ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS

Fiscal Year 2004

COOPERATIVE AGRICULTURAL RESEARCH CENTER

COLLEGE OF AGRICULTURE AND HUMAN SCIENCES

Prairie View A&M University

Prairie View, Texas

March 2005

TABLE OF CONTENTS

PAGE

Overview....3

Background....4

Planned Programs....5

Stakeholder Input....24

The Peer Review Process....26

Multistate Research and Extension....26

Integrated Research and Extension Activities....26

Summary of Expenditure/Fte Allocation....27

COOPERATIVE AGRICULTURAL RESEARCH CENTER

OVERVIEW

The Cooperative Agricultural Research Center (CARC) is the organizational unit within the college of Agriculture and Human Sciences at Prairie View A&M University, originally established as an agricultural experimental substation in 1947, with assigned administrative and managerial responsibilities research in the food and agricultural sciences. The Center serves to coordinate research activities in four major areas: Animal Systems, Food Systems, Plant and Environmental Systems, and Socioeconomic and Family Systems.

The **mission** of the Cooperative Agricultural Research Center is:

> To conduct basic and applied research in the Agricultural, food and social sciences to produce research information and technological developments which improves the socio-economic conditions of the clientele it serves in Texas, the nation and the world, with emphasis on the historically underserved; and
>
> to participate in and contribute to the University's land grant mission of teaching, research and service by developing and transferring scientific information, technical competencies, and human capital in the food and agricultural sciences.

The **vision** of the Cooperative Agricultural Research Center is to respond to the needs of agricultural producers, extension agents, government agencies, scientists, students, faculty, and the private sector to ensure that the best research information and technology is being developed.

Our **philosophy**: **Together We Make a Difference**

BACKGROUND

The AREERA of 1998 amended the Hatch Act of 1887, the Smith-Lever Act of 1914, and sections 1444 and 1445 of the National Agricultural Research, Extension, and Teaching Policy Act of 1977 (NARETPA) to require plans of work to be received and approved by CSREES prior to the distribution of funding authorized under these Acts. The collection of information includes 3 parts: the submission of a 5-year plan of work every five years; the submission of an annual update of the 5-year plan of work, if applicable; and, the submission of an annual report of accomplishments and results. The 5-year plan of works for fiscal years FY 2000-2004 was submitted in July 1999.

This Annual Report of Accomplishments and Results is a comprehensive statement of the Agricultural Research activities for the fiscal year 2001, as required by the Agricultural Research, Extension, and Education Reform Act of 1998 (AREERA), and as allowed under the USDA's "Guidelines for Land Grant Institution Plan of Work". This report is parallel to the 5-year Plan of Work that was approved by CSREES in July/August, 1999.

This report has been reviewed and approved by the 1890 Research Director. Therefore, all correspondences regarding this report should be directed to:

Alfred L. Parks
Research Director
Cooperative Agricultural Research Center
P.O. Box 4079
Prairie View, Texas 77446

Telephone: 936-857-2030/3809
FAX: 936-857-2325
E-Mail: Alfred_Parks@pvamu.edu

A. PLANNED PROGRAMS

National Goal 1: An agricultural system that is highly competitive in the global economy.

PROGRAM 1: Animal Systems

Overview:

The Cooperative Agricultural Research Center Coordinates research in four (4) program areas: Animal Systems, Food Systems, Plant and Environmental Systems, and Socioeconomic and Family Systems. The overall goal of the Animal Systems Program area is to increase the efficiency of production and value of farm animals. This is accomplished through research activities which generate scientific and technical information on animal production systems that are applicable locally, nationally and internationally. Key research projects are designed to improve scientific understanding of the physiological mechanisms affecting reproduction, growth and performance. These understandings are crucial for development of efficient production practices and for the promotion of a healthy and competitive livestock industry. Application of this science-based information allows for the development of humane and cost-effective practices which promote animal well-being and minimize stress. It is also necessary to produce animals which provide consumers with quality meat, milk and value-added products at an affordable price. High production efficiency is a critical element for expanding local and national markets and effectively competing in global markets.

Research Scientists at the Cooperative Agricultural Research Center have therefore established research projects that relate specifically to eight of the key themes: 1) Adding value to new and old products, 2) Agricultural Competitiveness, 3) Agricultural profitability, 4) Animal genomics, 5) Animal health, 6) Animal production efficiency, 7) Grazing, and 8) Biotechnology. The major animal specie used at our center is goats; however, much work is being done with poultry, swine, and to a lessor extent, beef cattle.

A major success of our animal systems research program is practical of the work that we do. With the repeal of mohair subsidies, for instance, goat producers are looking more to goat meat production, and value-added products from goats. Our research and technical assistance efforts are geared to address these issues. Within the last few years we have re-directed efforts to address to four (4) major areas of concern in the goat industry: 1) Grading standards for goat meat, 2) Grading standards for goat milk, 3) Marketing channels for goat meat and meat products, and 4) Improved goat genetics. The Institutional Meat Purchase Specification (IMPS) standards for fresh goats that was officially accepted by USDA has had a tremendous impact on the procurement and marketing of goat meat. It enhances efficiency thereby increasing the profitability to producers, processor, as well as retailers. The consumer benefits by getting a quality product they can rely on. Scientists at our Center are working on developing standards

for goat milk. This is a collaborative project with USDA/ARS and AMS. Results from this work will enhance the market value of goat milk.

Key Themes

1. Adding Value to New and Old Products

Research projects currently on-going at the Center address value-added products from goat milk as well as goat meat. Researchers are working on projects to develop new manufacturing parameters for goat cheese, ice cream and yogurt. Since very little goat milk is consumed as fluid milk, the demand for goats milk is derived primarily through its value-added components. Results from our work on textured parameters of goat milk allows for the manufacturing of hard-type goat cheese which have longer shelf life, and therefore greater marketability. Researchers are also looking into ways to speed the maturation and aging process of cheese.

In recent years, goat meat is becoming more and more popular as the other red meat. However, the per capita consumption of goat meat in the U.S., in comparison to other red meats is extremely small. More goat meat is consumed in "traditional" fashion primarily by distinct ethnic groups. That not withstanding, the demand for goat meat is on the rise. In fact, the available supply of goat meat from domestic supplies have been short of demand in recent years. However, preliminary data show that there is a large supply of goat meat imported from Australia, primarily as ungraded bulk carcasses. There is work to be done here as it relates to the establishment of uniform standards. IMPS standard for fresh goat meat were approved by USDA in October 2001. However, applying these standards to boxed frozen carcasses that are imported is still a challenge to the industry. Work done at our Center show that the quality of imported goat meat is inconsistent with the standards for quality as approved by USDA.

2. Agricultural Competitiveness

Improved genetics, management and new markets prepare way for small farm producers. Traditional production systems for small ruminants have been geographically located in West Texas rangelands. Unfortunately, these production areas are at great distances from primary markets on the East and West coast and in the Southeast. Greater distances to markets usually mean less profit to producers or higher prices to consumers, and, unfortunately, more middle man involvement. Within the past decade, there has been an increased awareness and demand for lean red meat, and in particular, goat meat. Paralleling this increased awareness has been the slow movement of goat production centers towards these markets. Producers in these areas are generally smaller scale land owners who are faced with different management problems than were typically encountered on Western ranges. Critical to these new producers is an understanding of better land management, low cost production systems, and direct marketing channels. Understanding the impact of genetics, management and environment is critical to a profitable (or loss) operation.

Our work with goats focus primarily on improving genetics. In our dairy goat operation we have purebreed French, Alpine and Nubians, as our base stock. Through careful selection, artificial insemination, and marker assisted selection, we have improved the quality of our herd. Dairy does from our herd have won the grand champion prize at the Houston Livestock Show and Rodeo for four of the last five years. Area producers are seeking assistance from us to provide technical assistance and advice on improving their herds. Area High School FFA/4-H chapters routinely seek our support and assistance. Each year for the past several years, dairy goats from our herd have won championship prizes at the Houston Livestock Show and Rodeo.

Recent research projects started include 1) breeding management in goats (with emphasis primarily on out-of-season breeding), and 2) production management systems (with primary emphasis on alternative feed supplements). This work is designed with a two-fold purpose in mind: a) to the stabilize supply over the course of this entire year, and b) to produce quality meat consistent with newly established grading standards for goat.

Maximizing least cost production for small land holders. Our Scientists are looking at the effects of new genetics on productivity of forage based goat production systems. Optimum land usage (ie. stocking rates), livestock rotation, forage alternatives, forage supplementation, annual forage cycles, etc. are being examined with an eye towards market/price responses. The effect of genetics and management on market responses as well as carcass quality and yields are preparing a path for producers which directs them in ways to increase profits.

Alternative breeding/production systems. Typical production systems for goat producers follow breeding programs which result in marketable goats at a time when supplies are very high (May through August each year) and prices are lowest. Annual fluctuations in production follow classical seasonal patterns of supply/demand imbalances. When supplies of marketable goats are lowest (December through April each year), prices are predictably highest. Programs at our Center are underway to assist producers in managing their breeding programs so that marketable goat meat is available at times of traditionally high market prices. Methods of genetic selection for intensive breeding programs (3 kid crops every 2 years) and for extended breeding season capabilities are now being examined for possible producer application. The results of photo stimulation work which has been widely used by dairy goat producers is now being used on meat goats with great success.

Winter grazing options. Environmental/climatic conditions found in Texas and along the entire Southern U.S. corridor provides an environment for a more extensive and cost effective production system. Fall kidding programs which supply markets with goat meat at a time of highest market prices require Fall and Winter forages to sustain production capabilities. High quality winter forages have been used well with sheep and cattle systems. Current work at our Center is looking at various types of winter forage and different breeds of goats in an effort to establish feasibility of such systems for goats.

An integrated approach. With available farmland acres decreasing each year, scientists

and producers must come up with practices which are more productive and environmentally safe. A diversified, multi-product small farm production system which optimizes resources and emphasizes environmental integrity must be pursued. More and more, urban sprawl is cutting into historical agriculture based areas. Plans for functional interfaces must be developed so that the agro-urban interactions meet the needs of both groups. Models must be developed and tested which will address the problems of such growth. Intensive, practical and profitable agricultural production systems must be developed in this type of environment. Increased productivity from smaller production units in conjunction with urban growth may bloom into direct marketing channels for creative producers. Our university is situated in one of the largest and fastest growing rural/urban interfaces (Houston) in the country. Large farms are being carved into small ranchettes (5, 10, and 15 acre parcels). Many of these newly established urban/rural dwellers are seeking alternative uses for this land. Among alternative livestock enterprises, goats seem to offer a viable alternative. Our outreach and research efforts are geared to assisting producers in defining the most effective method of rearing goats in this environment. We offer various workshops through our annual goat field day, and on other occasions as needed. Each year we attract 200-300 producers to our annual goat field day, with at least 50 percent of them being first time participants.

3. Agricultural Profitability

A very typical and legitimate question that we get from would-be goat producers is can I make money. Our work on enterprise budgeting indicate that yes goats are equally as profitable as beef cattle. However, there are still glitches in the marketing system for goats that must be worked out.

Maximizing least cost production for small land holders. Our Scientists are looking at the effects of new genetics on productivity of forage based goat production systems. Optimum land usage (ie. stocking rates), livestock rotation, forage alternatives, forage supplementation, annual forage cycles, etc. are being examined with an eye towards market/price responses. The effect of genetics and management on market responses as well as carcass quality and yields are preparing a path for producers which directs them in ways to increase profits.

An integrated approach. With available farmland acres decreasing each year, scientists and producers must come up with practices which are more productive and environmentally safe. A diversified, multi-product small farm production system which optimizes resources and emphasizes environmental integrity must be pursued. More and more, urban sprawl is cutting into historical agriculture based areas. Plans for functional interfaces must be developed so that the agro-urban interactions meet the needs of both groups. Models must be developed and tested which will address the problems of such growth. Intensive, practical and profitable agricultural production systems must be developed in this type of environment. Increased productivity from smaller production units in conjunction with urban growth may bloom into direct marketing channels for creative producers.

4. Animal Genomics

The introduction of Boer goat genetics into the U.S. (1993) has resulted in a greater awareness of goats and their market potential. Traditional goat breeds in Texas are not meaty type animals. The Boer goat, a larger frame/meaty animal, offer potentials for increased goat meat production. Also, critical to the success of improved great genetics, is the adjustment/timing of breeding programs to match market demands. As stated earlier in this report, the normal breeding cycle for goats does not correspond with the traditional peaks and valleys in goat meat demands. Alternative breeding/management projects are underway to address this problem. Boer crosses with other breeds helps in overall genetic improvement.

Alternative breeding/production systems. Typical production systems for goat producers have breeding programs which result in marketable goats at a time when supplies are very high (May through August each year) and prices are lowest. Seasonal fluctuations in production follow classical patterns of supply/demand imbalances. When supplies of marketable goats are lowest (December through April each year), prices are predictably highest. Programs at our Center are underway to show producers how in managing their breeding programs so that marketable goat meat is available at times of traditionally high market prices. Methods of genetic selection for intensive breeding programs (3 kid crops every 2 years) and for extended breeding season capabilities are now being examined for possible producer application.

With recent advances in gene mapping of livestock, the center has initiated steps for the collection, processing and conservation of semen and embryos of all breeds of goats. This endeavor is necessary in order to preserve genetic diversity in goats for future use. The International Goat Research Center currently serves as a satellite site to the National Animal Germplasm Program, centrally located in Fort Collins, CO, for the preservation and conservation of goat germplasm, in the short term. In addition to *ex situ* conservation plans, *in situ* breeding and conservation programs are underway with breeds in danger of extinction such as the Tennessee Stiff-Legged goat. Also Spanish and Boer goat genetics are being preserved. This collaborative project includes Langston University of Oklahoma, SUL Ross University, Alpine, TX, Texas A&M University, Virginia Tech University, ARS, Ft. Collins, CO, and the American Livestock Breeds Conservancy.

5. Animal Health

Our researchers are looking at animal from two perspectives: 1) Immune systems as it relates to respiratory diseases, and 2) Immune systems as it relates to parasites. The problems are particularly important in intensive rearing systems. In the cattle industry, many of these problems have been resolved. However, in goats, intensive rearing is a fairly recent phenomenon that must be addressed. We are looking at:

a) Pasteurella haemolytica – this organism is the major pathogen identified in the disease complex referred to as pneumonic pasteurellosis. It produces severe respiratory

problems in goats. The mechanism of pneumonic pasteurellosis is still unknown even though bacterial virulence factors have been identified. Our research approach is to apply the principle of "competitive exclusion" using bacterial flora from the respiratory tract to healthy animals to compete for binding site, nutrients and the production of bacteriocidins to eliminate *Pasteurella haemolytica*. Bacterial antagonism or competitive exclusion by normal bacterial flora is considered to be the main mechanism of elimination of various enteropathogens from the intestinal tract of man and animals. Our goal here is to define bacterial interactions in the controlled environment of the bioflo 3000 system so as to prevent the colonization of *Pasteurella* (Mennhemia) *haemolytica* in the respiratory tract.

b) Caprine arthritis encephalitis – is a lifelong disease characterized as a species non-specific nononcogenic retrovirus belonging to the subfamily lentivirinae. The virus has significant economic impact on the goat industry reducing the longevity of valuable animals. The virus is transmitted primarily through the ingestion of viral contaminated milk. We have identified a class of antibodies from infected goats that cleave DNA molecule. This activity can be inhibited by a viral specific protein. This research seeks to understand the biological basis for catalytic antibody activity in CAEV infected goats. We have correlated the catalytic antibody activity with disease progression in infected goats. We have now began the work on determining if the expression of DNA hydrolyzing activity is linked to the antibody response to CAEV positive sera and if it can be inhibited by a synthetic peptide corresponding to the ectodomain of gp38 transmembrane glycoprotein.

c) Caseous lymphadenitis (CLA) – Caseous lymphadenitis (CLA) is a disease in goats and sheep caused by corynebacterium pseduotuberculosis. It is characterized by fibrous incapsulated abscesses in the peripheral lymph nodes and sometimes in the lungs and other visceral organs. The progression of CLA in goats and sheep involves primary wound infection, lymphatic and hematogenous dissemination, and secondary infection of lymph nodes and various visceral organs.

The diagnosis of CLA is currently done by the synergistic hemolysis test (SHI). The SHI test is easy to perform, inexpensive, and detects antibodies formed against the exotosin of corynebacterium pseudotuberculosis. However, the test does not detect subclinically infected animals. Our scientists are working on more effective diagnostic tests and vaccines for CLA.

d) Parasites – The control of gastrointestinal parasites is a complex but important aspect of goat production in Texas. Selection of a control program is designed to identify the parasites causing problems in a particular herd. Not all parasites are the same. Intestinal parasites may be shared with other hosts or infective only to goats. Some are highly pathogenic causing debilitation or death, others are of little significance even in high numbers. Some parasites flourish in warm weather, others in cool, and a few year round. Some parasites stimulate protective resistance by the host, others do not. Drug treatments may work against all stages of some parasites but only certain stages of others. Each parasite has its own niche, some invade and destroy epithelial cells lining the intestines, others migrate through tissues. They may

be voracious blood suckers or dwell in the lumen of the digestive tract competing for nutrients in the ingesta. With so many variables, it is understandable why there is no single drug control program, or management system available to work effectively against all goat parasites and why parasite identification is so important. Once identification has been made, a control program can be developed to fit the needs of the production management system and to target specific parasites.

Two of the most important gastrointestinal parasites found in goats in Texas, whether they are raised for meat, milk, fiber production or pleasure, are *Haemonchus contortus* and coccidia.

Haemonchus contortus are the blood sucking trichostrongy lid nematodes found in the abomasum. They can cause sudden death from acute blood loss or a chronic disease characterized by anemia and protein loss resulting in animal with lowered production of meat, milk or quality fiber. The life cycle is direct proper identification of *Haemonchus* and coccidial infections if possible is essential in developing and selecting the best control program for each individual goat production operation. Well planned programs usually control but rarely eliminate parasite infections. It is therefore important to monitor the efficacy of a control program, and efforts should be made to routinely check the levels and identity of parasite infections in goat herds. Research scientists at our goat center are working closely with scientists from Texas A&M University and The Texas Veterinary Medical Diagnostic Laboratory to devise effective diagnostic techniques to reduce losses due to these diseases.

6. Animal Production Efficiency

Present: Our current research efforts have included leading a team of scientists in developing a decision support system for meat goat production. Embedded within this DSS is a goat growth simulation model, or a decision tool, to aid producers in maximizing their resources. The thrust of the simulation has been on developing a growth model incorporating the fundamental genetic processes regulating the accretion of body protein and appetite as well as energy and protein metabolism and their interaction with climate and season, temperature, nutrition, health and management on the growth and body composition and reproductive performance of individual animals. This has involved inter-disciplinary cooperative work, among the milieu of multi-disciplinary areas of genetics, nutrition, economics, physiology, reproduction, health, *et cetera*. The research team is searching to find a suitable point on the growth curve in goats (different breeds of goats) where growth would be maximized given appropriate levels of nutrition. This model will assist decision makers in making some critical decisions regarding input/output relationships.

Additional activities that have built capacity and transformed the culture of the goat center include the following: We have established criteria for meat animal research at our Center; equipped the International Goat Research Center with fenced breeding pastures and portable huts to facilitate breeding, pasture rotations and handling of goats; equipped the Center with individual feeding stalls for goat nutritional studies; provided demonstrations and answers to

clientele questions and supplied information on technical know-how; and, actively participated in annual Field Day's to demonstrate efficient goat production strategies. Our research program this past year has expanded to include local producer groups as part of our stakeholder's input. Our goal here is to see if what we are doing at our research center will work on a "real" production farm and to get advise, suggestions and feedback from producers.

7. Grazing

Our Scientists are looking at the effects of new genetics on productivity of forage based goat production systems. Optimum land usage (ie. stocking rates), livestock rotation, forage alternatives, forage supplementation, annual forage cycles, etc. are being examined with an eye towards market/price responses. The effect of genetics and management on market responses as well as carcass quality and yields are preparing a picture for producers which directs them in ways to optimize profits. The effort is being coordinated with area producers and collaborating institutions in Louisiana (LSU and Southern University). Preliminary results of this work has been presented at scientific meetings (i.e., American Society of Animal Science and the Southern Association of Agricultural Scientists).

Winter grazing options. Environmental/climatic conditions found in Texas and along the entire Southeastern U.S. corridor lend themselves to a more extensive and cost effective production system. Fall kidding programs which supply markets with goat meat at a time of highest market prices require Fall and Winter forages to sustain production capabilities. High quality winter forages have been used well with sheep and cattle systems. Current work at our Center is looking at various types of winter forage and different breeds of goats in an effort to establish feasibility of such systems for goats. In order to sustain production throughout the year, water is needed for forage growth. Water sources other than deep well supplies are being utilized to irrigate pasture lands. Surface waters trapped in tanks and reservoirs are being looked at as sources for irrigation practices. Potential problems associated with irrigation programs (foot rot, parasites, erosion, depletions, etc.) are factors that also must be taken into consideration.

An integrated approach. With available farmland acres decreasing each year, scientists and producers must come up with practices which are more productive and environmentally safe. A diversified, multi-product small farm production system which optimizes resources and emphasizes environmental integrity must be pursued. More and more, urban sprawl is cutting into historical agriculture based acreage. Plans for functional interfaces must be developed so that the agro-urban interactions meet the needs of both groups. Models must be developed and tested which will address the problems of such growth. Intensive, practical and profitable agricultural production systems must be developed in this type of environment. Increased productivity from smaller production units in conjunction with urban growth may bloom into direct marketing channels for creative producers.

8. Biotechnology

For several years we have had a number of research projects focusing on certain aspects of biotechnology. For the most part these have been externally funded projects (MBRS, CBG, NIH), nevertheless, they are an integral part of our research thrust. Projects include: "Cellular Basis for Pregnancy Recognition". The thrust of this project is to examine molecular mechanisms underlying the effects of gonadal steroids and conceptus regulatory factors on the cellular interactions which initiate placentation in ruminants. A second thrust has been "Regulation of Uterine Function During Pregnancy in Swine". This project looks at two aspects of endometrial function in swine and the factors regulating them: 1) proteins regulating conceptus/endometrial adhesion and 2) factors controlling secretion of proteins known to be required for conceptus/placental development. The basic goal of this work is to increase litter size in swine. A third project in this area entitled, "Dietary Lipid Effects on Brian Cholesterol Metabolizing Enzymes" is designed to examine the fatty acid profiles in the brain, cholesterol levels and cholesterol metabolizing enzyme activity in neonatal pigs.

Impacts:

Our research are focusing efforts on the role of specific carbohydrate antigens play in the process of cell recognition and attachment within the female reproductive tract. They have recently evaluated this work on goats. Results indicate active remodeling of the apical plasma membrane glycocalyx of caprine uterine epithelial (UE) cells occurs during the first 24 days of pregnancy. The aim of this work is to define the cellular events responsible for the establishment and maintenance of pregnancy in farm animals and use this information to enhance fertility and thereby increase the profitability of animal production systems.

A second long-term goal is to develop a decision-support system for goat production systems. Our scientists have developed a simulated computer model to define parameters of optimal input/output relationships. Results indicate that intensive feeding as an input parameter does not add to the profitability in meat goats. However, pasture grazing with supplemented feeding improves handling and management of goats.

A third major goal is to develop a gene pool (repository) for the preservation of goats. This is a collaborative effort involving several land-grant institutions and USDA agencies. The aim is to ensure to survival of genetics for goats.

A fourth goal is to develop techniques for reducing the somatic cell count in goat milk. This will enhance the opportunity for more goat milk producer to achieve grade "A" status for their milking operations, thus increasing the viability of goat milk operations.

Goal 2: **A safe and secure food and fiber system and a healthy, well nourished population; and**
Goal 3: **A Healthy, well-nourished population.**

PROGRAM 2: **Food Systems**

Overview

Texans, as well as people from other regions, and the nation, want a high quality, safe, and nutritious food supply that can maintain a healthy status and reduce the risk of illnesses and chronic diseases. The food supply must contain products that are free of pathogens and risk. It must be adequate to sustain adequate growth and development from infancy to senescence. The capability to meet this demand is determined by product development and food technology, understanding cultural diversity and its associated factors, and improved production and distribution of foods. Research in the Food Systems Program will further the understanding and significance of food quality, safety, nutrition and health that will enhance the quality of life through better food and lifestyle choices and a safer food supply.

Research scientists in the Food Systems research group are engaged in research projects that relate specifically to key themes under this broad objective: 1) Food handling, 2) Food quality, 3) Food Safety, 4) Food Borne Illnesses, 5) Food borne pathogen protection, and 6) HACCP.

On-going research activities at our Center are designed to address these issues in a very pragmatic way. This is, our research attempt to address issues that address national, international, as well as local and state concerns.

Key Themes:

1. Food Handling

The transmittal of bacteria through food handling has become an increasing national and international concern. The recent outbreak of diseases in the United States created quite a national scare. The outbreaks of such diseases as Salmonella, E. coli, mad cow, and SARS, etc. has heightened the awareness and the urgency of finding solutions to these problems.

At our research center, scientists are engaged in research to address issues related to food contamination during handling. Our primary emphasis is on meat. Because of the various ways that meats are transported, there are many ways for meat to become contaminated with bacteria. A recent survey by the Food Safety and Inspection Service indicated that whereas four percent of broilers entering processing plants tested positive for Salmonella, thirty-five percent of carcasses leaving the plants tested positive. This points to a clearly identified need for successful intervention strategies. At our poultry center one of our scientist has successfully developed a

novel approach of decontaminating poultry carcasses. Application for a patent on this process is pending at this time.

2. Food Quality

Consumers are becoming increasingly concerned about the quality and safety of the food that they eat. The proliferation of foodborne pathogens, the increasing concern about chemicals in foods, as well as mineral deficiencies in food, point to the need for research on food quality. Our researchers are engaged in research that addresses several of the issues: toxic metals, fungi, and mineral deficiencies. On-going research addresses such topics as Biocontrol of fungi contamination in food and crops, increasing the production of vitamins, minerals and hormones in plants, the control of toxic metals in soils and water, the control of oil contamination (oil spills, etc.), and the control of pesticide uptake in plants. We have started a new project that looks at the traceability of antibiotics in goat milk.

Food industry participants, from growers to servers, have always shown a genuine concern for the quality and wholesomeness of the products they deliver. Two of the biggest concerns are oxidation, especially oxidative rancidity, and microbial growth, especially foodborne pathogens. The oxidative stability of processed food products containing susceptible fats and oils is of paramount importance to the producer, processor, distributor, and consumer. The increasing complexity of the food system presents continuing challenges to enhance the oxidative stability of processed foods containing susceptible fats and oils. In order to improve and develop novel processes, scientists must better understand and evaluate parameters that are affected during processing, packaging, distribution, and storage.

Today's popularity of new products does not change the picture of food preservation. Consider, for example, the blaze of new no-fat and low-fat products hitting the market. In spite a reduction in fat, they may still need protection for whatever amount of fat remains in the product. Even non-fat products may still legally contain very small amounts of fat. It is well known that whatever their kind or origin, fats and oils have limited stability. During storage they undergo various deteriorative reactions that reduce their nutritive value and also produce volatile compounds, giving off unpleasant smells and tastes. In general, the term rancidity has been used to describe the mechanism by which lipids alter in nature, mechanisms that may have a biological or chemical origin. Among the alternation of a biological nature there are those produced by microorganisms (bacteria, fungi, yeast), which may be inhibited by the addition of preservatives, and those produced by enzymes, mainly hydrolytic rancidity or lipolysis. The latter may be inhibited by thermal treatment, by conservation at low temperature, or by reducing the percentage of water.

Alterations of a chemical nature are due to the action of oxygen. Lipid oxidation reactions, known as autooxidation, commonly occurs in lipids with a high content of unsaturated fatty acids and constitute the most common deterioration of fats used in the food industry. However, unsaturated fatty acids are not the only constituents in foods that undergo oxidation. Compounds that impart color and taste to foods, like some vitamins are also susceptible to

oxidation, the existence of double bonds in their structure being their common denominator.

It has been shown that the oxidation of unsaturated fatty acids takes place through a chain reaction that essentially consists of an initiation or induction stage, which implies the formation of free radicals and hydroperoxides; a propagation stage in which hydroperoxides and radicals intervene and by-products such as peroxides, aldehydes, ketones, acids, epoxides, polymers, and ketoglycerides, some of which are responsible for the strange smells and tastes characteristics of rancid fats, may be formed; and a final, or terminal stage, that is characterized by the interruption of the chain reaction when the free radicals disappear because of the formation of dimers or other inactive products. In the propagation stage, peroxides may also interact with proteins, pigments, and other food constituents to generate substances whose chemical nature may be harmful to human health.

One of our food scientists is looking for plant-derived (phenolic) antioxidants to aid in the reduction of oxidation (rancidity) of food products containing susceptible fats and oils. These water-soluble antixoidants derived from plant tissues are capable of reducing the peroxide level. These natural antioxidants provide more cost-effective protection from oxidation than existing natural antioxidants, and they may be used for food preservation. Implementing these findings should aid in enhancing the oxidative stability of food products containing susceptible fats and oils.

3. Food Safety

Food quality and food safety research at our Center are integral to the success of our work. Therefore, it is often difficult to distinguish one from the other. Under the previous theme of food quality, results of some of our on-going research were delineated. Additionally, there are other projects that we consider food safety related: Antibiotics in animal feed, pesticide uptake in plants, antibiotics in goats milk, contaminated animal carcasses, etc. For years, feed containing subtherapeutic levels of antibiotics has been a common practice in promoting growth in poultry. Recently, this has become a food safety issue, particularly in many European nations. A recent study to compare the effects of yeast cultures, MOS, and terramycin as growth promoters in turkeys, show promising results. This work has been reported at scientific meetings.

Another of our scientists is looking at pesticide inactivation in plants by glutamate dehydrogenase. The ability of glutamate dehydrogenase (GDH) to immerize in response to changes in the environment makes the enzyme potentially useful for the diagnosis of the response of crops to soil nutrient changes. The goal here is to better understand how nitrogen nutrients impact the nutritive value and quality of crops.

Impact:

One of our long-term goals in food safety is to reduce the incidences of foodborne illnesses by reducing contaminated animal carcasses and/or value-added products. Our

scientists have used poultry, goats, swine, and to a limited extent, beef cattle to identify practical ways of decontaminating animal carcasses. Results of our work with poultry have shown that there are simple techniques (patent pending) that handlers can use to significantly (more than 70 percent) reduce the bacterial count on poultry carcasses. This work is now being extended to pork carcasses and eggs. Preliminary work indicate that the results on pork will achieve results equal to or greater than that for poultry.

A third goal is to control the passage of antibiotics in goat milk. No conclusive evidence has been shown.

4. Foodborne Illness

In recent years there has been a proliferation of foodborne illnesses attributable to foodborne pathogens. As part of our on-going research, we are exploring ways to reduce and/eliminate the spread of such bacteria. Results of our work are promising in regards to tracking the spread of bacteria on poultry carcasses. One of our scientists has developed a technique (patent pending) to virtually eliminate such bacteria by pre-slaughter flushing and rinsing.

5. Foodborne Pathogen Protection

Because of the various ways meats are transported from the farm to the kitchen table, there are many ways for meats to become contaminated with bacteria. Consequently, contaminated meat at the kitchen table, the final step in the food-chain, makes consumers vulnerable to illnesses associated with foodborne pathogens. Once the bacteria enters the restaurant or the kitchen, the possibility of cross-contamination of other foods exists.

As part of our on-going research to increase the safety of meats for consumers we have explored the combined effects of pre-harvest flushing of the gastrointestinal (GI) tract and ready-to-cook (R.T.C.) Carcass rinsing on the reduction or elimination of entropathogens from poultry and poultry parts with significant success. One of our scientists has recently developed a novel and potentially effective and safe method of improving the safety of poultry based on the application of tropical fruit extracts on the total elimination of Salmonella from poultry carcasses and parts. This method has been tested and application for a patent has been processed.

6. HACCP:

Our HACCP plan for meat handling covers beef, goat, pork, and poultry carcasses and cut products. The plan was accepted and approved by USDA, and has been implemented as an integral part of research, teaching and outreach efforts. Provisions in the plan call for the educational intervention and training of meat processors and handlers. A series of workshops and training sessions involving area meat processors, cooperative extension workers, 4-H leaders, are conducted on an ongoing basis. The objective of these sessions is to educate the

public on proper techniques of meat handling and sanitation of equipment and facilities used in meat processing. In addition to working with local extension workers, 4-H leaders, local citizens and area school teachers have been included in the workshop as well. Also, students participating in our summer research apprentice program for high school students (RAP) are also given HACCP training.

Goal: 4: An agricultural system which protects natural resources and the environment.

Program 3: Plant and Environmental Systems

Overview:

The production of crops provides income for many Texas families. Poor management of nutrients can result in soil infertility or accumulation of toxic substances in the soil. Excessive applications of nutrients are a source of inefficiency and cost for the producer as well as a potential source of contamination of water supplies. Also, as a result of the great economic development of Texas based on both chemical and agri-chemical industries, soil and groundwater have been exposed to a variety of synthetic chemical and toxic metal wastes thus threatening public health and sustainability of the natural resource systems. In addition to man-made chemical pollutants, there are also natural contaminants (mycotoxins) in crops and soils. Toxic waste management by bioremediation and biodegradation, fundamental molecular biology of the response of plants to the chemical and physical environment, and environmentally sustainable agricultural practices are the focal points of this research program.

Research Scientists in the Plant and Environmental Systems group are engaged in projects relating to six (6) key themes: 1) Agricultural Waste Management, 2) Biological Control, 3) Natural Resources Management, 4) Nutrient Management, 5) Water Quality, and 6) Wetlands Restoration and Protection. Results of our research are encouraging as two of our scientists have developed several patents that deal specifically with biocontrol. We are engaged in collaborative projects with USDA/NRCS, the Texas Parks and Wildlife, and EPA on projects designed to protect and restore Texas Wetlands. Water quality monitoring and wetlands delineation have become major through our efforts.

Key Themes:

1. Agricultural Waste Management

Agricultural waste accounts for much of the reported cases of non-point-source pollution in Texas and the nation. Major contributors to point-source and non-point-source pollution are Concentrated Animal Feeding Operations (CAFOs) and Animal Feeding Operations (AFOs). The former are facilities housed in a relatively concentrated area, animals used for eggs, milk and meat. The main hazards from animal waste can be summarized as high levels of biochemical oxygen demand (BOD) nitrogen, phosphorus, suspended solids, microorganisms and decomposing organic matter. Several scientists at our Center are collaborating on research (TAES & ARS/USDA) to remediate and disinfect waste water from farm lagoons and dairy cattle runoff. Results from these studies are being used to implement strategies to reduce water contamination from farm runoff. We have used our own research center as a test model to develop monitoring points to track waste water runoff. Preliminary results indicate that runoff

can be carefully crafted monitoring systems. Additional work is being done at off-campus sites in the Texas coastal zones to delineate the impacts of toxins on estuaries and waterways.

2. Biocontrol

Researchers at our Center are engaged in projects to define bio-control methods to reduce toxins in plant, water and soil. A new technology (patent) has been developed at our Center that reduces toxic metals such as copper, zinc, chromium, in lakes, ponds, rivers, and in soil by up to sixty (60) present. This technology is being tested for use in large scale municipal aqueducts and sewage treatment facilities. Biocontrol methods have also been developed at our center (patent) to control oil spills and de-contaminate water from cattle dipping vats. Results of this work is being tested for commercial application. Results of this work has also shown great promise in cleaning up oil spills in the Houston ship channel. We have very recently entered into a commercial agreement with a private company to commercialize one of the products developed through this process.

3. Natural Resources Management

The world's human population is projected to double in the next 40 years, and the demand for food is projected to triple because of the growing middle class. Right now only an area the size of North American is under agricultural cultivation, but many tools are available including biotechnology, new agrochemicals, and biological controls. Expanded food production can be achieved by cultivation of crops on challenged environments. There is therefore need for the assessment of the molecular changes induced on plant metabolism by abiotic stresses. Since glutamate dehydrogenase (GDH) isomerizes in response to changes in the plant's environment, it could be used as a high through put screening (HTS) target for assessing abiotic risks imposed on plants growing in challenged environments. Also, because GDH regulates crop growth and yield, the enzyme is a determinant of the biological efficiency of plants. But the molecular mechanisms of the enzyme are not fully understood. The broad aims of the work are to elucidate the molecular mechanism of the isomerization reaction, and to apply it as a high through put screening method for assessing the response of plants to altered environments. The results will on the long-term lead to improvements in the biological efficiency of crops. To date, results have been very successful on peanuts and recent work has begun on forage crops.

4. Nutrient Management

Annual crops absorb a high percentage of mineral nutrients from the top soil thereby depleting the soil nutrients. It becomes necessary in the following cropping season to add fertilizer to the soil in order to increase crop yield. But the productivity gains achievable through fertilizer use have led to excess fertilizer application with consequent contamination of surface and ground waters. Emphasis is therefore shifting from maximizing crop yields to improving the accuracy of fertilizer recommendations. Conventional methods for making fertilizer

recommendation relies on chemical soil and plant analyses data. They do not indicate the response of plant metabolism to the nutrients. Furthermore, during crop growth, there is no method for evaluating the accuracy of the fertilizer rate applied to the crop. The consequence is that the conventional method recommends more fertilizer than the crop needs for maximum yield.

A team of our scientists have been studying the effect of fertilizer nutrients on crop metabolism with the aim to develop a method for making accurate fertilizer recommendations. The new method is based on the isoforms (isoenzymes) of glutamate dehydrogenase (GDH), an enzyme that is found in the mitochondria. The enzyme suffers differential degradation depending on the concentration of fertilizer nutrients applied to the crop. The differential degradation is visualized by displaying the isoelectric isoenzymes by native polyacrylamide gel electrophoresis followed by GDH activity staining of the gel. The method is being tested with soybeans, maize, and peanuts which are commonly cultivated in Texas.

A collaborative project in which scientists at our Center have been engaged in focus on "Systems for Sustainability of Alfalfa Production on Acid, Coastal Plain Soils Using Various Harvesting Strategies". Again, the goal here is nutrient management. Results of this work will increase the areas where alfalfa can be profitably produced in Texas.

5. Water Quality

Waste water from animal feeding operations (AFO's and CAFO's), and chemical fertilizer and pesticide applications are major contributors to point and non-point source water pollution in Texas and the nation. Research scientists at our Center are working on methods to remediate and/or disinfect water from these sources. Working in conjunction with USDA Agencies, the EPA, the Texas Agricultural Experiment Station, and the Texas Natural Resources Conservation Service, our Scientists have developed techniques and strategies to reduce water contamination from such sources. We are using our own farm as a test model site to develop an effective water runoff monitoring system.

6. Wetlands Restoration and Protection

Since climatic processes are dynamic and ever changing, wetlands, which are dependent on hydrologic cycle inputs, increase or decrease in size due to yearly and decadal alternating wet/dry cycles. Wetlands are defined based on the presence of hydrology, plants, and soils. Each of these parameters is affected by the larger climatic cycle, therefore we should expect a buffer or transition zone to exist naturally on dynamic wetland landscapes. Soil scientists have been focusing on water levels in seasonally wet and wetland soils, because the wetness conditions provide important clues to the soil features that can be used to identify seasonally wet soils during the yearly dry period.

A natural progression from research on specific wetland sites to extrapolation of the

monitoring data to the larger landscape requires selection of typical wetland sites that have soil wetness related (redox) features that are measurable on the characteristic landscape. Two important soil redox features include: 1) redox accumulations of iron (red, brown, or yellow spots) and 2) redox accumulations of manganese (black spots). These soil features can occur along soil pores (holes), on soil ped (block) faces, or in the interior of the soil blocks.

Research sponsored by the USDA-CSREES at our Center has identified zones of maximum accumulation of these soil features which can be used to define the wetland boundary and the associated wetland buffer, which at present is not used as part of the wetland size criteria. The work has expanded to include several test sites in the Gulf Coast area.

Impact:

One of our long-term goals is to reduce the amount of chemicals used in crop production. Our scientists have developed biocontrol methods to reduce the amount of synthetic chemical fertilizers needed for efficient crop production. An added benefit of reducing the level of fertilizer usage is reduced incidences of contaminated water through run off.

Our scientists are also working on methods to determine the combined effects herbicides and pesticides in plant growth. Through a technique called GDH – scientists are analyzing the effects of various combinations of pesticides and herbicides in crops.

A third goal of our research is to develop a water quality monitoring system. Our scientists have established projects to monitor the flow of water runoff within various watersheds and climatic zones. The procedure is currently using manual monitoring check points. However, GPS/GIS technology is being developed to enable researchers to monitor these sites by remote sensing. This work is a collaborative effort involving several agencies – USDA/NRCS State agencies, and Agricultural experiment stations.

Goal 5: Enhanced economic opportunities and Quality of Life for Americans

Program 4: Socioeconomic and Family Systems

Overview:

The structure of American Agriculture and Rural America is greatly impacted by the dynamics of change which include technologies (information, mechanical, etc.), family structure and function, and global economics. In order to support individuals, families and communities, especially rural communities, in adapting to change, new strategies and techniques must be employed to address these issues. Strategies that enhance the economic health of families and rural communities must be a priority. Research in social issues is required to meet the needs and challenges of an expanding and more complex set of stakeholders involved in agriculture, natural resource use, and environmental protection and enhancement. The potential problems and opportunities resulting from the multifaceted dynamics of change and how these changes impact the socioeconomic well-being of individuals and families, must be systematically analyzed for their strategic importance to the life quality of Texans.

Emerging issues in Texas converge around economic and social well-being of families. The growing obesity epidemic, particularly among the clientele we serve continues to pose problems that demand new solutions through research.

Key Themes:

Impact:

The incidence of obesity in our society has reached (by some accounts) epidemic proportions. This problem is even more acute among the African-American, Hispanic, and Native American populations. Our scientists are working on alternative strategies that influence the prevalence of obesity. Preliminary results show that lack of knowledge, socioeconomic status, and income are major factors impacting lifestyle habits that contribute to obesity.

Obesity accounts for more than $68 billion in direct health care expenses each year. From a public health perspective, the increasing prevalence of obesity and its associated conditions exerts an important and increasing impact on virtually every aspect of health care in America. Within the last two years we have began to look at obesity in three project areas: 1) Prevalence and Factors Influencing Childhood Obesity Among African-Americans and Hispanics. 2) Hypnosis: An Intervention Strategy for the Treatment of Hypertension in African-Americans. 3) An Examination of the Attitudes and Behaviors of African American College Students Toward Healthful Eating Habits.

STAKEHOLDER INPUT

The Cooperative Agricultural Research Center uses several input processes to obtain stakeholder input for purposes of designing research.

1) Joint Research and Extension field days and related activities (e.g., Annual Goal Field Day, County Extension Field Days, short courses, etc.). For twenty-two (22) years, the Cooperative Agricultural Research Center has co-sponsored an Annual Goat Field Day. For several years, this format was expanded to incorporate a full college-wide field day and open house. Evaluation sheets, suggestions were distributed and received from participants. Results indicate overwhelming interest in this activity. This annual program was held on May 1, 2004. The Annual Beef Cattle Workshop was held on June 12, 2004.

2) Co-sponsoring small farmers conferences - for several years we have co-sponsored the small farmers conference with the Texas Department of Agriculture, The Texas Landowners Association, Inc., and various other co-sponsoring entities. On October 9-11, 2003, we participated in the 20th Annual Farmers and Ranchers Conference with the Texas Landowners Association in Crockett, Texas. Over 300 farmers and ranchers participated, with issues and concerns being discussed. Several scientists from our Center conduct workshops at this program annually.

3) Participation in the Texas A&M University System Agriculture Program initiatives:

   A) The Texas Agricultural Summit Initiative. The Texas Agricultural and Natural Resources Summit Initiatives began in 1993. It is an apolitical forum for people concerned about Texas' food, fiber, and natural resource system to meet and plan for a future we all share. The Initiative is based on the principle that Texans can find workable solutions to any challenge if given an open forum in which to share ideas. The Initiative purpose is to identify and resolve critical issues facing Texas agriculture by bringing together representatives from every sector and interest. Since it's inception in 1993, the following Summits have been held: Food Safety, Nutrition and Health Summit, December 1995; Farm Bill and Beyond Summit Conference, June 1996; Environmental and Natural Resource Policy for the 21st Century Summit Conference, November 1996; Rice Summit Conference, February 1997; Financing Texas Agriculture Summit Conference, May 1998; Texas Forestry: Preparing for the 21st Century, June 1999; Agricultural Biotechnology and Genomics Summit, October 1999. The 2001 Summit focused on Agricultural Policy (i.e., the Farm Bill) with the U.S. Secretary of Agriculture in attendance.

   B) Texas Community Futures Forum. The Texas Community Futures Forum

(TCFF), is a statewide process begun in January 1999, that identifies priority issues and needs in all 254 Texas counties. A form of the TCFF has been used for long-range program planning since 1985, and is a broad assessment of needs sponsored by the Texas Cooperative Extension and the Texas A&M University System's network of county, district, and state faculty. The TCFF engages citizens, experts and staff from local and state agencies to plan for the next 3-5 years.

C) Texas Community Leadership Forums – In 2000, The Texas Agricultural and Natural Resources Summit Initiative shifted to a new format called the Texas Community Leadership forums. These forums are designed to be more inclusive of grass-roots input and are held monthly at the county level. Representatives from our College and our Research Center are active participants in these sessions.

D) USDA Sponsored Workshop – When available, CARC scientists participate in various USDA sponsored workshops.

E) Advisory Committees – Many of our scientists, including the Research Director, who is a member of the ESCOP-PC, the SRDC Advisory Committee, and the Texas Department of Agriculture Organic Standards Committee, routinely participate on various advisory committees. Ideas are gathered at these meetings and are brought back and shared among other scientists. We also are members of Council of Ag. Administrators of the Texas A&M University System Ag. Program.

F) Bi-Weekly Staff Seminar Series – Our Center conducts a bi-weekly seminar series. Each scientist is required to present a minimum of one seminar per year before their colleagues. External speakers are invited on a regular basis to share around topical issues.

G) Professional Conferences, Workshops, Short Courses – All center scientists are required to participate annually in a minimum of one professional conference. This is where new ideas are gathered.

H) Business/Industry Cluster – Our Center Research Director is a member of the Executive Committee of our campus cluster committee. Over fifty (50) private sector companies are members of this cluster. As a result, at least one cluster company is currently contributing to our research program.

THE PEER REVIEW PROCESS

1) Merit Review

All funded projects, either Evans-Allen, Experiment Station (Hatch), or State Matching, undergo a scientific review process. Each scientist (or faculty) when submitting a proposal for funding support, must submit the name of at least two qualified individuals to provide technical review of the project. Additionally, the Research Director selects individuals to serve as members of an internal review panel in consultation with the University's Vice President for Research and Development. At minimum, three individuals review and evaluate each proposed project prior to approval for external submittal and /or internal fund allocation. From August to October 2000, a consultant and consulting team was hired to evaluate the operations of the Center against its plan of work and funding guidelines. Recommendations from this committee have now been incorporated into the program.

2) Scientific Peer Review

All research proposals submitted for funding (including CRIS projects) must show evidence of one or more external reviews. Written comments should be included with final proposals for campus routing. Routing proposals through quality control check points (Research Director –> Dean of the College –> Vice President for Research) are designed to ensure that proposal meet RFP guidelines as well as meet scientific merit qualifications. All proposals are quality checked by our on campus Office of Sponsored Programs.

MULTISTATE RESEARCH AND EXTENSION

We are currently engaged in three multistate research project. The first project is designed to investigate alternative breeding and production systems for goats. Institutions involved include LSU and Southern University of Baton Rouge, LA. Results of this work have been reported at recent scientific meetings. A second project which focus on the preservation of Goat Genetics involve institutions in two (2) states Texas and Oklahoma, and one USDA Agency (ARS) in Colorado.

INTEGRATED RESEARCH AND EXTENSION ACTIVITIES

* Houston Livestock Show and Goat Show, February 28, 2004 - March 21, 2004

* Annual Goat Field Day, May 1, 2004

* Beef Cattle Workshop, June 12, 2004

* Cropping with Biotechnology, June 13-15, 2004

* Landowners Association of Texas, Inc's, Annual Small Farm Conference, October 7-9, 2004, Crockett, Texas

* Jointly appointed Research Scientists/Extension Specialists

A third project, which is a Sec 401 IFAFS Project is a multistate, multi-institutional, multifunctional project, involving twelve (12) 1890 Institutions. The focus of this project is education, research and outreach on Biotechnology Education.

* Jointly appointed Research Specialist/Extension Specialist in 4-H and Youth Development - Goats (one in 4-H Goat currently on staff)

* Joint IFAFS (Sec. 401) proposal funded in FY 2000; this project ends in March 2005.

Summary of Expenditure Fte
Allocation by Goal and Program Area

	Goal 1	**Goal 2**	**Goal 3**	**Goal 4**	**Goal 5**
Funding by Source	Program 1	Program 2	Program 2	Program 3	Program 4
Evans-Allen	$1,419,560	$425,891	$425,891	$812,546	$77,524
State Matching	$687,372	$274,566	$274,567	$362,160	$300,770
Subtotal	$2,106,932	$700,457	$700,458	$1,174,706	$378,294
Fte Allocation	22.39	6.71	6.71	12.68	2.23