regional small-scale wineries and other processors in producing value-added blackberry products. However, knowledge and experience with respect to which cultivars are best suited for production and best processing practices are lacking. With this knowledge in hand, the regional market for value-added blackberry products could be significantly expanded, thus creating new products, increased sales, and expanded employment.

Continuing Work

The initial stages of the project are complete. Ongoing research will evaluate winemaking techniques to maximize the quality and health-beneficial properties of blackberry wines. Continuing efforts include attempting to identify and quantify the relative contributions of antioxidant compounds to overall antioxidant capacity in blackberries and blackberry products.

Publications

One master's thesis was published from the research of this project.

Funding

Funding was provided by the North American Bramble Growers Research Foundation and the FAPC.

Collaborators

Dr. William McGlynn, FAPC horticultural products processing specialist, was the primary investigator on this project. Other collaborators included Youri Joh, food science graduate student; Richelle Stafne, FAPC horticultural processing research specialist; Eric Stafne, assistant professor of horticulture and landscape architecture; Terry Toomy, owner of Toomey's Thornless Blackberry Farm in Broken Arrow, Oklahoma; Sue Gray, Extension educator of the OSU Cooperative Extension Service in Tulsa County; Kendra Woodburn, research specialist at the University of Arkansas Fruit Research Station in Clarksville, Arkansas; John Ridgeway, research specialist at the University of Arkansas Fruit Research Station in Clarksville, Arkansas; Darren Scott, FAPC food scientist and sensory specialist; and Yannis Oikonomakos, food science graduate student.

MEAT INDUSTRY EDUCATIONAL PROGRAMS: OK BEEF QUALITY SUMMIT AND PORK 101

Objective

The objective of this project was to introduce and highlight the complexity of the industries. The beef industry is very segmented, with sectors ranging from cow/calf producers to culinary professionals, and really the final consumer. Additionally, this project provided a venue for individuals from various sectors to meet and discuss what they do and learn how their operations impact others downstream. Furthermore, this project reemphasizes the criteria identified in the Beef and Pork Quality Assurance Programs, and taught attendees why these criteria are important to their respective industries.

Approach

Sponsored by the Oklahoma Beef Council with beef checkoff dollars, the Oklahoma Beef Quality Summit (BQS) was held at Oklahoma State University with most of the activities stationed at the FAPC. The BQS is a three-day program held routinely. The Pork 101 is a three-day, hands-on experience designed to update participants on quality and consistency issues in the pork industry. OSU hosted the Pork 101 program in cooperation with the American Meat Science Association and the National Pork Board.

Both programs provided the targeted audiences (producers, retailers, food service professionals, and packers) with the hands-on information they need to improve and maintain high standards of beef and pork quality. The core deliverables of both programs include up-to-date information about the practices of live animal production, evaluating live animals for value and quality, understanding and assigning USDA yield and quality grades to carcasses, understanding and performing carcass evaluation and fabrication, understanding the addition of value through beef and pork product processing, and reviews of current trends in the industries.

OSU has hosted the BQS continuously each year since its inception in 1999, and also has hosted the Pork 101 since its inception.

Benefits

The benefits of this project are rooted in the principles of continuous improvement of consumers and the industry. Through analyzing and interpreting continuous industry assessments, the industry can continue to improve production and processing techniques to deliver the best possible product to the customer and consumer.

Economic Impact

Potential economic impacts include an increased dollar value of live animals due to implementation of quality assurance programs presented to audience; increased dollar value of carcasses due to the increased understanding of USDA grades standards; increased carcass cut-out values due to the introduction of innovative processing techniques and put in place by the industry; and increased returns on sales of products due to a fuller understanding of value-added processing principles and key applications.

Continuing Work

The FAPC will continue to host these programs until the need is no longer realized. OSU personnel continue to serve on planning committees for each of the respective programs.

Publications

Numerous press releases were distributed following this project, including features in trade publications.

Funding

Sponsorships from the Oklahoma Beef Council, the American Meat Science Association, and the National Pork Board funds this project.

Collaborators

Jake Nelson, FAPC meat processing specialist, was the primary investigator on this project. Other collaborators included Kyle Flynn, FAPC meat pilot plant manager; J.D. Hathcock, FAPC assistant meat pilot plant manager; Karen Smith, FAPC conference coordinator; Dr. Brad Morgan, animal science professor; Dr. Deb VanOverbeke, animal science assistant professor; Dr. Gretchen Hilton, animal science assistant professor; Dr. Bob Kropp, animal science professor; Dr. Derrell Peel, agricultural economics professor and Extension livestock marketing specialist; and Heather Buckmaster-Schulte, executive director of the Oklahoma Beef Council.

SOUTHERN PLAINS AG RESOURCES COALITION STONE GROUND WHOLE WHEAT

Objective

Through the attainment of a stone flour mill, the Southern Plains Agricultural Resources Coalition (SPARC), with the Great Plains Resource Conservation and Development Council are supporting the conservation efforts of Oklahoma no-till wheat farmers.

The objective was to create a premium-priced market for the produced stone ground whole grain flour, made from "identity-preserved" wheat, with information provided on the flour bag to track back to the Oklahoma farmer who grew the wheat for the flour. This market allows Oklahoma no-till wheat farmers to sell their wheat directly to the mill, obtaining mill price per bushel for the wheat, instead of a lower elevator price. The produced whole grain flour qualifies for the Oklahoma Farm-to-School program. Additionally, Oklahoma bakeries have a desire to market a complete Made-In-Oklahoma product.

Approach

Milling and baking specialist at the FAPC worked with Larry Wright, Great Plains Resource Conservation and Development Council coordinator, Loren Liebscher, owner of the Stone Stack Mill at P Bar Farms in Weatherford, Oklahoma, and no-till wheat farmers supporting this effort on a variety of aspects relating to whole grain flour production. This group discussed wheat storage for whole grain flour production and how farm audit sheets allow a record trail for the farmer to prove the identity of his product. Further discussion included the aspects of flour quality and safety testing, and the value of a quality flour milling program. The FAPC has baked bread from the flour produced and aided in label design assistance.

Benefits

A "feel-good" benefit from this project has been introduced to school-age kids as the basics of whole grain flour. Liebscher provided educational tours of his farm to school kids from all over Oklahoma. During the tour, kids see flour milling and a demonstration of how bread is made. At the end, the kids are given whole grain bread made from the flour produced at the Stone Stack Mill.

Economic Impact

Economic impacts are a chain reaction. Increased revenue for the no-till wheat farmers involved as they obtain a higher price per bushel for their wheat than what is obtained at the elevator; the more traditional means of selling wheat and more income for wheat farmers provides more income for the towns and areas where farmers work and do business. As the milling operation at Stone Stack Mill increases, P Bar Farms will need to hire additional assistance.

Continuing Work

The project is relatively new and on-going. More work is planned with the marketing of the flour and flour products. Additional work includes on-farm audits to support the identity-preserved program.

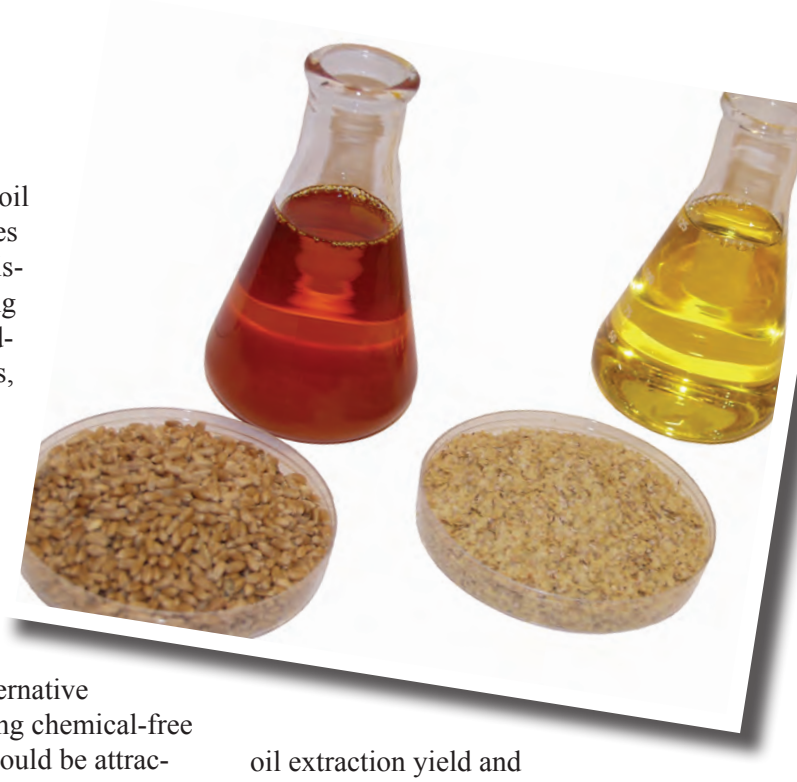
Publications

One FAPC Flash was written for this project.

Collaborators

Renée Albers-Nelson, FAPC milling and baking specialist, was the principle investigator. Collaborators included Chuck Willoughby, FAPC business planning and marketing relations manager; Jason Young, FAPC quality management specialist; and Kevin Shelton, OSU entomology and plant pathology coordinator.

AQUEOUS AND ENZYMATIC EXTRACTION OF WHEAT GERM OIL



Objective

The objective of this study was to investigate the efficiency of aqueous and enzymatic extraction of oil from wheat germ (WG).

Approach

Four enzymes (Viscozyme L, Multifect CX 13L, Multifect CX GC, and Alcalase 2.4L FG) were screened for their efficacies to extract oil from WG. Alcalase 2.4L FG, higher oil yield than the other enzymes, was chosen for optimization of the enzymatic oil extraction process by using Response Surface Methodology (RSM). Three processing parameters of liquid to solid ratio, extraction time, and enzyme concentration were investigated as the independent variables. The aqueous extraction of WG at pH 8 was examined as a control resulted in comparable oil yield to that obtained with Alcalase 2.4L. Hence, using the two independent variables of liquid to solid ratio and extraction time also optimized aqueous WG extraction. The model developed for the aqueous extraction had a high correlation coefficient. The highest oil yield of 73 percent was obtained at liquid to solid ratio of 20:1 and extraction time of 0.5 hour. The highest enzymatic oil extraction yield was achieved when wheat germ was treated with Alcalase 2.4L FG using Tris-HCl buffer at pH 8. This study demonstrated that aqueous extraction of WG was more effective in oil recovery than enzymatic extraction under the conditions examined in this study.

Benefits

Wheat germ oil, a specialty product, is one of the richest natural sources of Vitamin E, which provides a number of health benefits to human. Conventional oil extraction techniques have a number of disadvantages including utilization of hazardous organic solvents, and low efficiency of mechanical oil pressing. Aqueous and enzymatic extraction techniques utilize water as solvent and can be an environmentally benign alternative technology producing chemical-free final products that could be attractive to health conscious consumers. Furthermore, aqueous and enzymatic extraction of wheat germ result in simultaneous recovery of both oil and protein with high nutritional value.

Economic Impact

Wheat milling industry by-products represent about 25 percent of the original grain and are of considerable economic significance to the miller. Although wheat germ and bran present a great potential for development of high value products such as nutraceuticals, they have not yet been exploited to their full capacity. Considering that wheat is the largest crop grown in Oklahoma, process development for value-added product manufacturing from wheat milling industry by-products may lead to establishment of a new manufacturing sector creating jobs and benefiting farmers, consumers, and residents in the state.

Continuing Work

Further research should be conducted to refine experimental range within which a model can satisfactorily explain the relationship between oil extraction yield and the processing parameters, and thus maximizing the oil extraction. Since the non-enzymatic process at pH 8.0 can produce an oil yield as high as 70 percent, an extraction process involving a non-enzymatic process followed by an enzymatic treatment should be considered with the objective of achieving higher oil yields. Mixtures of protease and cellulase also should be examined for their combined efficiency to recover oil from WG.

Publications

One master's thesis was published and two presentations were given as a result of this study.

Funding

This project was funded by Hatch Funding.

Collaborators

Dr. Nurhan Dunford, FAPC oil/oilseed specialist, was the primary investigator on this project. Other collaborators included Meizhen Xie, food science graduate student; and Dr. Carla Goad, OSU department of statistics.

OKLAHOMA NATIONAL GUARD TRAINING: HARVESTING SAFETY TECHNIQUES

Objective

The objective of this project was to expose and teach members of the Oklahoma National Guard goat harvesting techniques, harvesting safety techniques, and food safety. The lessons taught through this project trained participants to assist the people of Afghanistan with agriculture.

Approach

Participants of the class met at the FAPC. Five of the students in the training were selected to perform and demonstrate to the class. The student demonstrators were dressed in proper safety equipment and briefed on the safety of knife handling. On the harvest floor, the animal was rendered unconscious using humane handling techniques. Students then skinned the animal and were showed proper evisceration techniques. The class discussion concluded on food safety and the potential conditions of an absence of running water and electricity in Afghanistan.

Benefits

This project trained individuals who work with the people and resources in Afghanistan while exposing them to the FAPC and services offered on-site.

Economic Impact

The economic impact will be a direct impact for the Afghan people.

Collaborators

Kyle Flynn, FAPC meat pilot plant manager, was the principle investigator for this project. Other collaborators included Dr. David Henneberry, assistant dean for international agricultural programs; and J.D. Hathcock, FAPC assistant meat pilot plant manager.

FACTORS DETERMINING THE VISCOSITY OF A HOT FUDGE SAUCE AT ROOM TEMPERATURE

Objective

The objective of the project was to assist the client in producing a hot fudge sauce that maintained a smooth, creamy texture throughout its shelf life at room temperature. The product could then be used for test marketing purposed to gauge potential consumer interest in the sauce.

Approach

After an initial meeting to determine the needed volume of the product, necessary equipment, and personnel, the FAPC worked with the client to manufacture test batches of the hot fudge sauce. The pilot plant batches were manufactured to specifications that were provided by the client, along with modifications recommended by the FAPC.

Several test batches of product were manufactured and monitored to determine the factors that influenced the viscosity of the fudge sauce. Additionally, the factors that influenced the stability of the sauce at room temperature also were determined. It was discovered that the temperature, along with the order of ingredient addition, played an important role in determining the final viscosity of the sauce. Failure to take these into consideration caused the sauce to have a texture that was either gritty and sandy, or thin and runny. Additionally, the water activity of the product was determined to influence both the viscosity of the finished product, as well as shelf life.

After modifying the sauce formulation, the FAPC was then able to assist the client in manufacturing a product that maintained the desired viscosity throughout shelf life while being stored at room temperature.

Benefits

Consumers will benefit from an additional food choice on the market that maintains a desirable viscosity throughout shelf life at room temperature.

Economic Impact

The client can now manufacture a fudge sauce that matches its competitors of viscosity and shelf life. Additionally, consumer expectations for the category of product will be satisfied.

Collaborators

Darren Scott, FAPC food scientist, served as the principle investigator for this project. Dave Moe, former FAPC pilot plant manager (retired), was a collaborator.

FOOD DEFENSE WORKSHOP PROVIDES TRAINING TO FOOD PROCESSING FACILITIES

Objective

The objective of this project was to provide food defense awareness and training to food processing facilities.

Approach

In 2002, the Bioterrorism Act was passed requiring federal agencies to develop a crisis communications and education strategy regarding bioterrorist threats to the food supply. The strategy was to address threat assessments, technologies and procedures for securing food processing and manufacturing facilities and modes of transportation, response and notification procedures, and risk communications to the public.

Shortly after, the Food Safety and Sanitation Audit criteria and Quality System Audit developed those schemes to meet the Global Food Safety Initiative (GFSI) implemented criteria for food defense planning and implementation. This new criteria required the food processing industry to find training for employees and understand the responsibilities of designing food defense programs.

The FAPC was contacted on several occasions by representatives of the Oklahoma food industry to help identify proper food defense training for personnel. One processor, BAMA Companies, specifically requested that the FAPC provide a food defense workshop for the food industry of Oklahoma.

Benefits

Benefits of this project include assistance with reducing the risk of an intentional attack on the food supply that could potentially harm consumers by causing severe sickness or even death.

Economic Impact

The Centers for Disease Control and Prevention reports three types of economic effects that may be generated by an act of food terrorism:

1. Direct economic losses attributable to the costs of responding to the act.
2. Indirect multiplier effects from compensation paid to affected producers and the losses suffered by affiliated industries, such as suppliers, transporters, distributors, and restaurant chains.
3. International costs in the form of trade embargoes imposed by trading partners.

Continuing Work

The FAPC plans to establish an annual Food Defense Workshop.

Publications

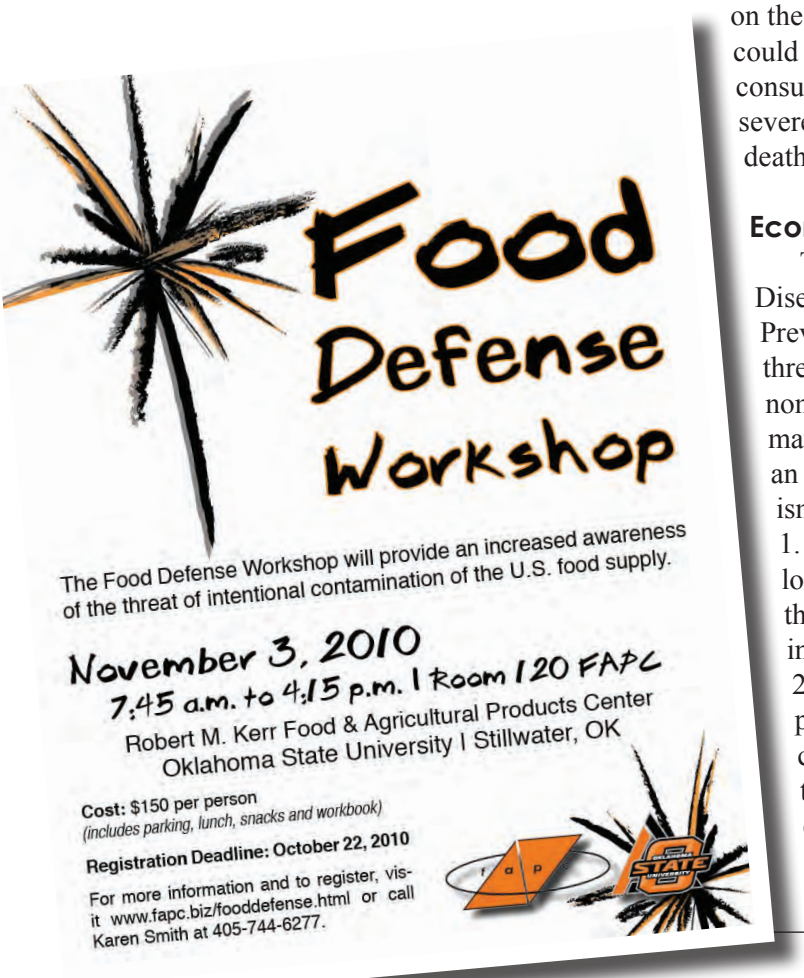
An informational workshop binder and CD with support material and presentations were given as a result of this project.

Funding

The participant registration fee of $150 provided funding for this project.

Collaborators

Jason Young, FAPC quality management specialist, was the principle investigator on this project. Other collaborators included Andrea Graves, FAPC business planning and marketing specialist; David Arvelo, small business representative for the Food and Drug Administration southwest regional office; Maria Velasco, public affairs specialist of the Food and Drug Administration Dallas district office; Dr. Kevin Ehlers, front-line supervisor of the Food Safety Inspection Service Springdale district; Dr. Michael Haworth, enforcement analysis investigative officer for the Food Safety Inspection Service Springdale district; Glenn Moore, protective security advisor for the United States Department of Homeland Security Oklahoma district; and Tressa Madden, director of consumer protection division for the Oklahoma State Department of Health.



IMPACT ASSESSMENT AND UTILIZATION OF EASTERN REDCEDAR IN OKLAHOMA

Objective

The objective of this project was to determine the impact assessment of Eastern redcedar utilization.

Approach

This study examined the adverse ecological and economical impacts of Eastern redcedar and proposed the sustainable development of value-added panels products from such underutilized species. Additionally, the study examined what economical sectors were mostly influenced in addition to manufacturing experimental value-added panels from Eastern redcedar in Oklahoma. It is a well-known fact that Eastern redcedar is a significant problem to farmers and ranchers who often lose crop and pasture land to this species. Having volatile oil in its wood anatomy, which increases the fire risk when the complications from weather conditions combined, such as wind and drought. The invasion of highly tolerant and competent redcedar has displaced many native species, which are less competitive but ecologically significant. All problems related to such invasion resulted in millions of dollars lost in lease hunting in Oklahoma. Furthermore, the value-added panels from Eastern redcedar would be considered one of the alternatives in addition to oil manufacture from wood to solve this problem. However, capital for production of either interior or exterior panels by small manufacturers is one of the major barriers for the action.

Benefits

Potential benefit of this project provide an alternative way to solve Eastern redcedar invasion converting such underutilized species in the form of value-added products.

Economic Impact

Potential impact of producing value-added panels, oil, or pallet fuel from Eastern redcedar will create an important impact when the ecological affect of invasion of redcedar results in millions of dollars. Manufacturing of such value-added products will not only bring a substantial income to the state in the form of new job opening, but also solve an important problem at certain extend.

Continuing Work

Natural Resources Conservation Service (NRCS) has been developing inventory of Eastern redcedar in different counties in Oklahoma. The data combined with the findings of this study provides solid information regarding how much Eastern redcedar exist in Oklahoma can be determined.

Publications

One Ph.D. dissertation was published from research on this project.

Funding

McIntire Stennis and the FAPC provided funding for this project.

Collaborators

Dr. Salim Hiziroglu, FAPC value-added wood products, was the primary investigator of this project. Dr. Difei Zhang, assistant professor of natural resource ecology and management, was a collaborator.

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