ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS

Fiscal Year 2000

COOPERATIVE AGRICULTURAL RESEARCH CENTER

COLLEGE OF AGRICULTURE AND HUMAN SCIENCES

Prairie View A&M University

Prairie View, Texas

March 2001

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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, techni cal 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.

The **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 2000, 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:

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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 Science, Food Systems, Plant and Environmental Systems, and Socioeconomic and Family Systems. The overall goal of the Animal Systems Program areas is to increase the efficiency of producing food from animals. This is accomplished through research activities whi ch 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 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 developm ent of humane and cost-effective production practices which promote animal well-being and minimize stress. It is also necessary to produce animals which provide consumers with the quality meat, milk and value-added products at an affordable cost. 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 been engaged in research projects that related specifically to seven 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, and 7) grazing. The major animal specie u sed at our center is goats; however, some work is being done with beef cattle, poultry, and swine as well. Most research projects are designed to provide practical information as well as generate basic scientific information.

A major success of our goat research program is that goat producers are looking to us for practical ways to make goat production a viable enterprise. With the repeal of mohair subsidies, goat producers are looking more to goat meat production, and value-added products from goat milk. Our research and technical assistance efforts are geared to address these issues. Within the last two years we have re-directed efforts to address to three (3) major areas of concern in the goat industry: 1) Grading standards for goat meat, 2) Grading standards for goat milk, and 3) Marketing channels for goat meat. A draft set of grading standards for goat meat have been submitted to USDA/AMS, and are currently under review. A new research project was initiated this year to develop standards for goat milk. This is a collaborative project with USDA/ARS and AMS. No results are available at this time. And just recently, a pilot project has started to develop preliminary data on marketing channels for goat meat.

Key Themes

1. Adding Value to New and Old Products

Goat (Caprine) research is a major part of our total research program. In 1983 we established the International Dairy Goat Research Center on our campus. In 1991 a meat goat component was added to the emphasis at the Center. In 1993 Boer goats were brought to the Center, and thus a major emphasis has been placed on meat goat research since that time.

Research projects currently on-going at the Center address value-added products from goat milk as well as goat meat. Goat milk projects are geared primarily to developing new manufacturing parameters for cheese, ice cream and yogurt. The reason being is that very little goat milk is consumed as fluid milk. Consequently, if the dairy component of the goat industry is to thrive, value-added products must be developed. Results from our work indicate that there are textured parameters of goat milk which allows for the manufacturing of hard-type goat cheese which have longer shelf life, and therefore greater marketability. Goat milk has unique odors and flavors that are preferred by gourmet consumers. However, in order to gain widespread acceptance, more acceptable flavors must be found. Research efforts are also under investigation to address these issues.

The per capita consumption of goat meat in the U.S., in comparison to other meats is extremely small. Most goat meat is consumed in "traditional" fashion primarily by distinct ethnic groups. Interest, however, in goat meat has increased in recent years. The available supply of goat meat from domestic supplies is far short of demand. Prior to 1992, the U.S. was a net exporter of goat meat. However, since 1992, domestic supplies of goat meat has fallen short of domestic demand (FAS data). We have recently begun to address this issue by investigating alternative marketing channels for goat meat.

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 are typically encountered on West Texas ranges. Critical to these new producers is an understanding of better land management, low cost production systems, and direct marketing channels and potential. Understanding the impact of genetics, management and environment is critical to profit (or loss) for an operation.

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 picture for producers which directs them in ways to optimize profits.

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. Annual fluctuations in production follow classical patterns of supply and demand. When supplies of marketable goats are lowest (December through April each year), prices are predictable highest. Programs at our Center are underway to show producers how to manage their breeding programs to 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.

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 feed 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.) Will be studied over the next several years.

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.

3. Agricultural Profitability

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4. Animal Genomics

The introduction of Boer goat genetics into the U.S. (199e) has resulted in a greater awareness of meat goats and their market potential. Traditional goat breeds in Texas are not meaty type animals. The Boer goat, a larger frame/meat y animal, offer potentials for increased goat meat production. Also, critical to the success of improved great genetics, is the adjustment/timing of breeding programs.

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With recent advances in genome mapping of humans and livestock, the center has initiated activities into the collection, processing and conservation of semen and embryos of all breeds of goats. This activity is necessary to preserve genetic diversity in goats for future use. The International Goat Research Center will serve as a satellite 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 herds are being maintained.

5. Animal Health

Researchers at our Center are engaged in research focusing on two areas: 1) Respiratory diseases, and 2) parasites. Respiratory problems in goat husbandry is particularly important in intensive rearing systems. Our scientists are focusing primarily on four problem areas:

a) Pasteurella haemolytics – this organism is the major pathogen identified in the disease complex referred to as pneumonic pasteurellosis. The organism produce 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.

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 seek to understand the biological basis for catalytic antibody activity in CAEV infected goats. We are in the process of correlating catalytic antibody activity with disease progression in infected goats.

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 animals. Our scientists are working on more effective diagnostic tests and vaccines for CLA.

d) Parasites – Control of gastrointestinal parasites is a complex but important aspect of goat production in Texas. Selection of a control program beings with identify ing 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 signif icance 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 identifi cation 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.

After a brief review of the diseases associated with each organism and how they are transmitted, techniques for diagnosing these pathogens will be discussed.

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 a poor doing animal with lowered production of meat, milk or quality fiber. The life cycle is direct proper identification of *Haemonchus* and coccidial infections is possible and 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.

6. Animal Production Efficiency

There has been increased interest in goat meat production and consumption in recent years. The elimination of the National Wool and Mohair Act in 1993, and the almost simultaneous introduction of the Boer goat, has heightened the awareness among goat producers of the potential of meat goats as a viable alternative. Our scientists have been involved in meat goat research since 1991. In 1993 we brought Boer goats to our center and have used them in our breeding programs since that time.

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 enter-disciplinary cooperative work. Among 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 give appropriate level of nutrition.

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.

7. Grazing

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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 senescent. 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 outbreak of E. coli in the United States created quite a national scare. Since that time, the outbreaks of Salmonella, E. coli, etc. has become all too frequent.

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.

In January 2000 we adopted a HACCP plant for meat handling. The plan covers beef, goat, pork, and poultry products. It was accepted and approved by The Food Safety and Inspection Service.

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.

At our Center, 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 pesticides uptake in plants.

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 what ever their kind and 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.

Alternations 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.

Results from on-going research has led to four (4) patents, with three (3) patents pending. The commercial application of these patents will provide great economic as well as food quality and safety benefits to society.

3. Food Safety

Food quality and food safety research at our Center are integral parts and parcel of the same. 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, and pesticide uptake in plants.

Within the past year, one of our researchers have began to search for viable alternatives to growth promoting antibiotics in poultry. 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.

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.

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.

6. HACCP:

On January 13, 2000 we submitted a HACCP plan for meat handling to the Food Safety and Inspection Service of USDA. The plan covers beef, goat, pork, and poultry carcasses and cut products. The plan was accepted and approved.

Provisions in the plan call for the educational intervention and training of meat processo rs and handlers. A series of workshops and training sessions involving area meat processors, cooperative extension workers, 4-H leaders, and citizens are currently on-going. The objective of these sessions is to educate on proper techniques of meat and sanitation of equipment and facilities used in meat processing.

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 bio remediation and biodegradation, fundamental molecular biology of the response of plants to the chemical and physical environment, and environmentally sustainable agricultural practices will be 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 in two of our scientists have developed two 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.

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 that house 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 will be used to implement strategies to reduce water contamination from farm runoff.

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.

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. Because glutamate dehydrogenase (GDH) isomerizes in response to changes in the plant's environment, it could be used as a high throughput 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 this project are to elucidate the molecular mechanism of the isomerization reaction, and to apply it as a high throughput 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.

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 method 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 differenti al 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.

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, Scientists have developed techniques and strategies to reduce water contamination from such sources.

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 focused 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 of Prairie View A&M University 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.

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

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 issues of family well being, child care, and literacy and human capital development are especially important. Growing urbanization of Texas and the decline of rural communities and their infrastructure continues to pose problems that demand new solutions through research.

Key Themes:

1. Child Care/Dependent Care

Child care providers from a six county area, including metropolitan Houston area engage in workshops designed to provide updates on current critical issues impacting the provision of quality care for children in varied settings. Participants earn continuing education and/or in-service credit for participation. Audience size averages 300-500 individuals in management to care providers. Conference is conducted for 8 hour period in early spring with focus group concurrent workshops.

Co-sponsors: 1) College of agriculture and Human Sciences, 2) Cooperative Agricultural Research Center; 3) Cooperative Extension Programs, 4) Texas Agricultural Extension Service, 5) HGAC-Houston-Galveston Area Council, and 6) Child Care Licensing.

2. Children, Youth and Families at Risk, 2) Conflict Management, 3) Parenting, 4) Communication Skills.

Program activities focuses on helping youth learn conflict resolution skills that minimize or eliminate the use of violence. Effective communication skills among peers and with adults, especially parents and siblings, is stressed. Program is delivered to forty each of rural and urban youth grades 5-8 in an after school setting. Area school facilities are used and teachers and counselors within the respective school setting provide guidance regarding individual needs of participants. Academic

enhancement, homework guidance, personal/social development, career awareness, and recreation are encouraged. Parent participation is required to foster enhancement of parent-child interaction, parental involvement with school based programs, increased awareness of academic needs, and improvement of general parenting skills, especially discipline. Youth participants demonstrated improved grades, improved state mandated test scores, fewer in-school conflict, and improved overall attendance. Parents demonstrated increased awareness of roles and responsibilities, involvement with school related activities, and heightened awareness of community services available to support families at risk.

Co-sponsor: Primary funding through Office of Minority Health , Department of Health and Human Services. Co-Participants: College of Agriculture and Human Sciences, and College of Nursing, PVAMU.

3. Community Development Impact of Change on Rural Communities, Leadership Training and Development

Monthly training sessions that focus on enhancing participant awareness of rural community needs and available resources to support problem resolution primary focus on five counties surrounding PVAMU. Individuals are encouraged to pool human and material resources to achi eve mutual goals.

Rural economic development workshops are designed to engage a larger spectrum of rural communities served by the Houston Galveston Area Council (13 counties). Focus of activities are on engaging at-risk populations within these countie s to acquire the skills to provide leadership for individual, family and community economic development. Specific needs have been identified and will guide development of priority programs that focus on solving problems.

Co-Sponsor: Economic Developme nt Agency of Rural Development.

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 activi ties (e.g., Annual Goal Field Day, County Extension Field Days, short courses, etc.). For eighteen (18) years, the Cooperative Agricultural Research Center has co-sponsored an Annual Goat Field Day. On May 5-6, 2000 this format was expanded to incorporate a full college-wide field day and open house. Evaluation sheets, suggestions, are distributed and received from participants. On May 12, 2000, we co-sponsored a beef cattle workshop for area beef cattle producers. Issues specific to beef cattle producers were addressed at this workshop.

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 13-14, 2000, we co-sponsored the 16th Annual Farmers and Ranchers Conference with the Texas Landowners Association in Humble, Texas. Over 200 farmers and ranchers participated, with issues and concerns being discussed.

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

4) 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.

5) 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 Agricultural Extension Service 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.

6) 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 forms are designed to be more inclusive of grass-roots input and are held monthly at the county level.

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

8) 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.

9) 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.

10) 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.

11) Business/Industry Cluster – Our Center Research Director is a member of the Executive Committee of our campus cluster committee. Over forty (40) private sector companies are members of this cluster.

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 p roposal 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.

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.

MULTISTATE RESEARCH AND EXTENSION

We are currently engaged in one multistate research project. The project is designed to investigate alternative breeding and production systems for goat. Institutions involved include TSU and Southern University of Baton Rouge, LA. In FY 2000 scientists from our Center participated in writing several multistate research proposals (e.g. Sec. 401; Sec. 406; NRI).

INTEGRATED RESEARCH AND EXTENSION ACTIVITIES

* Annual Goat Field Day, May 5-6, 2000
* Beef Cattle Field Day, May 12, 2000
* County level farmers field day(s), (various dates)
* Small Farmers Conference, October 13-14, 2000
* Jointly appointed Research Scientist/Extension Specialist (one for beef cattle being recruited for)

* 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 development in FY 2000 (participated jointly with extension in writing three proposals); (one funded)

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	$1,218,897	$328,947	$328,947	$714,385	$73,822
State Matching	$256,071	$71,235	$71,235	$149,881	$15,516
Subtotal	$1,474,968	$400,182	$400,182	$864,268	$89,338
Fte Allocation	24.0	7.9	7.9	9.8	2.4