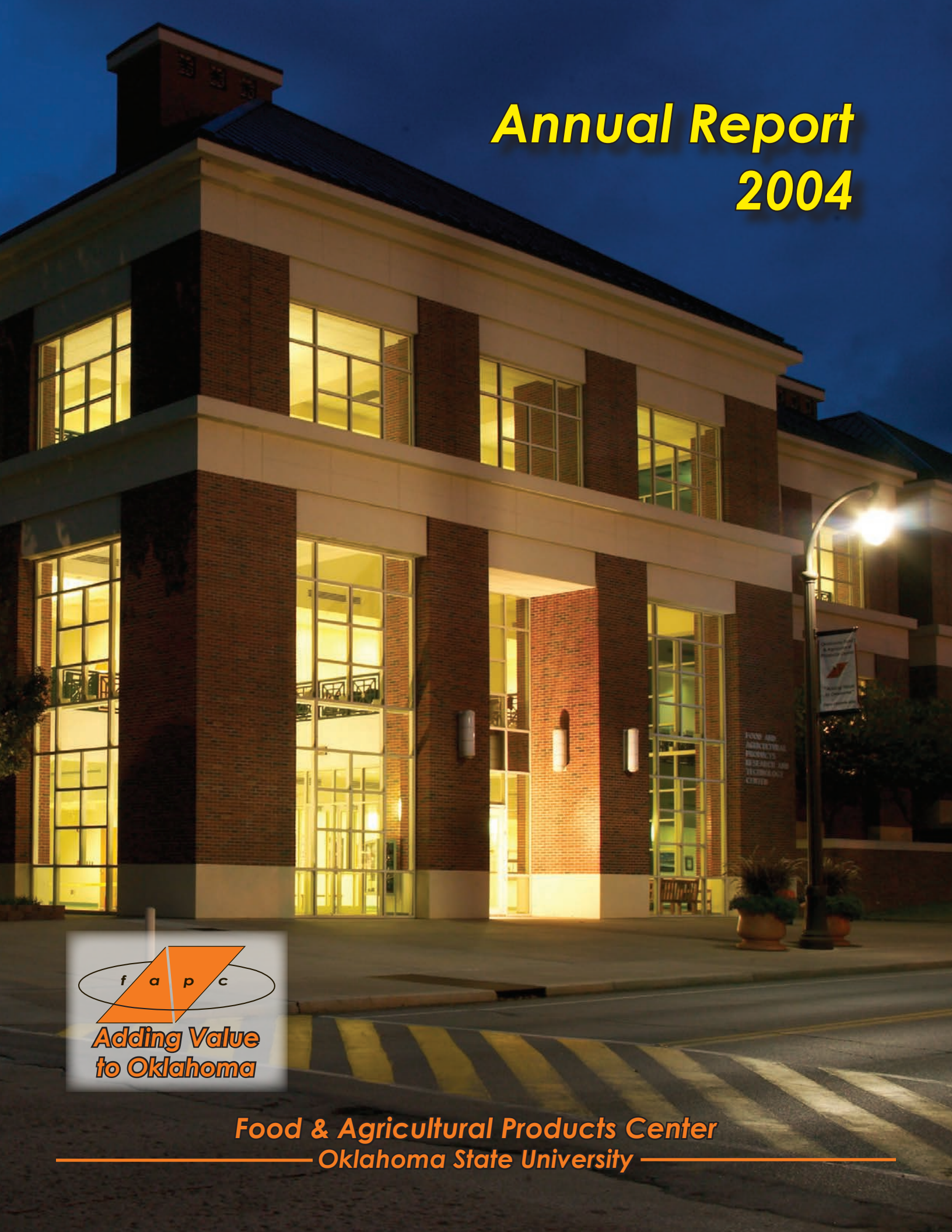

# Annual Report 2004

f a p c

Adding Value to Oklahoma

Food & Agricultural Products Center

Oklahoma State University

# Annual Report 2004
# Food & Agricultural Products Center

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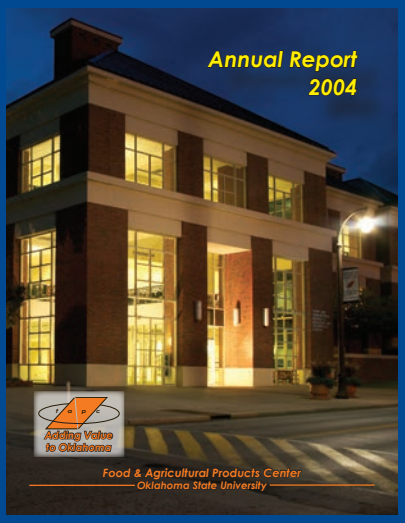


## About the cover...

The FAPC is a state-of-the-art research and development, business development, and business and technology outreach laboratory. The 96,000-square foot facility houses faculty and professional staff who foster growth of value-added food and agricultural products processing in Oklahoma.

**Front and back cover designs by Mandy Gross**
**Front and back cover photos by Todd Johnson**




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# A Message to Our STAKEHOLDERS

The Oklahoma Food & Agricultural Products Research & Technology Center is a food and agricultural industry focused applied research, product development, and technical assistance resource. This 96,000-square foot stand-alone building has animal harvest facilities; a food manufacturing pilot plant; a food sensory profiling laboratory; conference facilities; and applied research, food microbiology, and food analytical laboratories.

In 2004, the FAPC was active in more than 125 client projects, approximately 25 major grant and contract research projects, and more than 20 small contract research projects. The FAPC has assisted in the start up of more than 10 entrepreneurial businesses and has offered more than 25 business, marketing, food safety, and technical training programs and symposia in 2004.

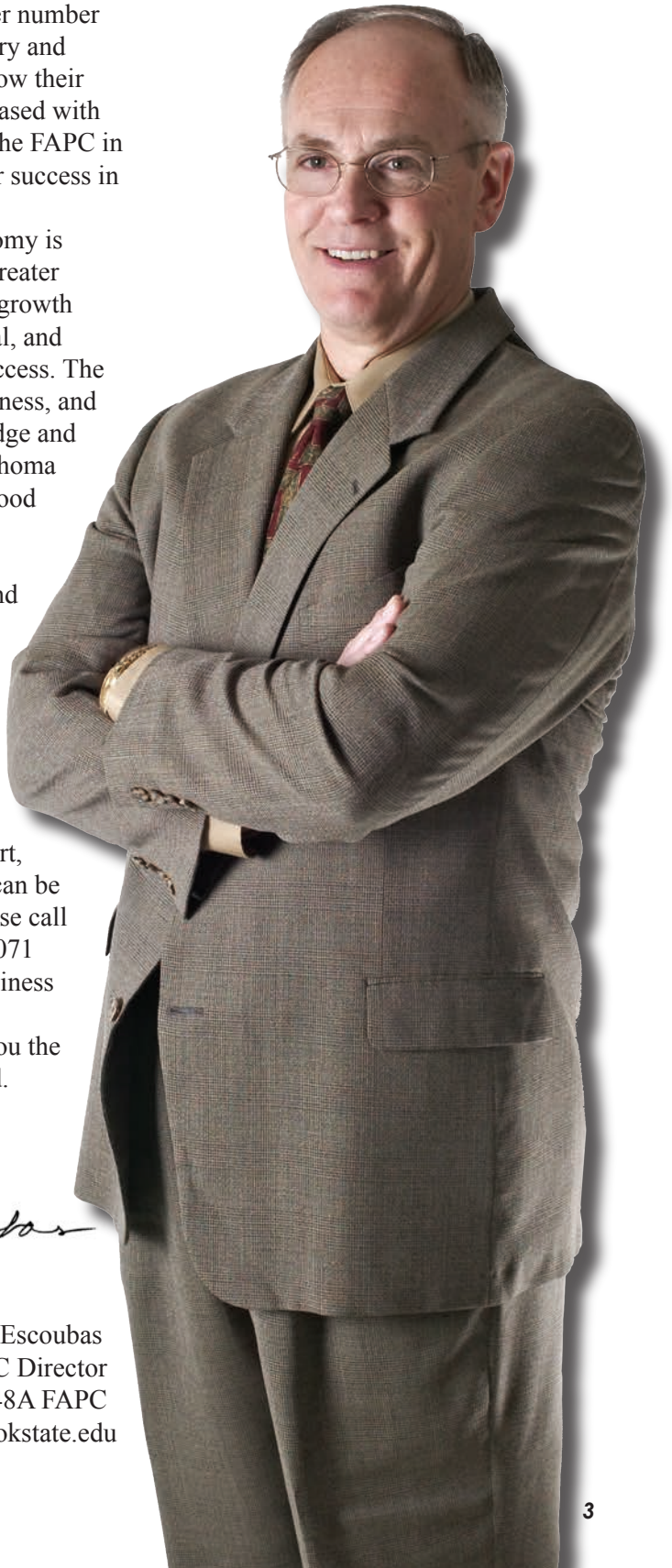
The FAPC successfully operated in 2004 with nine faculty members, nine professional staff, seven technical staff, and two full-time clerical staff and made significant value-added product and processing contributions in horticultural products, small grain products, forest products, oilseed products, and meat products.

Furthermore, significant food industry and agribusiness support was given in process engineering, agricultural economics, business planning and market development, food manufacturing, food sensory technology, food harvest and processing technology, and quality manufacturing.

Even though the FAPC was very active in 2004, there is remaining capacity to assist a greater number of Oklahoma food industry and agribusiness clients to grow their businesses. I am very pleased with the accomplishments of the FAPC in 2004, but I expect greater success in this next year.

The Oklahoma economy is expanding, and there is greater opportunity for business growth in local, regional, national, and international business success. The FAPC has technical, business, and communications knowledge and experience to assist Oklahoma clients in essentially all food and agricultural products and all areas of business, marketing, economics, and communications.

Please peruse this 2004 Annual Report and identify for yourself the success and capability of the FAPC. As you read through the Annual Report, consider how the FAPC can be of assistance to you. Please call the FAPC at (405) 744-6071 and ask to speak to a Business Planning and Marketing Specialist who will get you the specific support you need.



Dr. J. Roy Escoubas
FAPC Director
148A FAPC
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## 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

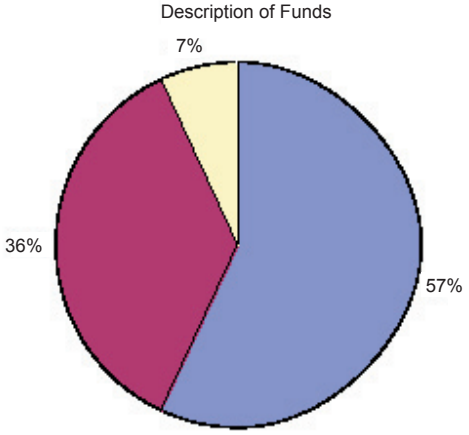
*The Oklahoma Food and Agricultural Products Research and Technology Center has programs, projects, and activities that support innovation and growth of the food and agricultural business sectors of Oklahoma, increases food safety for consumers, assists in the development of students for careers in the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

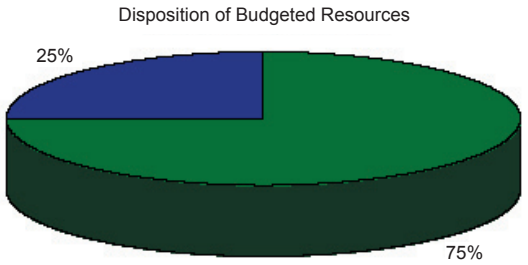
## Mission

*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.*

# 2004 Financial Highlights

| | |
|---|---|
| **Total Working Funds, 2004** | $2,695,582 |
| State Sourced[1] | $2,411,262 |
| Fee-Based Sourced[2] | $ 284,320 |
| **Total State Funds[3], 2004** | $2,411,262 |
| Research Funds, State of Oklahoma | $1,687,953 |
| Outreach Funds, State of Oklahoma | $ 723,309 |
| **Total Fee-Based Funds, 2004** | $ 284,320 |
| Conference Income | $ 28,640 |
| Small Project Product Development Income[4] | $ 130,600 |
| Pilot Plant Processing Income | $ 125,080 |
| **Grants and Contract Research Funding[5], 2004** | $1,520,000 |
| **Total Available 2004 Funds** | $4,215,582 |
| State Sourced Funds | $2,411,262 |
| Fee-Based Funds | $ 284,320 |
| Grants and Contract Research Funds | $1,520,000 |
| **Total Available 2004 Funds** | $4,215,582 |
| **Total Expense of Operating** | $4,173,955 |
| **Net Fund End-of-Year Balance** | $ 41,627 |
| **Description of Funds** | |
| State Funds | 57% |
| Grant and Contract Research | 36% |
| Fee-Based Funds | 7% |
| **Description of Funded Activities** | |
| Research and Product Development Activities | 70% |
| Outreach Activities | 30% |
| **Disposition of Budgeted Resources** | |
| Faculty and Staff Salaries and Benefits | 75% |
| Maintenance and Operational Funds | 25% |
| **Description of Fee-Based Funds** | |
| Conferences and Training Programs | 10% |
| Pilot Plant Processing Programs | 44% |
| Small Applied Research and Product Development Projects | 46% |




*Notes:*

1. *The state-sourced funds are from State of Oklahoma appropriated sources.*
2. *The fee-based funds are from fees and services to the private sector.*
3. *Research and outreach channels are the route through which state funds are received at the FAPC and arrive from the Oklahoma Agricultural Experiment Station (research) and the Oklahoma Cooperative Extension Service (outreach).*
4. *Small project product development income is from private sources and must be less that $5,000 for each project.*
5. *Grant and contract funds are from state, federal, and private competitive fund sources, are granted for specific work, and do not enter into the day-to-day operational costs of the FAPC.*

# Keeping the PRODUCTS, JOBS, and MONEY in Oklahoma

The purpose of the FAPC is to help develop successful value-added enterprises in Oklahoma–keeping the products, jobs, and money in Oklahoma. A study recently conducted by the FAPC and OSU's Department of Agricultural Economics assessed the impact of the center on the State of Oklahoma. The specific objectives of the study were to determine the economic impact of all the firms assisted by the FAPC and to determine the economic impact of services offered by the FAPC.


Of the firms surveyed, there was a 12 percent increase in full-time employment, a 32 percent increase in payroll, and a 144 percent increase in total sales. Direct, indirect, and induced effects of the firms were also estimated. Direct effects are the changes in economic activity that results from the production or processing of a product. Furthermore, indirect effects are the result of increased business spending by the basic sector, and induced effects are the increase in household spending due to an increase in income. The direct employment totaled 8,385, and the total related employment was 21,960. The total direct sales equaled $544,915,000, and the total related sales was $2,129,654,871.

The research also included case studies, which provided useful qualitative data about the services provided by the FAPC. Some of the responses by the firms included:

- Potentially increased revenues through the better business and tax structuring.
- Potentially saved the firm money, decided not to expand from current market.
- Grateful that Oklahoma can provide these services at a minimal cost to value-added firms.
- Probably would not have started the firm without the assistance of the center.
- Provided helpful information through every phase of starting the firm.
- Appreciated that the center's staff stayed in contact through the entire process.
- Potentially made production more efficient.
- Useful to compare with in-house research.

In conclusion, the study found the firms assisted by the FAPC accounted for approximately 21 percent of the direct food processing jobs and 31 percent of the indirect food processing jobs in the State of Oklahoma. Also, the firms indicated an increase in full-time employment, sales, and payroll, and the responses to the case study indicated the services provided by the FAPC are having a positive impact on the firms.

# Agribusiness Economics

The FAPC has a stake in the economic viability of Oklahoma's value-added food and non-food processors. The FAPC strives to ensure a profitable future for Oklahoma food and fiber processors by necessitating a constant and intensive review of changes in both industry characteristics and markets.

# Establishment of an Agricultural Marketing Resource Center

## Objective

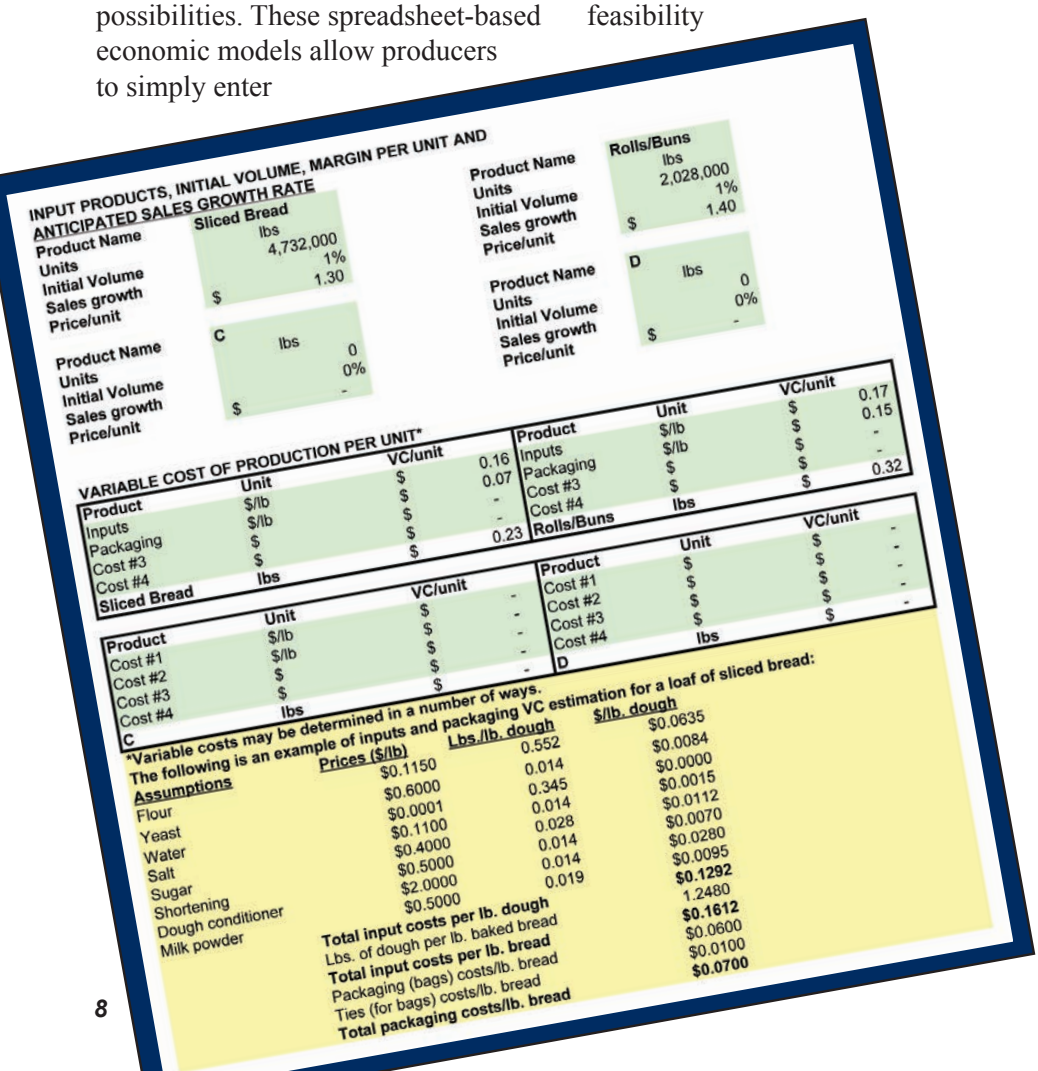
The objective of this project was to assist U.S. agricultural producers in examining value-added processing possibilities for various commodities.

## Approach

Processing specifications and financial analysis tools are often difficult and costly to obtain, thus many producers proceed with a value-added idea without a full understanding of operational requirements and any type of risk assessment. To enlighten producers and hopefully eliminate expensive business failures, a series of "pre-feasibility" templates were developed for several food and fiber processing possibilities. These spreadsheet-based economic models allow producers to simply enter a series of expected costs, output prices, and production volumes that the model uses to estimate profit/loss, cash flow, and returns on investment. A "base" spreadsheet model was also created for producers/entrepreneurs to use as a starting point for developing a customized economic model for any given value-added venture.

## Benefits

The feasibility templates allow producers/entrepreneurs to get a simplified, yet relatively inclusive assessment of business risks and returns before sinking considerable time and money into a start-up venture. While these templates are not designed to replace a detailed feasibility study or eliminate the need for a thorough business plan, they are meant to provide a glimpse into the viability of a venture.


INPUT PRODUCTS, INITIAL VOLUME, MARGIN PER UNIT AND ANTICIPATED SALES GROWTH RATE

| | | | | |
|---|---|---|---|---|
| Product Name | Sliced Bread | | Product Name | Rolls/Buns |
| Units | lbs | | Units | lbs |
| Initial Volume | 4,732,000 | | Initial Volume | 2,028,000 |
| Sales growth | 1% | | Sales growth | 1% |
| Price/unit | $ 1.30 | | Price/unit | $ 1.40 |
| Product Name | C | | Product Name | D |
| Units | lbs | | Units | lbs |
| Initial Volume | 0 | | Initial Volume | 0 |
| Sales growth | 0% | | Sales growth | 0% |
| Price/unit | $ - | | Price/unit | $ - |

VARIABLE COST OF PRODUCTION PER UNIT*

| Product | Unit | VC/unit |
|---|---|---|
| Inputs | $/lb | $ 0.16 |
| Packaging | $/lb | $ 0.07 |
| Cost #3 | $ | $ - |
| Cost #4 | $ | $ - |
| Sliced Bread | lbs | $ 0.23 |

| Product | Unit | VC/unit |
|---|---|---|
| Inputs | $/lb | $ 0.17 |
| Packaging | $/lb | $ 0.15 |
| Cost #3 | $ | $ - |
| Cost #4 | $ | $ 0.32 |
| Rolls/Buns | lbs | |

| Product | Unit | VC/unit |
|---|---|---|
| Cost #1 | $/lb | $ - |
| Cost #2 | $/lb | $ - |
| Cost #3 | $ | $ - |
| Cost #4 | $ | $ - |
| C | lbs | |

| Product | Unit | VC/unit |
|---|---|---|
| Cost #1 | $ | $ - |
| Cost #2 | $ | $ - |
| Cost #3 | $ | $ - |
| Cost #4 | $ | $ - |
| D | lbs | |

*Variable costs may be determined in a number of ways.
The following is an example of inputs and packaging VC estimation for a loaf of sliced bread:

| Assumptions | Prices ($/lb) | Lbs./lb. dough | $/lb. dough |
|---|---|---|---|
| Flour | $0.1150 | 0.552 | $0.0635 |
| Yeast | $0.6000 | 0.014 | $0.0084 |
| Water | $0.0001 | 0.345 | $0.0000 |
| Salt | $0.1100 | 0.014 | $0.0015 |
| Sugar | $0.4000 | 0.028 | $0.0112 |
| Shortening | $0.5000 | 0.014 | $0.0070 |
| Dough conditioner | $2.0000 | 0.014 | $0.0280 |
| Milk powder | $0.5000 | 0.019 | $0.0095 |
| Total input costs per lb. dough | | | **$0.1292** |
| Lbs. of dough per lb. baked bread | | | 1.2480 |
| Total input costs per lb. bread | | | **$0.1612** |
| Packaging (bags) costs/lb. bread | | | $0.0600 |
| Ties (for bags) costs/lb. bread | | | $0.0100 |
| Total packaging costs/lb. bread | | | **$0.0700** |

## Economic Impacts

These templates are meant to be used as financial and risk assessment tools; thus, any measure of economic impacts in terms of jobs and revenue are inappropriate. However, both the "base" and commodity-specific templates have been used by producers/entrepreneurs in Oklahoma and other states to examine the potential for both new business development and the expansion of existing businesses. The "base" template also has been used as a training tool in the 2004 FAPC Financial Management Workshop, "Do Your Dollars Make Sense?"

## Continuing Work

The project concluded in September 2004. However, additional feasibility templates have been suggested, including one for an oilseed processing plant and an herb processing operation.

## Publications

As a result of the research, one journal paper, two conference proceedings papers, and five extension publications have been published.

## Funding

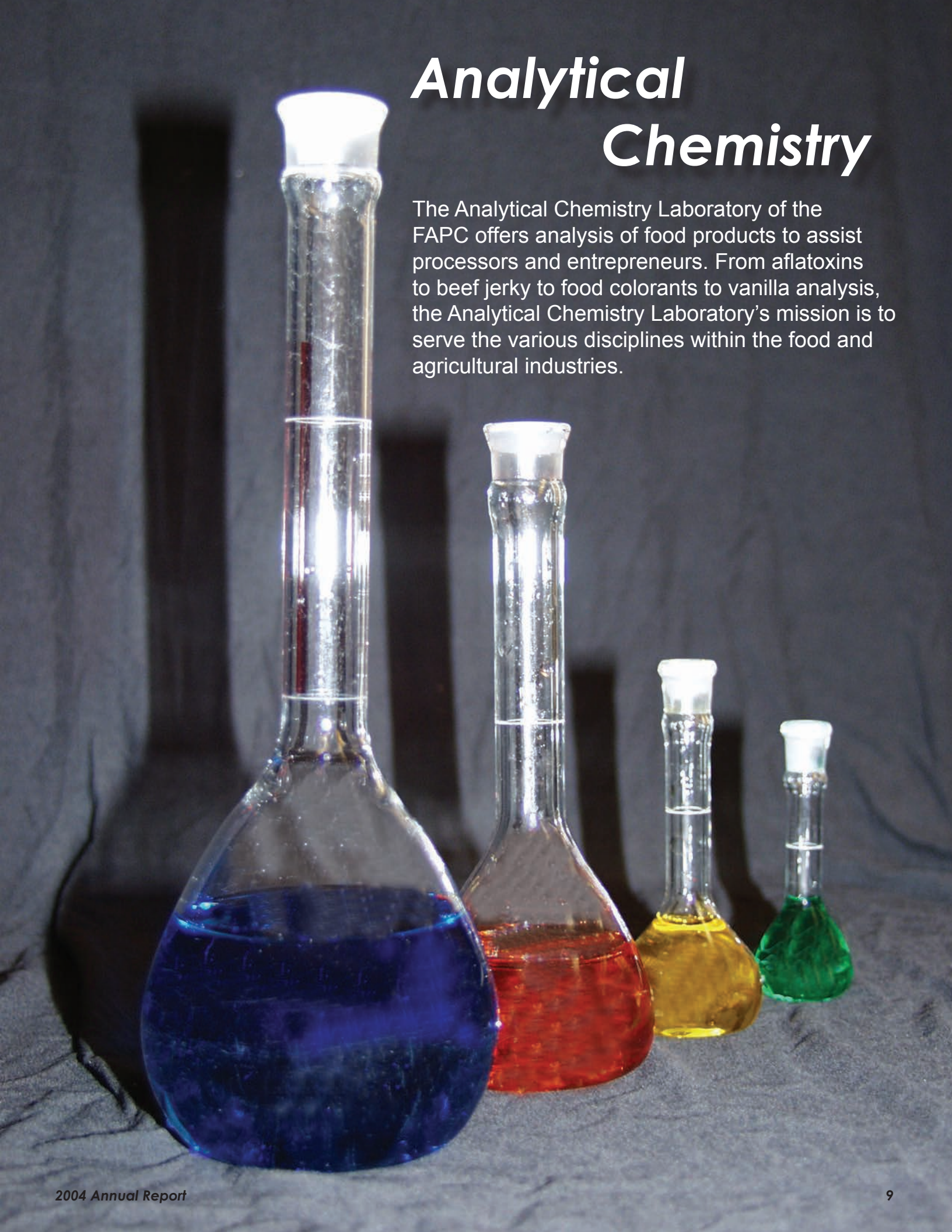
The U.S. Department of Agriculture funded this product.

## Collaborators

Dr. Rodney Holcomb, FAPC Agribusiness Economic Specialist, was the principal investigator. Dr. Phil Kenkel, Agricultural Economics Professor, served as a collaborator.

# Analytical Chemistry

The Analytical Chemistry Laboratory of the FAPC offers analysis of food products to assist processors and entrepreneurs. From aflatoxins to beef jerky to food colorants to vanilla analysis, the Analytical Chemistry Laboratory's mission is to serve the various disciplines within the food and agricultural industries.



# Establish a Sensitive Method to Determine Trans Fat Acid in Food by Gas Chromatography

## Objective

The objective of this project was to provide entrepreneurs with accurate nutritional labels concerning fat types.

## Approach

The determination of *trans* fatty acids content is normally carried out by either infrared spectroscopy or capillary gas chromatography. The FAPC decided to establish and optimize the gas chromatography method because it offers better sensitivity. Prior to analysis, the homogenized samples from several food products were hydrolyzed, followed by the extraction and methylation of fatty acids. Using the gas chromatography, calibration curves to determine the identification and quantification of *trans* fatty acid could be applied to a wide array of samples matrices.

## Benefits

In January 2006, a new requirement from the Food and Drug Administration will require changes in the nutritional facts panel for all food and dietary supplements. This change requires the nutritional facts label to specify contents of *trans* fats (grams) on a separate line below saturated fats. The FAPC is offering technical assistance to the food industry, so food processors and manufacturers can benefit from this new service.

## Economic Impacts

With the new FDA requirements, the services FAPC is providing could have an economic impact on the food and agricultural industries. The FAPC facilitates to all Oklahomans with nutritional fact label services. This vital information could enhance the sale of certain products or speed the development of new ones with lower amounts or no *trans* fatty acids content. These new products ultimately could replace products already in the market thus increase revenues.

## Publications

As a result of this research, a *FAPC Flash* has been published and an abstract for a meeting presentation has been developed.

## Collaborators

Guadalupe Davila-El Rassi, FAPC Analytical Chemist, was the principal investigator during this project. Other collaborators included Renee Albers-Nelson and Miriam Velasco, FAPC Research Specialists.



# Business Planning & Marketing

The primary goal of the FAPC is to help producers, processors, and entrepreneurs add value to Oklahoma's food and agricultural processing industries. Agricultural processors are not merely manufacturers, but business professionals with a unique set of needs and objectives. Our business planning and marketing associates can assist any Oklahoma community by providing information, tailoring workshops to meet specific needs, and assisting in a variety of business and marketing areas.

# Heartland Cup
## Styrofoam Manufacturer


### Objective

The objective of this project was to create awareness of the new company, Heartland Cup, and the variety of Styrofoam products the company manufacturers for the food service and convenience store industry.

### Approach

To achieve the objective, the FAPC utilized contacts the center had established with food service and convenience store groups in Oklahoma to create awareness of Heartland Cup and the ability of the company to customize Styrofoam cups and other food disposable containers with personalized logos and colors.

One of the contacts was Mr. Phil LaRue, President of Food Marketing Specialists and a food service broker, who has established business relationships with the major service distributors, fast food restaurants, and multi-unit operators who use Styrofoam products. A meeting was scheduled with LaRue and the owner of Heartland Cup, Mr. Truett McCarty, to discuss broker representation and the potential accounts in Oklahoma.

### Benefits

One of the benefits for the consumer is the ability to purchase custom Styrofoam cups, bowls, and other disposable products from Oklahoma's only Styrofoam plant at a lower cost per unit. Heartland Cup also offers a minimum order of 25,000 units of each size for color logos, where most of the competitors require a minimum of 100,000 units.


### Economic Impacts

Heartland Cup opened for business in July 2004 with a total of 37 employees, and in January of 2005, the company has increased to 57 employees. Heartland Cup currently runs three shifts and manufactures more than 1.5 million cups per day.

The company also has purchased new state-of-the-art equipment, which will manufacture a new concept of products. Heartland Cup will be the only plant in the United States to have this new technology.

### Continuing Work

Heartland Cup has grown so rapidly that it is in need of another warehouse for storage of finished products, and the company is currently working with the local bank and other financial organizations to obtain the funds for the expansion.

The FAPC is continuing to evaluate potential customers for their products with the broker, and Heartland Cup is also adding a sales force to manage the regional area for additional business.

### Publications

A story about Heartland Cup was published in *The Oklahoman* that was written by Business Writer Tricia Pemberton.

### Collaborators

Jim Brooks, FAPC Business Planning and Marketing Specialist, was the principal investigator for the project. Other collaborators included Dr. Roy Escoubas, FAPC Director, and Chuck Willoughby and Corey Stone, FAPC Business Planning and Marketing Specialists.

# Red River Gourmet
## Raspberry Gourmet Food Products


### Objective

The objective of this project was to introduce a line of raspberry food products to the gourmet food market.

### Approach

To reach the objective, the FAPC helped Red River Gourmet identify the most potentially profitable strategy for marketing a line of products. A plan to strategically capture market share at a manageable pace was then developed. Budget estimates for the program were calculated, and additional funding through outside sources was sought.

This marketing plan has resulted in the introduction of at least five stock keeping units (SKUs) under the Red River Gourmet label in both retail and fundraising markets in five states.

### Benefits

Consumers now have an opportunity to purchase several new raspberry products in a market that is growing and is currently underserved nationally.

The gourmet products industry benefits from the extension of the small raspberry products market, while the raspberry industry itself enjoys the opportunity to further stabilize berry prices through the success of value-added raspberry products.

### Economic Impacts

This project has resulted in the creation of a new food product company, increased business for an existing food processor, additional product facings for gourmet retail outlets to sell, six new food products, at least one new job, and greatly increased revenue from retail sales in the last six months.

### Continuing work

A marketing plan is a dynamic document. It requires constant attention and revision to be executed successfully. It is likely that this project will remain active in the near future as details of the plan are played out. Further work will include assessing progress and adjusting goals to reflect the current state of market.

### Publications

As a result of this project, a *FAPC Flash* has been published.

### Funding

Red River Gourmet has funded their own project, with some outside funding through the Marketing Utilization Program sponsored by the State of Oklahoma.

### Collaborators

Corey Stone, FAPC Business Planning and Marketing Specialist, was the principal investigator during this project. Other collaborators included Dr. William McGlynn, FAPC Horticulture Processing Specialist; David Moe, Pilot Plant Manager; Darren Scott, Sensory Specialist; and Jim Brooks and Chuck Willoughby, FAPC Business Planning and Marketing Specialists.

# J & K HayGuard

### Objective

The objective of this project was to develop HayGuard™. This product is a paraffin-based, non-nutrient liquid suspension that is designed to preserve hay quality and reduce losses associated with moisture absorption and accumulation, molding, and subsequent animal refusal when applied by spraying on hay or ground where hay is to be stored.

### Approach

To achieve the objective, the FAPC used unbiased third party testing to verify the effectiveness of the product. Preliminary research required to apply for a Small Business Innovative Research (SBIR) Grant from USDA is being conducted. Following the advise of Dr. Raymond Huhnke, Professor of Biosystems and Agricultural Engineering at Oklahoma State University and well noted research expert on hay storage, J&K HayGuard realized that it is imperative to research the potential performance and intended claims for this product. Such research can take up to two years (SBIR Phase I and Phase II funding). Because preliminary studies, which should include fall and spring testing, are required by SBIR, J&K HayGuard sought funding for Spring 2005 Test Trials from the Oklahoma Department of Agriculture, Food, & Forestry's Ag Enhancement and Diversification Program. They were awarded a $5,000 Basic Research Loan in October 2004.

### Benefits

Storage conditions have a dramatic effect on hay chemical composition and feeding value as well as dry matter losses. J&K HayGuard has the potential to substantially reduce these annual hay storage losses.

### Economic Impacts

It is expected that sales from HayGuard™ will result in the creation of jobs in manufacturing, transportation, and sales and marketing segments of the economic enterprise. The resulting economic impact of this venture, outside projected sales receipts, would include an associated multiplier effect. A study conducted by the FAPC showed Oklahoma's agricultural services sector has a multiplier effect on employment of 1.45. This means for every one job J&K HayGuard provides an additional 0.45 jobs are created throughout the economy. Currently, J&K HayGuard expects to employ four people in the first year of operation. Thus, approximately two additional jobs will be created in the local economy. Comparatively, this study showed the multiplier effect of agricultural services to gross sales is 2.19. This means for every $1 in sales captured by J&K HayGuard, an additional $1.19 in sales is created elsewhere in the economy. This multiplier effect not only provides jobs and income to Oklahomans but also provides sales tax revenue to state and local governments.

### Continuing Work

This preliminary research required to apply for a SBIR Grant should be completed by July 2005. It is anticipated that research funded under SBIR could take up to two years (SBIR Phase I and Phase II funding).

### Funding

J&K HayGuard has funded the Fall 2004 Test Trials. Spring trials are being funded through Oklahoma Department of Agriculture, Food, & Forestry's Ag Enhancement and Diversification Program.

### Collaborators

Chuck Willoughby, FAPC Business Planning and Marketing Specialist, was the principal investigator during this project. Other collaborators included Dr. Nurhan Dunford, FAPC Oil/Oilseed Chemist; Dr. Raymond Huhnke, Biosystems and Agricultural Engineering Professor; and Mr. Jerry Rogers, hired consultant.

# Cereal Chemistry

Cereal Chemistry 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. Examples of the basic research projects include interactions of wheat proteins and carbohydrates, rheological properties of dough and model systems, and proteomics of wheat endosperm organelles that synthesize and modify storage proteins during grain development.

# Understanding Intrinsic Properties of Wheat Gluten Proteins

## Objective

The objective of this project was to investigate the factors that contribute to a desirable extensibility in dough systems.

## Approach

The functional properties of wheat are not well understood at the present time and are of extreme importance to the wheat industry. Using hard red winter wheat varieties with contrasting extensibility properties, the dough's physical properties and gluten protein patterns were evaluated. Also, factors associated with the differences in extensibility were analyzed, such as the specific classes of proteins that form the gluten matrix. Studies included observations on their related physical properties (dough rheology, electrophoretic mobility, and molecular weight) and chemical composition.

## Benefits

Continued improvement of hard winter wheat is essential for survival of farm business and particularly of wheat production in Oklahoma in order to sustain the supply of wheat the world needs. Besides the agronomical traits, which no doubt are extremely important, quality aspects of the wheat in reference to its performance in the different final baked products manufactured around the globe are next on the list. Understanding the factors that contribute to dough extensibility and the manipulation of such factors to obtain desirable characteristics tailored for a particular application should directly benefit the wheat industry.

## Economic Impacts

A long-term benefit of this project is the contribution of the survival of farm operations in the state, particularly of wheat production. This is very important to keep the quality attributes of Oklahoma wheat production constantly improving. Continued efforts are needed to maintain a competitive edge of wheat production with characteristics that meet the needs of the domestic and overseas customers.

## Continuing Work

The complete understanding of the properties of wheat gluten and their relationship to quality is a great challenge to the cereal chemistry community. For example, the role of specific gluten protein classes and their individual contribution to extensibility must be understood. Also, a complete kinetic model that would include all the internal components as well as processing variables is needed.

## Publications

As a result of the research, two journal papers have been published.

## Funding

The Oklahoma Wheat Commission, Oklahoma Wheat Research Foundation, and Oklahoma Agricultural Experiment Station funded this project.

## Collaborators

Dr. Patricia Rayas-Duarte, FAPC Cereal Chemist, was the principal investigator during this project. Other collaborators included Ma. Cristina Escober, FAPC Research Specialist; Sabitha Patel, University of Pennsylvania; Ana Romero, Visiting Scientist; and Maya Joray, Mohamad El-Osta, Fadi Al-Jorf, and Harini Gudiseva, graduate students.

# Food Engineering

The Food Engineering area 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.

# The Biodegradation of Waste Cellulose from the Meat Industry

### Objective

The objective of this research was to determine ease and rate of bioconversion of spent casings into glucose and cellobiose sugars using cellulase enzymes.

### Approach

The approach involved screening several commercial cellulase enzymes for bioconversion efficiency. Rate of enzymatic hydrolysis of spent casing waste was measured while varying the temperature, pH, mixing, enzyme concentration, substrate concentration, and incubation period of the fermentation process. The effect of various ionic and non-ionic surfactants on the conversion efficiency was also tested.

During hydrolysis, samples were taken at 0, 4, 8, and 24 hours and analyzed for total suspended solids and soluble sugars using high performance ion chromatography. After establishing conversion efficiency with commercial enzymes, the next step was to produce cellulase enzymes with the fungi *Trichoderma reseei* (RUT-C30) using spent casing waste as the main carbon source for growth and production. The activity and efficiency of the enzymes produced in-house, using casing as the substrate, were then compared to the commercial cellulase enzymes.


### Benefits

Results from this study will help obtain the optimum operating conditions to maximize the hydrolysis efficiency and reduce the cost associated with the enzyme. Once optimum operating conditions are determined, an economic assessment of the process will be conducted.

### Economic Impacts

Meat processing companies currently send waste casing to landfills and pay a cost for disposal. The casing is a good clean source of cellulose and has the potential for conversion into value-added products. This process could turn a product liability (i.e. a cost) into a profitable by-product.

### Continuing Work

Future work will include an economic evaluation of the bioconversion process.

### Publications

As a result of the research, numerous abstracts for meeting presentations have been developed.

### Collaborators

Dr. Dani Bellmer, FAPC Food Engineer, was the principal investigator during this project. Other collaborators included Hector Cumba, Research Engineer and Ph.D. candidate, and Randy Lewis, Chemical Engineering Faculty Member.

# Start-Up Assistance for Guymon Extracts, Inc.

### *Objective*

The objective of this project was to assist with start-up efforts of a new business venture, Guymon Extracts, in Guymon, Oklahoma. Guymon Extracts is a joint venture between several Japanese firms and Seaboard Farms, which receives pork bones from Seaboard Farms and extracts a "bone broth" material in a pressure-cooking process. Fats are separated from the resulting liquid and the non-fat portion is concentrated to produce the final product or "bone broth," which is used to flavor soups and other foods.

### *Approach*

To reach this objective, a hands-on approach was necessary. There were several site visits to Guymon and meetings with the client at the FAPC. A great deal of communication was also carried out via e-mail and fax.

The FAPC made recommendations for process improvements, drawing review, safety, regulatory review, and vendor identification.

### *Benefits*

The project has created new, high-paying jobs in Guymon, Oklahoma; an increase in exports (100 percent of bone broth production will be shipped to Japan); tax revenue from a new business; productive use for a low-quality food waste product; and potential plant expansion into additional products and facilities.

### *Economic Impacts*

A new plant facility is currently under construction in Guymon (20+ million total installed cost), which will create at least 10 new jobs; new revenue from waste product; and a new product with strong possibilities of line extensions, such as flavorants, ingredients, and other by-products.

### *Continuing Work*

Future work will be continuing to provide assistance in the form of workshops, individual consultation, and rapid response to developing needs.

### *Funding*

This project was funded by the FAPC ongoing maintenance accounts, and the client paid for workshops.

### *Collaborators*

Dr. Tim Bowser, FAPC Food Engineer, was the principal investigator during the project. Other collaborators included Jason Young, FAPC Quality Management Specialist; Dave Moe, FAPC Pilot Plant Manager; Jake Nelson, FAPC Meat Processing Manager; and Chuck Willoughby, FAPC Business Planning and Marketing Specialist.

# Horticulture Processing

The FAPC is committed to helping Oklahoma's producers and processors of horticultural products provide nutritious, delicious, and convenient food products to consumers everywhere. Whether assistance is needed with formulation, process evaluation, trial production runs, or other services, the FAPC has the know-how and equipment to help move the project forward.

# Adapting the Oxygen Radical Absorbance Capacity (ORAC) Assay for use with Watermelon and Watermelon-Based Foods

## Objective

The objective of this project was to improve the analytical methods used to measure the antioxidant activity of watermelon and watermelon-containing foods.

## Approach

The ORAC assay was originally designed to measure the activity of water-soluble antioxidants. This led to very low values for foods that contain more oil-soluble antioxidants such as the lycopene found in watermelon, tomatoes, and red grapefruit.

Other labs had experimented with using additional chemicals to increase the solubility of oil-soluble antioxidants in the ORAC assay and achieve a better correlation between antioxidant concentration and measured antioxidant activity. Cyclodextrin, a ring-shaped compound composed of sugar molecules, was one chemical that had been used successfully to adapt the ORAC assay to antioxidant compounds such as ß-carotene and tocopherol. However, no one had attempted to use this modified ORAC assay to measure the antioxidant activity of lycopene.

The FAPC conducted a series of experiments using purified lycopene to determine the form and concentration of added cyclodextrin that gave the best correlation between measured ORAC value and lycopene concentration.

## Benefits

Fruits and vegetables are rich in antioxidant compounds, which play an important role in promoting good health. It has been difficult to measure accurately the antioxidant activity of watermelon and other foods containing fat-soluble antioxidants. This work offers the opportunity to better and more easily measure the activity of those compounds, thus creating products with enhanced antioxidant effects. This will result in a wider selection of healthier foods for consumers.

## Economic Impacts

The work will ultimately open up significant new markets for watermelon-based products to supplement the current market for fresh whole melons and fresh cut melon pieces. This may result in increased revenue for growers, as well as opportunities for new processing ventures.

## Continuing Work

Work is currently underway to refine the analysis using randomly methylated ß-cyclodextrin to further improve the accuracy and repeatability of the method. The next step will be to test the improved method using watermelon tissue.

## Publications

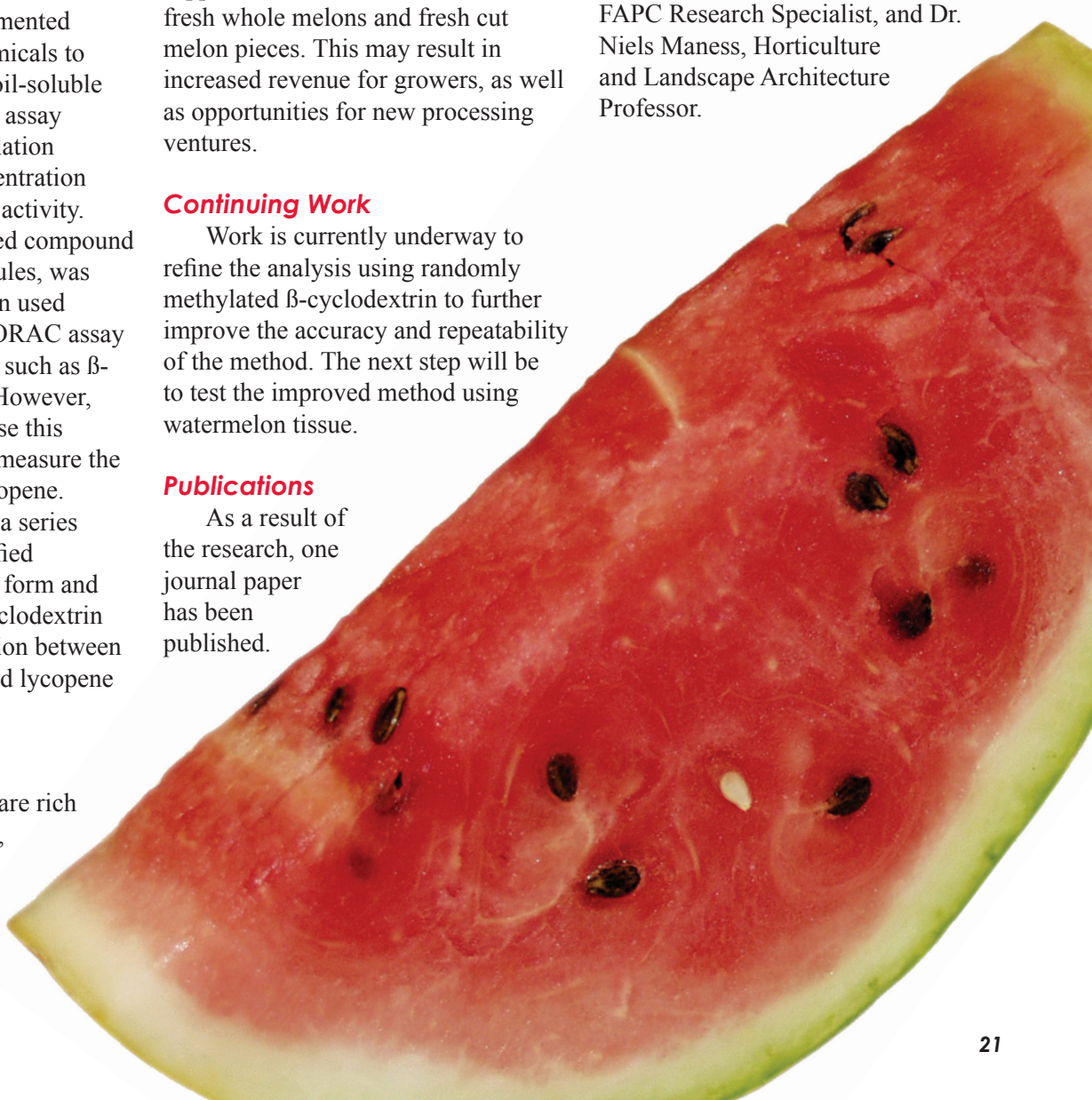
As a result of the research, one journal paper has been published.


## Funding

This project was funded by the Oklahoma Agricultural Experiment Station and through the USDA IFAFS grant #2001-52101-11446 titled, *"Production, Development, and Marketing of Value-Added Horticultural Products."*


## Collaborators

Dr. William McGlynn, FAPC Horticulture Processing Specialist, was the principal investigator during the project. Other collaborators included Dharmendra Bangalore, FAPC Research Specialist, and Dr. Niels Maness, Horticulture and Landscape Architecture Professor.



# Food Microbiology

The main focus of research in the Food Microbiology area is microbial food safety from farm to table. There also is heavy commitment to research related to the beneficial use of lactic acid bacteria as starter cultures for foods and as probiotics for both humans and animals. Other research involves microorganisms responsible for food spoilage.

# Lactobacilli as Probiotics, Biopreservatives, and Producers of Nutraceuticals

### Objective

The objective of this project was to select a culture of *Lactobacillus* having a potential use as a probiotic for dogs.

### Approach

To achieve the objective, the dominant species of *Lactobacillus* isolated from intestinal contents of healthy dogs and characterized in the food microbiology laboratory was *Lactobacillus reuteri* along with a few strains of *Lactobacillus acidophilus*. The cultures exhibited a considerable amount of variability with regard to the ability to grow in the presence of bile and to inhibit the growth of *Salmonella* in laboratory media.

The cultures of *Lactobacillus reuteri* also were compared for their ability to produce ruterin, a compound that has been shown to be active in inhibiting the growth of undesirable organisms. One or two strains of *Lactobacillus reuteri* appear to have great potential for use as a probiotic for inclusion in dog food.

### Benefits

The successful development of a probiotic for dog foods could be beneficial in helping control intestinal pathogens in these animals, as well as improving their general health and well-being.

Family pets can serve as a source of pathogens, such as *Salmonella* entering the home. The use of a probiotic in animal feeds to reduce the level or incidence of occurrence of such a pathogen could result in protection of the consumer from a source of intestinal infections.

### Economic Impacts

This research could result in the development or commercialization of new projects, which might enhance the sale of certain types of products. Whether this project would result in economic impact or a situation in which one product replaces another already in the market place is beyond the scope of this investigation.

Anything that can be done to control the occurrence or the incidence of intestinal infections in animals or in humans certainly can have an economic impact by reducing the amount of medical bills and/or the amount of time lost in the work place.

### Continuing Work

Future work regarding the second objective will include steps to determine or compare the cultures of *Lactobacillus reuteri* from the dog to select one that will be stable during the production of the probiotic and in the dog food itself.

### Publications

As a result of the research, four journal papers and one book chapter have been published or are being published.

### Funding

This project was funded by the Oklahoma Agricultural Experiment Station and royalty accounts.

### Collaborators

Dr. Stanley E. Gilliland, FAPC Food Microbiologist, was the principal investigator during this project. Other collaborators included Dr. Paloma Cuesta, Post Doctoral Research Associate; Sandra McCoy and Jennifer Nangle, FAPC Research Specialists; and Trenna Blagden, Lacey Smith, and Lyn Early, graduate students.

# Evaluation of Activated Lactoferrin for Reduction of E. coli O157:H7 on Beef Carcasses

## Objective

The objective of the project was to determine if activated lactoferrin could successfully reduce the level of *E. coli* O157:H7 on beef carcasses.

## Approach

To achieve the objective, the project needed to simulate beef carcass processing in order to be as realistic as possible for proper evaluation of what would be obtained during actual beef carcass treatments. An electrostatic spraying cabinet and a multipurpose wash cabinet were set up in a side room near the FAPC kill floor. The difficulty was to use six strains of the pathogen, *E. coli* O157:H7 to inoculate beef fat plates that had been excised from beef carcasses, treating them with various activated lactoferrin (activin), buffer, cold/hot water, and/or lactic acid. The main purpose was to determine the efficacy of activated lactoferrin in reducing *E. coli* O157:H7 (in comparison to the buffer it was dissolved in) and in comparison with other microbial interventions such as hot water and lactic acid that are currently used in beef carcass processing.

## Benefits

One of the main benefits of this project was to demonstrate pathogen-inoculation studies can be performed on a large scale and be cleaned up so the pathogen does not present a problem for subsequent work that will be performed.

The potential benefit to the industry would be the verification of a biochemical solution for reducing the presence of *E. coli* O157:H7 on beef carcasses that would make subsequent ground beef safer.

## Economic Impacts

Beef processors would not have as much product recalled if *E. coli* O157:H7 levels could be reduced (USDA samples ground beef for *E. coli* O157:H7).

Many beef processors who slaughter cattle consume upwards of 400 gallons of water per carcass, which is a tremendous economic burden. Much of the water is used to deliver microbial interventions. If Activin can aid in detaching/removing *E. coli* O157:H7 from carcasses, it may result in less water use during processing.

The successful use of the FAPC second floor processing area for pathogen-inoculated studies presents the possibility for similar large-scale inoculated studies that can have broad impacts on meat or other processing issues.

## Continuing Work

The current results were based on a scale up from laboratory studies and are inconclusive. However, they do show the impact of a short, hot water rinse on providing approximately a 1-log reduction and 2 percent lactic acid in providing about a 0.5-log reduction, of *E. coli* O157:H7 compared to cold water rinses, thereby, validating the use of these interventions.

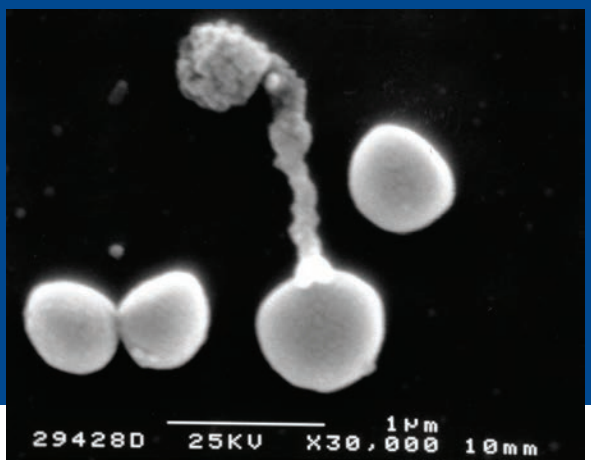
## Funding

ALF Ventures in Salt Lake City, Utah funded the project.

## Collaborators

Dr. Peter Muriana, FAPC Food Microbiologist, was the principal investigator during this project. Other collaborators included Dr. Brad Morgan, Animal Science Associate Professor; Jake Nelson, FAPC Meat Processing Manager; Linda Guenther, Animal Science Research Technician; Adam Tittor, Animal Science Doctoral Student; William Robertson and Brad Jordan, FAPC Research Technicians; and Dr. Stan Gilliland, FAPC Food Microbiologist.

# Improved Method for Recovery of Campylobacter jejuni from Food




## Objective

The objectives of this project were to investigate several strains of *Campylobacter jejuni* and compare the improved method and FDA method for detection in several new food systems.

## Approach

*Campylobacter jejuni* is difficult to work with because of its ability to morphologically change during growth. *Campylobacter jejuni* is helical rod shaped and transforms into a coccoid form when conditions are unfavorable for growth.

Current regulations have been set by the USDA/FDA in respect to the recovery of *Campylobacter jejuni* from several food products (i.e. milk, pork, and ground beef). Recent research have shown there is low recovery rate using their current methods. The method relies on a bag technique in which a plastic bag is placed in an aerobic jar with Campy-Paks (reduced oxygen, enriched carbon dioxide environment) to provide a suitable environment for growth.

Recent studies of *Campylobacter jejuni* have shown optimal conditions can be attained through maintenance of the integrity of the culture, maximization of culture activity, and consistency of growth by using a vented tissue culture flask.

The goal of this experiment was to compare the recovery rates of *Campylobacter jejuni* using the FDA/BAM method versus the improved method using vented tissue culture flasks. In the experimental set-up, low and high numbers of *Campylobacter jejuni* were inoculated into food products. The experiment was designed to enhance the detection of *Campylobacter jejuni* from the food supply using reliable and consistent methodologies.

## Benefits

The potential benefits of this research is *Campylobacter* is the leading cause of foodborne illness in the United States, enhanced detection of *Campylobacter* will result in fewer incidents of contamination and related human illness.

## Economic Impacts

It is possible this research could result in the development or commercialization of new projects, which might enhance the sale of certain types of products. Whether in total this would result in economic impact or a situation in which one product replaces another already in the market place is beyond the scope of this investigation. Anything done to control the rate of foodborne illness will undoubtedly have a positive economic impact.

## Continuing Work

Future work will include several more replications that need to be completed.

## Publications

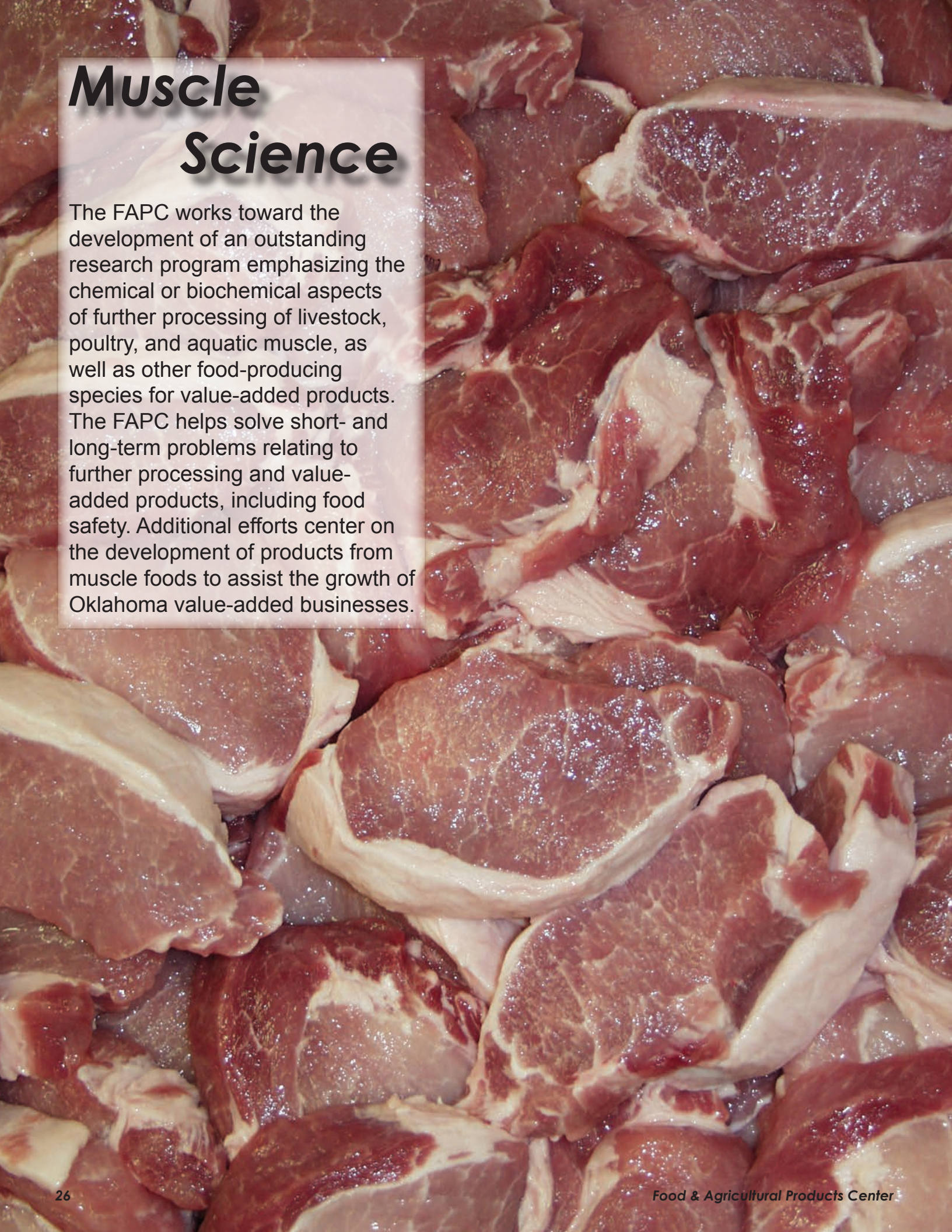
As a result of this research, two journal papers have been published.

## Funding

The FAPC, Project H-2485 Food Research Initiative Project, and Sitlington Endowed Funds funded this project.

## Collaborators

Dr. Siobhan Reilly, FAPC Food Microbiologist, was the principal investigator during this project. Other collaborators included Dr. Stanley Gilliland, FAPC Food Microbiologist, and Rose Odongo and Rachel Wright, graduate students.



# Muscle Science

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. The FAPC helps solve short- and long-term problems relating to further processing and value-added products, including food safety. Additional efforts center on the development of products from muscle foods to assist the growth of Oklahoma value-added businesses.

# Effect of Ethanolic Tocopherol Addition and Cooking Method on Oxidative Stability and Quality of Beef Patties During Refrigerated Storage

## Objective

The objective of this project was to compare the quality characteristics and oxidative stability of ohmically cooked beef patties to those cooked with an impingement oven as affected by ethanolic tocopherol addition.

## Approach

Ethanolic δ-tocopherol was sprayed onto ground beef prior to forming patties. Untreated patties and patties sprayed with just ethanol were used as controls. Patties from each treatment were formed by stuffing into a casing and crust freezing in a blast freezer. Crust frozen patties were cut with a band saw at 15 mm thick. Patties were cooked either in an impingement oven or were cooked in an ohmic heater. Cooked patties were evaluated for proximate composition, color, texture, and the development of primary and secondary oxidation products over time.

## Benefits

Results indicated ethanolic addition of tocopherol effectively reduces oxidation in pre-cooked patties when stored under refrigeration. The development of warmed-over flavors in pre-cooked meats is particularly challenging to processors of ready-to-eat meats.

Although further research is needed to determine the optimum minimal levels of ethanol that can be used for effective tocopherol addition, this research indicated the use of a polar organic carrier may be a means to slow the development of warmed-over flavors in ready-to-eat meats. In addition, research also demonstrated that additional challenges are presented when meat is cooked using an ohmic heating device. It appeared ohmic heating may actually promote oxidation to a certain degree.

## Economic Impacts

If the off-flavor contributed by the carrier can be addressed, this work demonstrates that Vitamin E addition may actually have affected many ready-to-eat meat products. A recent article in *Food Techonology* reviewed consumer trends with regard to ready-to-eat foods. The ready-to-eat segment of the food industry is a $115 to $150 billion industry. Ready-to-eat meats are a significant portion of most ready-to-eat dinner meals. Dinner solutions (i.e. “do it for me” meals) increased last year by $1.5 billion. Dinner solutions have enjoyed a 12 percent compounded annual growth rate since 1998. Dinner solutions with meat and poultry products increased 11.5 percent in one year. Meat and poultry entrees increased 9.4 percent.

## Continuing Work

Although the results were very promising, there is a flavor issue with regard to ethanolic addition of tocopherol. It was hoped cooking would drive-off alcohol; however, sensory panelist were not able to “get past” issues of alcohol flavors to effectively evaluate warmed-over flavors development in these patties. Work needs to be done to find out what is the lowest concentration of ethanol that can be used to effectively reduce oxidation and determine if this concentration is low enough to not be detected by sensory panelist. A possible solution may be Vitamin E addition via a marinade instead of ethanol.

## Publications

As a result of the research, one dissertation, two abstracts, one poster, and one article have been published.

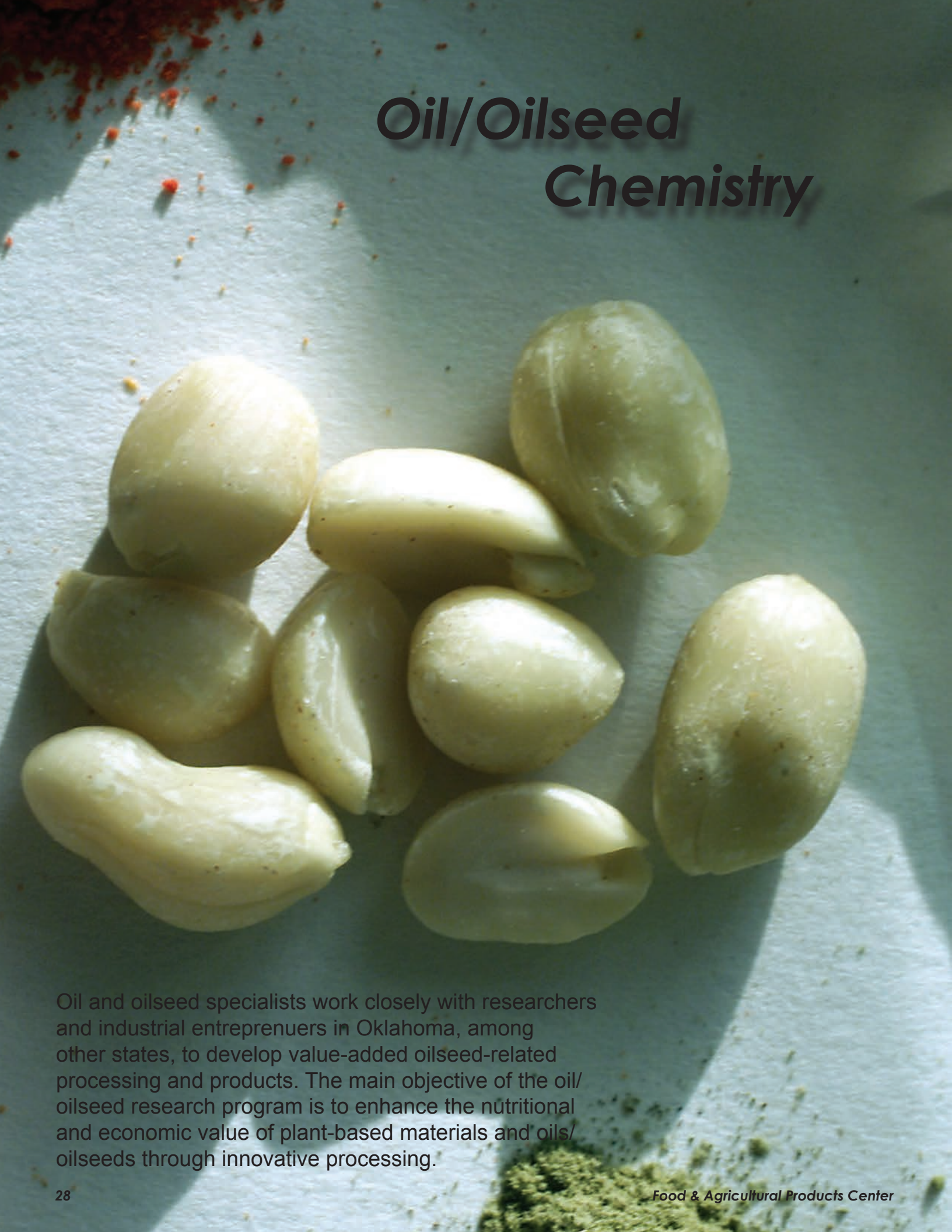
## Funding

The Food Research Initiative Program and Hatch projects OKLO2501 and OKLO2437 funded this project.

## Collaborators

Dr. Christina DeWitt, Department of Animal Science Assistant Professor, was the principal investigator during this project. Other collaborators included Dori Sigfusson, former FAPC Meat Scientist; Dani Bellmer FAPC Food Engineer; Renee Albers-Nelson, FAPC Research Specialist; Todd Wills and Russell Nabors, graduate students; and Jennifer Schieber, Shem Oliver, Jill Leslie, and Chris Bilby, undergraduate students.

# Oil/Oilseed Chemistry



Oil and oilseed specialists work closely with researchers and industrial entreprenuers in Oklahoma, among other states, to develop value-added oilseed-related processing and products. The main objective of the oil/oilseed research program is to enhance the nutritional and economic value of plant-based materials and oils/oilseeds through innovative processing.

# Value-Added Product Development from Wheat Milling Industry By-Products

### Objective

The objective of this project was to produce high value, functional foods, and nutraceuticals from wheat milling industry by-products.

### Approach

Thirty-one hard red and white winter wheat varieties grown in Oklahoma were analyzed for their policosanol content and composition. Conventional hexane extraction, accelerated solvent extraction, and supercritical fluid extraction techniques were examined for their efficacy to recover bioactive components from wheat fractions. The research results clearly demonstrated the accelerated solvent extraction method reduced the amount of solvent used and time required for oil recovery from wheat germ without sacrificing extraction efficiency. Supercritical $CO_2$ extracted products could meet the demand for high purity wheat germ oil with no solvent residue.

### Benefits

As the by-products of wheat milling industry represent about 25 percent of the original grain, they are of considerable economic significance to the miller. Value-added product development from milling industry by-products will benefit farmers, millers, and consumers.

Conventional oilseed extraction processes utilize n-hexane as a solvent for commercial operations. The "1990 Amendments to the Clean Air Act" listed n-hexane as a hazardous air pollutant. N-hexane was one of the solvents which was unlisted by the U.S. Food and Drug Administration because of toxicity concerns.

The FAPC expects to optimize wheat by-product processing conditions to obtain high quality products that are enriched in nutritionally, beneficial compounds. Although the FAPC is using laboratory scale equipment for this study, research findings will provide basic technical data for scale up and the potential transfer of these techniques to industry.

### Economic Impacts

It is possible this research could result in the development of commercial, high-value, new products from wheat milling industry by-products and new wheat germ oil processing techniques.

### Continuing Work

The work on optimization of the processing conditions that will produce wheat extracts concentrated in bioactive compounds at high efficiency is underway. Then, this new process will be scaled up to obtain large quantity of high value and high purity wheat extracts. The final product from the pilot runs will be characterized for its chemical, physical, and organoleptic properties. The FAPC also plans to collaborate with nutritionists to evaluate the health effects of the final product.

### Publications

As a result of this research, one book, six book chapters, and a peer-reviewed paper have been published.

### Funding

This project was funded by the Oklahoma Wheat Commission, Oklahoma Wheat Research Foundation, and Oklahoma Agriculture Experiment Station Hatch Funds.

### Collaborators

Dr. Nurhan Dunford, FAPC Oil/Oilseed Chemist, was the principal investigator during this project. Michael Eisenmenger, graduate student, served as a collaborator.

# Pilot Plant Facilities

The Pilot Plant facilities were designed with the needs of the Oklahoma food and agricultural products processing industry in mind; therefore, it fits all levels of the industry. The FAPC has pilot processing facilities for meat, cereals, dairy, and fruit and vegetables, as well as specific unit operations for thermal processing, drying, freezing, packaging, milling, and fermentation.

# Development of a Peanut Syrup

## Objective

The objective of this project was to assist an entrepreneur commercialize a family recipe.

## Approach

To obtain the objective, the client attended the FAPC Basic Training Workshop, and the FAPC helped the client develop a business and marketing plan.

Futhermore, the recipe was scaled up in the pilot plant. It was determined that various peanut ingredients react differently when blended and produce an inconsistent product.

Finally, alternative ingredients were evaluated, specific vendors were identified, and an emulsifier was found that would produce a consistent product. Therefore, consistency could be obtained through vendor selection and/or additives.

## Benefits

The potential benefits are to provide a new syrup product that is not currently available in the market.

## Economic Impacts

The project created income for the entrepreneur by developing a product the client could market. The project also created additional business for an Oklahoma co-packer and made use of raw materials from Oklahoma processors.

## Continuing Work

Future work includes finalizing processing systems, evaluating cost scenarios, producing product for market testing with an identified restaurant chain, and transferring processing to a co-packer based on success.

## Funding

The client and FAPC funded the project.

## Collaborators

Dave Moe, FAPC Pilot Plant Manager, was the principal investigator during the project. Other collaborators included Chuck Willoughby, FAPC Business Planning and Marketing Specialist, and Darren Scott, FAPC Sensory Specialist.

# Formulating and Analyzing a Shelf-Stable, Snack Stick Sausage for the U.S. Military


## Objective

The objectives of this project were to define and interpret the scientific and regulatory conditions regarding shelf-stable, dry, semi-dry sausages and assist the client in formulating and processing their product to fit the definition.

## Approach

Initially, the client manufactured a snack stick sausage with the intention of distributing to U.S. Troops through military procedures. Because of the nature of the distribution system, a very shelf-stable product would be required. Criteria for shelf-stable products have been defined and published by the USDA-FSIS, and these criteria would be the target for the client's product.

The client delivered multiple samples of the product from test batches to the FAPC. Analyses were performed on the samples, sensory characteristics were evaluated, and recommendations were made regarding procedures needed to be performed to achieve the goal. The client subsequently made two additional visits to the FAPC, and the same procedures were carried out until the pre-determined criteria were achieved.

## Benefits

The client is a state-inspected (rather than federally inspected) meat processing facility. Under state governed inspection programs, processing firms cannot sell their products to entities across state borders or to other countries. The client elected to donate the product rather than sell it.

This choice (along with the fact the military has procedures for meat/food distribution that are not entirely regulated by other state or federal agencies) may create opportunities for this client, as well as other processors to produce for the military.

## Economic Impact

It is estimated five new jobs and three new products were created as a result of this project.

## Continuing Work

The client is working towards completing final details on packaging and label appearance and details needed for the sale of the product.

## Funding

The client was responsible for the funding of this project.

## Collaborators

Jake Nelson, FAPC Meat Processing Manager, was the principal investigator during this project. Other collaborators included Linda Guenther, Animal Science Research Technician; Kris Novotny, Animal Science Lab Manager; and David Moe, FAPC Pilot Plant Manager.

# Product Development

The FAPC assists Oklahoma's small processors and entrepreneurs with the scale up and reformulation of products. They serve as a liaison between the test kitchen and the pilot plant. When it is not economically feasible to use the same ingredients, packaging, or processing in manufacturing a commercially produced product, specialists use sensory evaluation techniques to ensure that the product retains its consistency and value.

# Reformulation of a Refrigerated Cheese Sauce

### *Objective*

The objective of the project was to reformulate a refrigerated cheese sauce for La Fontanella Foods, so it could be retorted and sold as a room temperature, shelf-stable product.

### *Approach*

To achieve the objective of this project, the cheese sauce formulation was modified by changing the concentration of several ingredients and adding new ones, so that after retorting, it would maintain its appearance and texture.

### *Benefits*

The client has the ability to reach new markets by producing a room temperature, shelf-stable product with an extended shelf life that previously had to be stored refrigerated.

### *Economic Impacts*

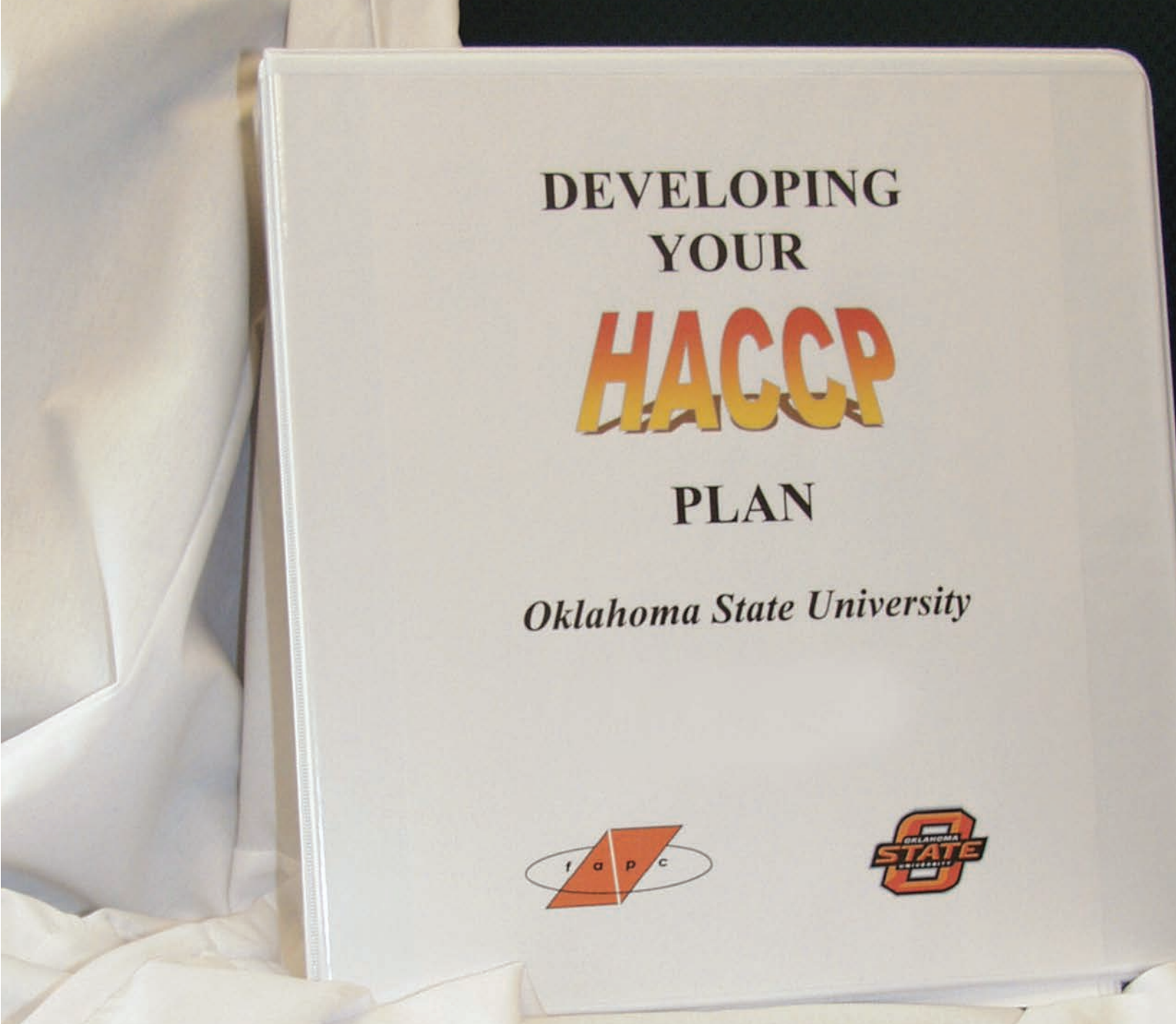
La Fontanella Foods has the potential to increase its revenue by reducing costs related to refrigerated shipping and storage of the cheese sauce. Additionally, the company may be able to reach additional markets with a cheese sauce that is shelf stable.

### *Continuing Work*

Future work will include additional modifications to the cheese sauce to improve its texture and color.

### *Collaborators*

Darren Scott, FAPC Sensory Specialist, was the principal investigator during this project. Other collaborators included Dave Moe, FAPC Pilot Plant Manager, and Dr. William McGlynn, FAPC Horticulture Processing Specialist.




# Quality Control & Assurance

FAPC is committed to helping Oklahoma's producers and processors incorporate quality management into their operations. In recent years, there has been growing pressure for companies to meet requirements of legislation and the quality assurance practices of customers. Programs relating to HACCP, GMPs, and Sanitation and Quality Systems are forcing food companies to take a look at how they manage quality. The FAPC can use its diverse team of individuals to provide assistance, guidance, interpretation of regulations, and workshops to give Oklahoma's producers and processors the tools to incorporate sound quality management practices into their operations.

# Regulatory HACCP Assistance for a Beef Jerky Production Establishment

### *Objective*

The objective of this project was to assist the client in meeting its regulatory requirements.

### *Approach*

The establishment contacted the FAPC after the Food Safety Inspection Service had completed a regulatory audit that identified several regulatory non-compliances. One of these non-compliances was the client did not have adequate support for its cook step to show potential pathogens were destroyed.

The FSIS had issued a Jerky Compliance Guideline and stated establishments using Appendix A (a guideline that is accepted by the FSIS as support material) must meet a humidity standard. At this time, the establishment did not know how to meet the standard or even measure for the humidity.

The FAPC contacted the FSIS Technical Center to determine the humidity required. At that time, July 2004, "measurable humidity," was accepted in the cook step. After discussions, the FAPC determined the best way to help the plant was to validate its process with thermometers and temperature data recorders. The FAPC was able to validate the jerky cook step and help the establishment with the support documentation and assist in the other regulatory non-compliances from the FSIS audit.

### *Benefits*

The consumers will have further confidence in the safety of the food supply.

### *Economic Impacts*

As a result of this project, two jobs in production and two distributor jobs were created.

### *Collaborators*

Jason Young, FAPC Quality Management Specialist, was the principal investigator for this project. Other collaborators included Jake Nelson, FAPC Meat Processing Manager; Dr. Tim Bowser, FAPC Food Engineer; and Dr. William McGlynn, FAPC Horticulture Processing Specialist.

# Value-Added Wood Products

**The FAPC is concerned with the physical and mechanical properties of wood products and value-added wood composites. Research areas include particleboard manufactured from eastern redcedar, overlaying quality of particleboard panels, and composite panel manufactured from underutilized species in Oklahoma.**

# Value-Added Composite Panel Manufacture from Under-Utilized Species in Oklahoma

## Objective

The objective of this project was to use whole-tree chip particles from three under-utilized species as raw material to manufacture experimental composite panels.

## Approach

To achieve the objective, the under-utilized invasive species in Oklahoma such as Osage orange (*Maclura pomifere*), mesquite (*Prosopis glandulosa*), and eastern redcedar (*Juniperus virginiana*) were used in this research. Currently, these trees have very limited uses such as shelterbelts, windbreaks, and fence posts.

This study investigated some of the important properties of experimental panels made from particles of three species and a mixture of 50 percent Osage orange and 50 percent eastern redcedar. Panels were made in a computer-controlled press using a pressure of 750 psi and a temperature of 350 degrees Fahrenheit for five minutes.

The samples were tested for mechanical strength and physical stability properties according to the procedures defined by ASTM D-1037. Modulus of elasticity and modulus of rupture of the panels made from 100 percent Osage orange particles had the lowest values, while eastern redcedar resulted in the highest bending properties among the four types of samples.

Overall mechanical properties of the panels were not significantly different from each other at the 95 percent confidence level. Based on the findings in this study, it appears whole-tree chipped particles of three species can be used to manufacture particleboard without having any adverse influence on single-layer panel properties.

## Benefits

Manufacturing composite panel from such resources would be considered as an alternative use of raw material to turn a costly land management problem into a value-added product.

## Economic Impacts

This study has improved the understanding of basic properties of particleboard made from whole-tree chip of under-utilized species in Oklahoma. This process would provide a value-added economic incentive to convert such raw material into marketable particleboard panels.

## Continuing Work

Three-layer panels, using screened fine particles on the face layers and coarse particles in the core layer of the boards from raw material, will be manufactured to calculate detailed information about three-layer panel properties.

## Publications

As a result of the research, four journal papers have been published.

## Funding

This project was funded by McIntire-Stennis project, OKL 2517.

## Collaborators

Dr. Salim Hiziroglu, FAPC Value-Added Woods Specialist, was the principal investigator during the project. Other collaborators included two visiting undergraduate students from Kasetsart University in Thailand.

# FAPC Industry Advisory Committee


***Front Row:***

*Mr. Roger Ediger, Chair - Mitchell & DeClerck*
*Mr. Bob Collins - Cooperative Ginners Association of Oklahoma*
*Dr. Charles Nichols - Davison & Sons Cattle Company*

***Back Row:***

*Dr. J. Roy Escoubas - FAPC Director*
*Mr. David McLaughlin - Advance Food Company*
*Mr. Bill Wiley - Oklahoma Refigeration Services*
*Mr. Rodger Kerr, Vice Chair - Southwest Technology Center*

***Not Pictured:***

*Mr. John Bailey - Schwan Bakery, Inc.*
*Dr. Robert Bingham - Bil-Jac Foods, Inc.*
*Mr. Brett Burk - Elanco Animal Health*
*Mr. Gary Crane - Ralph's Quality Meats*
*Mr. Danny Dupree - Bar-S Food Company*
*Mr. John Griffin - Griffin Food Company*
*Mr. Bruce Price - Price Farms, Inc.*
*Mr. Bill Ford - Shawnee Milling Company*
*Dr. Ed Miller - OSU Division of Agricultural Sciences and Natural Resources*

# Faculty and Professional Staff

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

*"Several new economic analysis tools were provided to Oklahoma agricultural producers, and the feasibility of three potential value-added ventures were assessed."*

**Research Projects** - 3
**Extension Projects** - 17
**Key Projects**
- Plains Grains, Inc.
- Basic Training: A Guide to Starting Your Own Food Business
- Production, Development, and Marketing of Value-Added Horticultural Products

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

*"The analytical lab has been busy establishing new methodology to better service entrepreneurs in Oklahoma."*

**Research Projects** - 12
**Extension Projects** - 3
**Key Projects**
- Ralph's Meat Colorant
- Good Laboratory Practices Workshop
- FAPC Best Practices

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

*"The business and marketing group have continued to emphasize the programs and services that are available to the food and agricultural industries in Oklahoma."*

**Research Projects** - 4
**Extension Projects** - 47
**Key Projects**
- Recommended Foods
- Pepper Jo's
- Granna's Chili

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

*"In 2004, the FAPC Business & Marketing Program experienced more growth than in any year since I have been here."*

**Research Projects** - 2
**Extension Projects** - 43
**Key Projects**
- Ruth Huffman Designs – Garments from Buffalo Hair
- Blessetti's Gourmet Pasta Sauce

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

*"This year has been exciting from the stand-point that many of the technical projects were diverse enterprises – hay preservative, farm implement, value-added wood products, novelty and gourmet products, and of course food."*

**Research Projects** - 1
**Extension Projects** - 47
**Key Projects**
- Big River Emporium
- The Clip Key
- Osage Orange

# Faculty and Professional Staff

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

*"Deciphering slices of wheat quality– still an elusive picture."*

**Research Projects** - 5
**Extension Projects** - 5
**Key Projects**
- Study of Wheat Grain Development: A Proteomic Approach Focused on Specific Endosperm Organelles
- Developing Security to U.S. Commercial Grain Storage and Transportation Systems
- Development of Whole Grain Products

***Mandy Gross***
***Communications Specialist***
***140 FAPC***
***mandy.gross@okstate.edu***

*"We significantly increased the amount of communications and promotional materials produced in 2004 compared to previous years."*

**Research Projects** - 0
**Extension Projects** - 66
**Key Projects**
- FAPC Promotional Videos
- FAPC Web site
- Food Facts Newsletter

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

*"I'll look back on 2004 as a year in which we significantly expanded research activities and technical assistance."*

**Research Projects** - 9
**Extension Projects** - 46
**Key Projects**
- Griffin Foods Syrup Process Evaluation
- La Fontanella Foods Retortable Cheese Sauce Formulation
- Redland Juice Co. Processing Plant Start Up

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

*"We have seen good recovery in the food industry activities from the recession following 9/11."*

**Research Projects** - 4
**Extension Projects** - 30
**Key Projects**
- Grassohol - Conversion of Biomass to Ethanol
- Bar-S Waste Conversion to Energy
- Head Country Plant Expansion

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

*"One year closer to sustainable, renewable energy."*

**Research Projects** - 8
**Extension Projects** - 6
**Key Projects**
- Production of Ethanol from Sweet Sorghum
- Osmotic Dehydration of Watermelon
- Use of Processing Industry Waste as a Media Source in Xanthan Gum Fermentation Systems

# Faculty and Professional Staff

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

*"We have made a number of strides in new discoveries and information relative to the use of lactobacilli as a probiotics and bio-preservatives."*

**Research Projects** - 6
**Extension Projects** - 6
**Key Projects**
- Food Safety: Farm to Table
- Sitlington Endowed Chair Funds
- Royalty Funds from Intellectual Properties

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

*"When you see the microscopic images of the strong biofilm forming isolates of Listeria monocytogenes, it becomes very clear why this organism is so difficult to eliminate from food processing environments."*

**Research Projects** - 12
**Extension Projects** - 4
**Key Projects**
- Pre- and Post-Package Pasteurization of RTE Deli Meat
- Biofilm Analysis of *Listeria monocytogenes*
- Evaluation of Liquid Smoke as an Antimicrobial for RTE Meats

***Siobhan Reilly, Ph.D.***
***Food Microbiologist***
***105 FAPC***
***siobhan.reilly@okstate.edu***

*"I am happily involved in the continuous improvement of food and agriculture in Oklahoma."*

**Research Projects** - 5
**Extension Projects** - 2
**Key Projects**
- Influence of Gaseous Atmosphere on Morphology and Cellular Fatty Acid Compositions of *Campylobacter jejuni*
- Epidemiological Relationship of Helicobacter and Food Products
- Identification of *E. coli* from Water and Fecal Samples

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

*"We have been successful in several projects including production of activated carbon from peanut and pecan shells and cedarwood chips."*

**Research Projects** - 6
**Extension Projects** - 16
**Key Projects**
- Biocatalysis of Linoleic Acid to Conjugated Linoleic Acid
- Development of Insect Attractants from Vegetable Oils
- Value-Added Product Development from Oklahoma Grown Peanut and Pecan Shells

***Jacob Nelson***
***Meat Processing Manager***
***205 FAPC***
***jacob.nelson@okstate.edu***

*"2004 was a year of much growth relative to pilot plant research and technical assistance activities."*

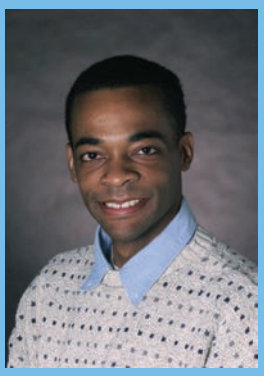
**Research Projects** - 7
**Extension Projects** - 12
**Key Projects**
- Oklahoma Specialty Beef
- The Use of a Carbon Monoxide Environment in Fresh Beef Packaging
- New Utilizations of Loins, Ribs, and Tenderloins from Freshly Slaughtered Sows

# Faculty and Professional Staff

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

*"The FAPC continues to be a resource and facilitator for entrepreneurs and small companies."*

**Research Projects** - 4
**Extension Projects** - 46
**Key Projects**
- Ham Glaze for Fundraising Sales
- Process Test Samples for an Oklahoma Meat Processor
- Scale Up and Determine Process Parameters for a Specialty Pickle Product



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

*"Various Oklahoma processors and entrepreneurs were assisted in the areas of product reformulation, scale up, and nutritional labeling."*

**Research Projects** - 0
**Extension Projects** - 17
**Key Projects**
- Determining the Stability of Dried Mushrooms
- The Reformulation of Ranch Salad Dressing

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

*"We provide an important resource to small food processing plants who have limited resources in regards to regulatory requirements and food safety."*

**Research Projects** - 0
**Extension Projects** - 31
**Key Projects**
- Carl's Chili
- Food Safety Training – Autry Tech - Enid
- Scott's Pet Treats HACCP Workshop

***Salim Hiziroglu***
***Wood Products Specialist***
***303G Ag Hall***
***hizirog@okstate.edu***

*"I worked as a visiting professor at Department of Forest Products, Kasetsart University, Thailand for teaching, research, and extension responsibilities for two months."*

**Research Projects** - 2
**Extension Projects** - 1
**Key Projects**
- Particleboard Manufacture from Bamboo, Rice Straw, and Eucalyptus in Thailand

*The FAPC faculty and professional staff may be contacted by telephone at (405) 744-6071.*
*Please feel free to contact the FAPC for more information or assistance.*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