Small Ruminant Research

The Georgia Small Ruminant Research and Extension Center (GSRREC) is the largest facility of its kind east of the Mississippi River and is recognized as a national leader in goat research. Since 1986, GSRREC scientists have studied reproductive performance, embryo transfer technology, forage utilization and nutritive efficiency, lactation physiology, and gastrointestinal parasitology in goats. Small ruminant scientists, producers, and individuals interested in goat production from all over the world visit GSRREC to learn about our research programs.

Current programs include biological control of internal parasites, evaluation of basic roughages and dietary supplements for dairy and meat goats, development of year-round grazing systems, genetic-marker assisted selection for internal parasite control in sheep, invasive vegetation management with sheep and goats, breed characterization and genotype x environment interaction studies with meat goats and sheep, improving meat goat management methods, improving meat quality using pre- and post-slaughter methodologies, developing value-added meat and dairy products, and food safety.

One of the most important findings in dairy technology research at FVSU is that goat milk cheeses can be frozen-stored and then can be marketed later during the off-season. The traditional belief is that goat cheeses cannot be frozen because of quality deterioration, but our research has proven that it can be done if parameters are tightly controlled. This finding is very important because the seasonality of goat milk production has limited dairy goat farmers' ability to produce a year-round supply of goat products, which is needed for consistent marketing and the survival and profitability of their businesses.

A state-of-the-art meat technology facility was built on the FVSU campus in 1998 to assist in animal science undergraduate and graduate instruction, to establish and maintain an internationally recognized chevon (goat meat) technology research program, and to provide service to the community. Current meat research projects focus on evaluating pre- and post-slaughter methodologies that improve chevon quality and food safety. A major thrust is on the development of value-added products using chevon to improve public perception and expand the existing market for goat meat.

FVSU is the lead institution for the American Consortium for Small Ruminant Parasite Control (ACSRPC), an international research group dedicated to finding non-chemical methods of controlling gastrointestinal nematodes in sheep and goats. Parasitology research at GSRREC and the 25 other institutions of the ACSRPC have greatly impacted small ruminant producers in the US and overseas by reducing dependence on expensive, ineffective anthelmintic drugs.

In addition to research, the Center's ongoing demonstrations, seminars and workshops provide producers and county agents across the country with the latest information on goats and other small ruminants. Outreach activities at the Meat Technology Center include providing custom slaughter services to farmers in the community, training very small producers and processors on food safety principles, and advising goat producers on pre-harvest management and post-harvest methodologies to improve chevon quality, marketability, and food safety.

Bioenergy and Climate Change

Bioenergy research is focused on sustainable alternatives to fossil fuels without infringing upon land and crops used for food production. By selecting biofuel crops with the ability to utilize marginal soils, these underutilized farm resources can be used to supplement farm income by supplying cellulosic biomass or stalk juice to biorefineries or by producing ethanol on farm.

Construction of a commercial biofuel plant is expensive and requires continuous operation throughout the year to obtain satisfactory return on investment. Long-term storage of bulky biomass feedstock is too expensive. Biofuel feedstock demand for a sustainable operation is substantial and can only be met by continuous supply of annual and perennial crops and high biomass trees.

Studies are being conducted at FVSU to address these issues using annual crops like sweet sorghum, forage sorghum and pearl millet, perennial crops like energycane, napiergrass, giant reed, and switchgrass, and woody biomass trees, like paulownia. Our research findings will establish the optimum level and mode of nitrogen input to maintain sustainable production of biofuel feedstocks from annual and perennial crops suitable for marginal soils of the southern Coastal Plain. The research will also provide guidance on suitable harvesting and handling modules for these crops.

Evaluating the physical, chemical and bulk characteristics of selected crops will help produce drop-in transportation biofuels and other co-products. Developing comprehensive life cycle assessment models to quantify the economic and environmental benefits of bioenergy crop production systems will help farmers' decision making in production of low-input biomass crops.

Paulownia, a fast growing tree that can grow on flat or mountainous land and in various types of soils, can attain 2 meters in height and 4-5 cm diameter per year. Major limitations of solid biomass fuels such as wood are difficulty in handling and portability. To address these issues, research is carried out to convert solid biomass into liquid and gaseous fuels. Biological (fermentation) and/or chemical means (pyrolysis, gasification) can be used to produce fluid biomass fuels. Densification characteristics of bioenergy crops are also studied in order to produce highly durable pellets/briquettes. Research at FVSU will address the feasibility of developing paulownia as a dedicated lignocellulosic energy crop for producing biomass.

Specialty Plant Biotechnology

According to the USDA National Institute of Food and Agriculture, biotechnology is a set of techniques used to adapt plants, microbes, and animals for specific situations. Cellular biotechnologies include tissue culture and fermentation. Genetic biotechnologies include genomics, molecular-assisted selection, and transgenic crops (genetic engineering). Plants, as the base for the ecological food chain, serve as the structural and functional foundation of natural and managed systems. Fresh and processed products derived from specialty crops make vital contributions to human health and well-being and contribute to economic sustainability of many rural communities around the world. Domestic market value of specialty crops surpasses $45 billion annually or approximately half of the total national crop production value. Exports of specialty crop products are increasing, with global per capita production and consumption rapidly expanding. The tremendous contribution of specialty crops to human health and wellbeing is evident in the recent revision of the food pyramid– three of the five recommended food groups are built around specialty crops.

FVSU is a national leader in development of specialty crop research and academic programs. Current research in specialty plant biotechnology at FVSU includes:

Scutellaria
- Germplasm collection
- Conservation
- Anti-tumor compounds
- Antioxidant properties
- Reproductive biology
- Micropropagation
- Genetic and metabolic engineering

Bacopa
- Micropropagation
- Genetic transformation
- *in vitro* conservation

Stevia
- Feasibility and cost effectiveness of direct seeding vs. transplanting
- Intercropping to enhance profitability
- Monitoring and improving sweetness agents

Paulownia
- Short rotation fast growing multipurpose tree for honey production
- Leaf for fodder
- Medicinal uses
- Reproductive biology

Food Safety

Strategies that reduce food-borne pathogens in the animal prior to processing for meat could reduce incidences of human exposure to these organisms. The gastrointestinal tracts of sheep and goats are natural reservoirs of *E. coli*. Fecal shedding in live animals is correlated with carcass contamination. Lambs are often fed a finishing grain-based ration in order to improve productivity. However, meat goats are predominantly fed a roughage diet until slaughter. Shedding of *E. coli* by ruminants is influenced by the diet and therefore dietary changes in food animals during the days prior to slaughter may reduce fecal shedding of bacteria.

Pre-harvest dietary management will serve as a cost-effective decontamination strategy in small ruminant production systems, particularly for goat processing enterprises, since most of the goat processors in the southern states operate with moderate resources and limited technology. Research conducted at FVSU include manipulating pre-harvest feed deprivation time, diet (concentrate vs. roughage), and diet change from hay to concentrate. Pre-harvest management methodologies can be implemented with virtually no additional operational costs to the farmers. These management methods are also expected to enhance marketability and profitability by improving the shelf life of carcasses and products.

FVSU researchers are also studying other cost-effective pathogen reduction strategies that can be adopted by small and very small processing facilities. Our goal is to determine and compare the microbiological characteristics of spray washing live goats and goat carcasses with ozonated water, electrolyzed oxidizing water, or salt water, as well as to determine the effects of such treatments on subsequent meat quality characteristics. Scientists are also conducting feasibility and economic cost-benefit analyses of introducing these technologies into goat slaughter establishments and meat processing facilities as strategies to inactivate foodborne microorganisms.

In FVSU's food engineering laboratories, researchers are working on finding novel methods to kill pathogens without using heat. Using non-thermal methods for destroying pathogens allows us to decontaminate food without damaging the products. The food industry wants to ensure the safety of its products while maintaining quality. FVSU scientists applied low voltage electric current to meat samples contaminated with *E. coli*, covered with a thin film of table salt solution. Exposure of contaminated meat to electric current destabilized bacterial cell membranes, and with sufficient current intensity and duration of treatment, cell membranes were irreversibly damaged, important cellular compounds leaked out, and the *E. coli* organisms were killed. The low voltage current reduced *E. coli* by 98.9% in 16 minutes. Further research is required to see how this technology can be implemented in commercial operations such as meat processing plants.

Agricultural Economics

The majority of farms in Georgia are classified as small farms which are characterized by low profitability due to high production costs. The Agricultural Economics Program at FVSU conducts research on the economic and social development of small, limited resource, minority, women, new and beginning farmers in Georgia. Research projects include: value addition through labeling, economics of organic farming, estimating the marketing potential of meat goats and demand for goat meat, food safety and food security issues, and childhood obesity. Interdisciplinary research on cost and benefit analyses of innovative research findings are also being conducted.

Developing and understanding structural elements and consumer preferences for organic fruits and vegetables and nontraditional agricultural products has been a focus of our recent research work. This effort will identify structural problems that exist in various markets and enhance producer and consumer decision making relative to revenue and food choices.

The practice and study of food safety is experiencing a shift from Hazard Analysis and Critical Control Points (HACCP) System to Country of Origin Labeling (COOL) and traceability. HACCP has been the primary response to food safety in the U.S. for many years and was mainly confined to the processing period, whereas COOL and traceability meet the new demand for surveillances and control over food safety along the whole food supply chain. The shift from HACCP to COOL challenged all agents and researchers by bringing about an extensive collection of food safety information and changes in the way information should be handled. FVSU research focuses on information aimed at choices to be made within the framework of COOL and Farm-to-Fork analyses. The results will have significant implications for development of food safety policies.