Agricultural Research Impacts

2012

College of Agriculture, Human and Natural Sciences

Tennessee State University

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College of Agriculture, Human and Natural Sciences

Tennessee State University
3500 John A Merritt Blvd.
Nashville, TN 37209

Dr. Chandra Reddy, Dean
creddy@tnstate.edu
615-963-7561

Dr. Carter Catlin
Associate Dean of Research
615-963-5819
ccatlin@tnstate.edu

Dr. Latif Lighari
Associate Dean of Extension
615-963-5526
llighari@tnstate.edu

Department of Agricultural and Environmental Sciences

Dr. Surendra Singh
Interim Department Head
615-963-5435
ssingh@tnstate.edu

Department of Family and Consumer Sciences

Dr. Geraldean Johnson
Department Head
615-963-5617
gejohnson@tnstate.edu

Department of Biological Sciences

Dr. Terrance Johnson
Department Head
615-963-5748
tjohnson@tnstate.edu

Department of Chemistry

Dr. Muhammad Karim
Department Head
615-963-5344
mkarim@tnstate.edu

Otis L. Floyd Nursery Research Center

Dr. Nick Gawel
472 Cadillac Lane
McMinnville, TN 37110
931-668-3233
ngawel@tnstate.edu

Agricultural Research and Education Centers Nashville and Ashland City

Dr. Roger Suave
3101 River Road
Ashland City, TN 37015
615-963-5828
rsuave@tnstate.edu

- Editorial Project Manager: Elizabeth Noakes and Nick Gawel
- Content Coordinator and Designer: Beverley Kreul
- Photographer: John Cross and Tim Hooper
- Contributing Writers: TSU Faculty and Researchers

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A MESSAGE FROM THE DEAN

Dr. Chandra Reddy

During this historic, centennial year at Tennessee State University, we are proud to launch this annual publication, *Research Impacts*, from the College of Agriculture, Human and Natural Sciences.

Agricultural research at Tennessee State University began modestly when federal dollars first became available in 1967. In recent years, the State of Tennessee has matched these funds, which has increased our reach and effectiveness. These investments have significantly strengthened TSU's agricultural research portfolio. This past year, the College's faculty garnered the highest external grant funding we ever had, which placed Tennessee State University as the leading agricultural research and extension grantee among 1890 Universities. Our research is now conducted through our academic departments, a network of three Agricultural Research and Education Centers, the Center for Prevention Research, and the Institute of Food, Agricultural and Environmental Research.

The food and agriculture research at TSU directly aligns with the NIFA/USDA priorities of food security, environmental sustainability, bio-energy, nutrition, and human health. Research also focuses on local needs like nursery production and youth and community development. The faculty in our College conduct meaningful research and generate results of immediate and long-term benefit to stakeholders. Graduate and undergraduate students are a big part of this research, along with the support provided by the College's technical staff.

This publication captures some highlights of their findings and impacts.

Mission

Your future drives our mission at Tennessee State University. As an Historically Black College/ University (HBCU), TSU fosters scholarly inquiry and research, lifelong learning, and a commitment to service.

Building on our heritage of strong instruction and solid research, we prepare you for leadership, professional success, personal achievement and service to local, national and international communities in our global society.

At Tennessee State University, you're the focus of our motto -- Think. Work. Serve. -- and the beneficiary of our core values:

- Excellence
- Learning
- Accountability
- Integrity
- Shared Governance
- Diversity
- Service

Through the education you receive at TSU, you'll grow and develop as a person who appreciates cultural diversity, embodies a sense of civic and social responsibility, and is well prepared to fulfill your life's goals.

Overview

Tennessee State University

College of Agriculture, Human and Natural Sciences

Tennessee's agricultural industry is diverse in nature — a characteristic greatly celebrated by researchers at Tennessee State University's College of Agriculture, Human and Natural Sciences.

With nearly 20 percent of all jobs throughout the nation being directly related to the agricultural industry, TSU has worked to become a leading research institution to serve all agricultural stakeholders including students and faculty.

Our faculty conduct research to provide our students with hands-on, real world training for their future careers, and to solve problems facing our state, nation and world.

Through innovative research, we address the needs of fellow Tennesseans, focus on finding solutions to challenges faced by socially and economically disadvantaged groups, and contribute to the prosperity of the citizens of Tennessee and the nation. All research programs are designed to include experiential learning opportunities for undergraduate and graduate students, and all offer the opportunity for student employment.

Our state-of-the-art research facilities include more than 52,000 sq. ft. of laboratory and office space on the main campus and the Otis L. Floyd Nursery Research Center in McMinnville, Tenn., plus more than 600 acres of field research space. In addition to the College's facilities, students and faculty utilize the TSU Core Facilities, a new $2 million laboratory for scanning electron microscopy, flow cytometry, protenomics and nano-technology research.

100

founded in 1912, Tennessee State University and the College of Agriculture, Human and Natural Sciences celebrated 100 years of excellence in 2012.

TSU is a comprehensive, urban, coeducational, **land-grant university** that offers more than **77** undergraduate, graduate and doctoral degrees. The uniqueness of our urban location coupled with out **network of research facilities** provides students with unique and marketable hands-on experience through research projects and industry internships.

What's Online

Find out more information on the college at tnstate.edu/agriculture

How does TSU research impact Tennessee?

Research on the majority of the state's row crops (corn, cotton, soybean and wheat) is conducted on the flat, tillable land of **West Tennessee.**

Middle Tennessee is known for its rolling hills and lush pastures, which are perfect conditions to study livestock and nursery crops.

Tobacco, goats and dairy cows are primarily studied in the more uneven and mountainous terrain in **East Tennessee.**

■ Tennessee State University Cooperative Extension County Locations

Agriculture Research Centers

The College of Agriculture, Human and Natural Sciences utilizes 3 research locations including TSU's main campus, the Ashland City Agricultural Research and Extension Center and the Otis L. Floyd Nursery Research Center.

GROUNDBREAKING

Summer 2012, TSU broke ground on a new 30,000 sq. ft. Agricultural Biotechnology Research Building.

52,000

square feet of laboratory and office space are utilized for research on TSU's main campus.

600

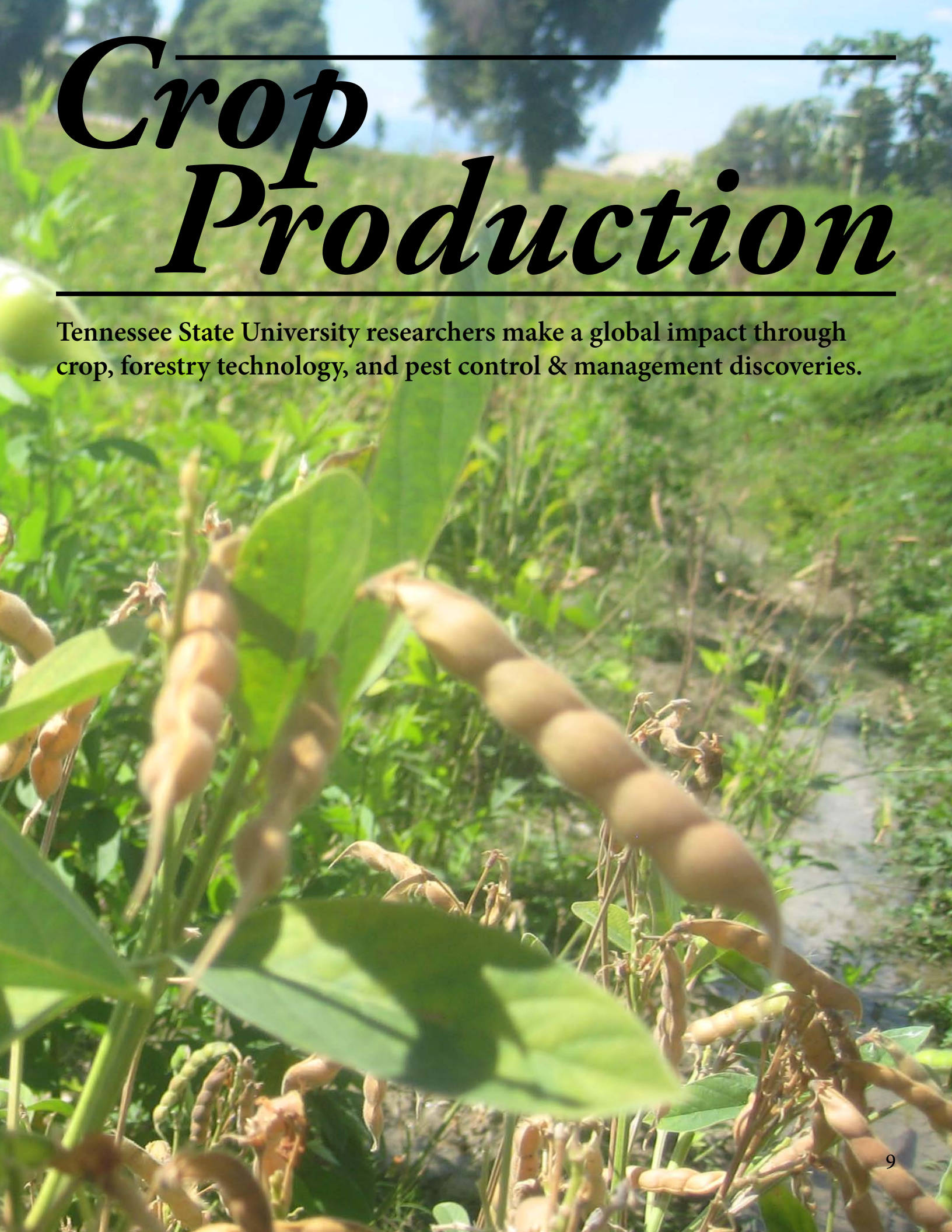
acres of farm land are available for field research and hands-on learning experience for students and extension programs.

$2 million

worth of laboratory space provides faculty and students with access to the newest and most efficient research equipment.

Crop Production

Tennessee State University researchers make a global impact through crop, forestry technology, and pest control & management discoveries.



Consumers who tasted pigeonpeas prepared with rice expressed their satisfaction with the taste.

In 2011, marketing research identified a major Indian food store in Nashville and vendors in the Nashville farmer's markets as potential buyers and retail sellers of pigeonpea.

This project provided opportunities for **student experiential learning** involving production practices, data collection and analysis. Students were also encouraged to use the data for their senior projects and theses.

In 2011 and 2012, farmers in Middle Tennessee planted the crop in their fields. An enterprise budget form was developed and given to farmers to keep record of cost of various inputs used to produce the crops. Feedback from farmers who grew the crop was positive.

$ **Marketing efforts** planned for 2012 and beyond include identifying additional ethnic markets for the fresh dry output. $

Opportunities for Small Farmers in Tennessee

Developing Pigeonpeas as a Cash Crop

Small farms represent an important segment of US agriculture - accounting for approximately 91% of all U.S. farms and more than half of the land in farms. Despite their number and importance, small farmers continue to face many challenges. Potential strategies for small farmers to remain viable include diversification, introduction of on-farm value-adding activities, and producing niche products.

TSU faculty members **Drs. Fisseha Tegegne**, **Desh Duseja**, **Surendra Singh**, **Enefiok Ekanem** and **Roy Bullock** have been working on pigeonpea (*Cajanus cajan L. Mills*) as a niche crop that can be grown both for human consumption and forage. Pigeonpea is a warm season grain legume that is nutritious, has a high protein content (21%), high protein digestibility (68%), is low in fat, has no cholesterol, and is high in dietary fiber. It is popular among ethnic populations from parts of Africa, Asia, the Caribbean and Latin America. The National Research Council has recommended the crop be grown widely in the United States.

What's Online

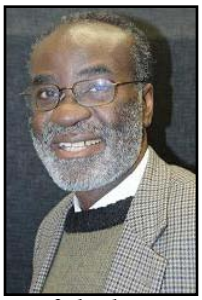
Learn more about pigeonpeas at tnstate.edu/agriculture


Surendra Singh


Desh Duseja


Fitzroy Bullock


Fisseha Tegegne


Enefiok Ekanem

Pigeonpea has many advantages as a crop for small farmers. It can be grown in a wide range of cropping systems and environments and is tolerant of dry weather and poor soil conditions. Pigeonpea grows well on marginal lands, and being a deep-rooted crop, is drought tolerant and capable of growing in semi-arid conditions and in a wide range of soil types. It has nitrogen fixing capability, is resistant to nematodes, and does not require much input.

Vegetables and Healthy Living

Small and limited resource farmers, forest landowners and ranchers in thirteen counties in the Tennessee region are always looking for alternative crops to increase their incomes. TSU faculty member **Dr. Arvazena Clardy** assists these farmers and producers through education, training and assisting with USDA program applications. Dr. Clardy's extension and research efforts include Herb Demonstration Gardens, Exotic Vegetable Gardens, and Christmas Cactus (an alternative fall crop). In addition, Dr. Clardy is working to address the high obesity rates in the US by growing various vegetables, fruits and herbs for use as a seasoning, instead of the traditional salt and pepper used to flavor foods. This research was funded by the USDA's Office of Advocacy and Outreach.

The IMPACTS:

- Assisting farmers and producers with alternative crops to increase their income.
- Establishing alternative selling methods
- Lowering obesity
- Introducing new vegetables and fruits to Tennessee markets
- Developing alternative ways to season foods
- Educating students in the Plant Science areas

To encourage individuals and groups to produce their own foods, exercise and reduce obesity, Dr. Clardy initiated the Tennessee State University Community garden, a 53 plot community garden located on TSU property. Last year's community gardeners saved thousands of dollars by producing their own fruits and vegetables. By canning and freezing the foods they grew for the upcoming seasons, participants lost weight through eating smart and exercising. An added benefit was the many new friendships everyone made.

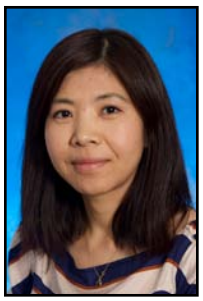
Arvazena Clardy

Building Local Food Systems

Creating sustainable communities in Tennessee

Fruits and vegetables are predominately produced in a few states and California. The production and distribution systems required to provide these perishable goods to American consumers are complex. They are made even more complicated by new, increased demand for fruits and vegetables, volatile energy costs, changes in retail marketing, organic foods, sustainable farming, and growing consumer and societal awareness of sustainability. Economic research performed by **Dr. Lan Li** is providing data to be used to make sure fruits and vegetables can still be produced and distributed as efficiently as possible, even with these new challenges.

Dr. Li's research examines trends and identifies changes in farm distribution and supplies of fruits and vegetables in selected states and measures factors that contribute to the growth of the produce industry, in particular, factors associated with market environment and marketing opportunities. The project has implications for building and strengthening local and regional food systems and increasing the supply of affordable and nutritious foods for consumers. Empirical evidence, insights and knowledge gained are needed for informed decision-making, and for stakeholders (policymakers, educators, producers, businesses and consumers) to evaluate needs and opportunities and to effectively design and implement programs. This information is of value to residents in Tennessee where small farms, in particular tobacco farms in transition, are prevalent and the obesity rate is high.



Lan Li

Standing TALL

Forestry is one of the strongest industries in Tennessee, and continues to grow.

Integrating Bioenergy Production & Agroforestry

Creating a diverse and multi-purpose forestry system

Small-scale production systems of agricultural and timber operations constitute a significant sector of the rural economy in the Southeast, especially in Tennessee. These agroecosystems and the people inhabiting them are challenged with natural resource management problems caused by various changes including intensive use of land, pressure on natural resources, rapidly urbanizing landscape and incremental use of agrochemicals. The other real challenge and opportunity lies in how agricultural and forestry efforts can actually be integrated to sustainably meet future renewable energy targets. Faced with such rapid changes, small-farm communities in Tennessee are under pressure to adopt integrated land management practices that provide the economic advantages of diversified production and the ecological benefits mixed use systems offer.

Integrated agroforestry systems for bioenergy do just that —the combination of agricultural energy crops and forestry create integrated, diverse, and productive land use systems. **Dr. Solomon Haile** is investigating the use of an agroforestry system as integrated feedstock production for energy — a switchgrass and loblolly pine trees combination. The objectives of the project are: 1) to assess the performance of switchgrass as energy crops in an integrated agroforestry bioenergy production setting, 2) to evaluate impacts of switchgrass cultivation in an integrated agroforestry system on critical soil properties, and 3) evaluate carbon sequestration in marginal lands.

The study is located at the TSU Ashland City Education and Research Center. Dr. Haile is measuring biomass production and growth characteristics of switchgrass, critical soil properties and carbon sequestration in both open field and agroforestry settings.

Solomon Haile

Forest Operations and Management

An understanding of resource sustainability, management, and harvest/supply logistics is of high importance because it raises awareness of the key components required to furnish the very many forest products that surround us. Without resource sustainability and accessibility, workforce capabilities and technology forest products industries would not be sustainable. Research performed by **Dr. Dalia Abbas** investigates methods to help improve forest feedstock harvesting, processing and hauling efficiencies while observing forest management guidelines and practices in natural forestlands and plantations.

Dalia Abbas

The impact of this research will:

1) Promote better understanding of the integrated objectives of harvesting, supply logistics and utilization within the context of protecting productive and protective ecosystem services in different forested landscapes;
2) Promote a better understanding of the role logging communities play in making forest products available;
3) Promote a more informed understanding and smart business decisions linked to the start up of new forest products industries in Tennessee.

The IMPACTS:

1	2	3	4
Contributing to the scientific knowledge base on disease mechanisms of soft rot and bacterial wilt.	Improved crop cultivars with better tolerance to these pathogens.	Improved cultural practices resulting from a better understanding of disease processes.	Reduction in crop loss due to soft rot, blackleg, bacterial wilt and other diseases.

"Our research into plant science has the potential impact of reducing crop losses in more than 100 crop species."
— Dr. Korsi Dumenyo

Plant Disease and Food Production

Agriculturalists are faced with the constant challenge of feeding an increasing world population. Plant disease remains one of the greatest obstacles to food production and availability. Losses to the US economy due to plant disease are estimated to be in excess of $21 billion annually. To effectively manage plant disease and reduce the losses they cause, a fundamental understanding of causal agents and the corresponding disease process is required.

Dr. Korsi Dumenyo is performing research focused on two important plant diseases. Bacterial soft rot/blackleg infects more than 80 cultivated crop species, including almost all vegetables produced in the US and across the world. Bacterial wilt of cucurbits is also a devastating disease that significantly impacts crop yields. Crops in more than 26 US states are vulnerable to this disease. Together, these two diseases inflict losses on almost one hundred cultivated crop plants. The goal of this research is to gain detailed understanding of the molecular mechanism of how these pathogens cause disease and to produce the knowledge necessary for designing effective management and control strategies.

Using modern technological tools and approaches, Dr. Dumenyo and his students are characterizing the pathogen / host components that interact to produce disease. Their specific research efforts include:

1) Developing molecular tools to enhance the study of these organisms;
2) Examining the DNA of the pathogens to identify the genetic constituents that enable them to cause disease; and
3) Identifying plant components that make them vulnerable to attack by specific pathogens.

State-of-the-art equipment in Dr. Dumenyo's Microbial Genetics/Genomics laboratory and elsewhere on campus has made his research possible. The recent acquisition of a microplate reader with capabilities for visible, UV absorbance, fluorescence, luminescence, FRET and bioluminescence now permit research scientists to process large volumes of samples. The StepOne Plus real time PCR thermocycler allows Dr. Dumenyo and his team to determine almost instantly how bacteria turn their genes on, and the Ion Personal Genome Machine allows them to define the genomes of entire organism in a single or small number of experiments.


Korsi Dumenyo

Managing Invasive Insects in Nursery Crops

Invasive insects are major threats to nursery and forest systems. They disrupt natural ecosystems and exhibit rapid population growth that produce crop damage and harm to human health and welfare. Many invasive insects impact the multi-billion dollar nursery industry in the U.S. and Tennessee. Insects of particular importance are black stem borer, brown marmorated stink bug, camphor shot borer, emerald ash borer, granulate ambrosia beetle, hemlock wooly adelgid, Japanese maple scale, Japanese beetle, and imported fire ant.

The Tennessee nursery industry is a major contributor to the state economy. It currently leads the nation in field-grown balled and burlapped nursery plant production. Quarantines imposed because of invasive insects reduce nursery trade and profitability. For example, the federal quarantine imposed on imported fire ants now impacts about 80% of Tennessee plant sales, requiring expensive and potentially environmentally damaging treatments. The entomology program at Tennessee State University is developing techniques for nurseries to manage multiple invasive insect threats.

Dr. Jason Oliver and his research team are developing new treatments and methods for countering invasive insect pests to reduce the management costs for nursery growers and ensure economic sustainability of producer operations. Cost effective and environmentally friendly quarantine treatments for Japanese beetle and imported fire ants are being developed, as well as new and improved management methods for non-indigenous ambrosia beetles and other borers. The program is also working to develop improved monitoring techniques for the detection and delineation of exotic wood-boring insects.

Jason Oliver

8 times

Program research was responsible for an 8 x reduction in insecticide rates for quarantine treatment of nursery stock against Japanese beetle, reducing grower costs and the level of contamination.

New treatments for field-grown nursery pre-harvest quarantine treatment of Japanese beetle larvae save growers an estimated $200 - $400 per treated acre over existing options.

TSU's Entomology Program plays an integral role in nursery-related treatment decisions. Dr. Jason Oliver is currently a Research Representative on the National Plant Board Japanese Beetle Regulatory Treatment Review Committee, a core team member of the Tennessee Fire Ant Research and Education Team (FARET), and a committee member of the Tennessee Thousand Canker Disease / Emerald Ash Borer - Technical Committee.

Research has directly led to a new nursery stock immersion treatment against Japanese beetle and imported fire ant, and inclusion of the treatment in the U.S. Domestic Japanese Beetle Harmonization Plan. **The new treatment provides longer fire ant control, extending grower certification periods.**

Research into colored traps for flatheaded borers was pivotal in the development of the new survey traps being used by USDA-APHIS in the emerald ash borer (EAB) survey program. There are now about

80,000

of these new traps deployed annually in a national survey program for EAB. The EAB is an invasive borer that is threatening to eliminate ash from the entire U.S. forest system.

Dr. Oliver has played a major role in obtaining a Section 24(c) supplemental label from the U.S. Environmental Protection Agency for Tennessee to use alternative treatments in field-grown nursery to meet imported fire ant quarantine certification. Because of his efforts, Tennessee is now the only state in the U.S. with this treatment option for field-grown nurseries.

Breeding Drought Tolerant Plants


Suping Zhou

In recent years, soil salinization and drought have become a major problem facing agricultural production worldwide. Research conducted by **Dr. Suping Zhou** focuses on the identification of molecular controls that allow plants to develop tolerance to drought, salt and toxic ions in the soil, and using this knowledge to develop plant lines that will perform well under stress conditions.

Cultivated tomato cultivars are sensitive to salt and drought stress. However, some wild tomato species have genetic traits for salt tolerance, which can be utilized for crop improvement. Transferring traits from salt-tolerant relatives into the cultivated tomato is difficult because of the large number of genes involved. Dr. Zhou's approach identifies gene sequences involved in salt tolerance to develop markers for selection of tolerant traits. Her research also targets identifying proteins that have an altered expression as a result of stress.

A large number of proteins associated with salt, water, chilling, heat and aluminum stress have been identified. These specific proteins and genes will be the focus of additional research targeted at breeding tolerant tomato varieties.

Full-length papers have been published in reputable journals such as the Journal of American Society Horticulture Science, the Journal of Experimental Botany, and the Journal of Research in Biology. Research findings have been presented at scientific conferences such as Plant and Animal Genome Conference, Southern Nursery Association Research Conference, and the Horticulture Science Conference.

Students have been exposed to **cutting edge technology** through collaboration with USDA-ARS laboratories, Cornell University, Vanderbilt University, and biotechnology companies.

Undergraduate and graduate students are fully trained to conduct research in genetics of stress-tolerance. Currently, **two** doctoral students and **three** master's students are working on their research.

Dr. Zhou was recognized by the American Society for Horticultural Science for **Outstanding Vegetable Publication** for 2011 for her paper dealing with proteome work in tomato.

Molecular Profiling of Crop Plants

As yield advances in crop production become more limited due to decreased availability of arable land, decreasing irrigation options, and increased fertilizer costs, the most promising avenue for yield improvement is in breeding better crops. Advances in breeding can boost productivity in a variety of ways: improved resistance to disease and insects, drought tolerance, better product quality, and improved nutrient use efficiency.

Modern plant breeding techniques combine traditional breeding methods with biotechnology to target specific traits for improvement and speed up the breeding process. A key component of the use of biotechnology in plant breeding is the identification of molecular markers – these are tags that let the breeder know if genes for a trait of interest are present or not. Identifying these tags usually takes a lot of time and a large number of plants.

Dr. Ahmad Aziz and his research team are pioneering new techniques to significantly speed the process of identifying these tags.

Using a unique strategy, Dr. Aziz is developing marker-based linkage maps of dark green vegetables, medicinal herbs, heirloom tomatoes and cotton plants in his lab at Tennessee State University. Instead of examining the progeny of the plants, he and his students are performing amplified fragment length polymorphism (AFLP), a popular DNA fingerprinting technique, on individual pollen grains. Pollen analysis with molecular markers reduces the cost of developing improved plant varieties by saving the time, labor, and environmental inputs required in maintaining large fields of plants needed in traditional cross-pollinations.

Ahmed Aziz

The IMPACTS:

- Circumventing controlled pollinations to construct genetic maps is important for plant breeders, academicians and producers since it reduces the cost of developing improved varieties.
- The protocols developed from this research have facilitated collaboration with the USDA/ARS Genetics and Precision Agriculture Research Unit (Mississippi State) on projects leading to combine agronomic adaptability and high fiber quality traits in cotton plants.
- These projects have resulted in dozens of students being trained in micromanipulation as well as molecular and bioinformatics tools for plant genetic studies. The trainees include three pre-college summer interns, five undergraduate and four graduate students in the College of Agriculture, Human and Natural Sciences.
- Through these research endeavors, students made 22 presentations at diverse forums such as university seminars, the Tennessee Academy of Science Meeting, International Horticulture Symposium, TSU Research Symposium, Southern Nursery Association Conference, Association of Research Directors Symposium, Tennessee Louis Stokes Alliance Conference, and Minorities in Agriculture, Natural Resources, and Related Sciences Conference.

Improving Food and Crops Through Precision Nutrients

Fertilizer and pesticide use in the agriculture industry has produced many positive benefits, but these benefits have not come without some cost: increased production expense, pollution of the environment, and in some cases, lower plant quality. **Dr. Dharma Pitchay** is conducting research to address these issues. His research goal is to develop a system to reduce the usage of chemical inputs, minimize pollutants, and improve the nutritive value of food crops.

Dr. Pitchay's research explores the factors that control how plants can absorb, retain and beneficially use macro and micro nutrients. The emphasis of this applied and fundamental research program includes formulating organic as well as inorganic nutrient regimes that are specific to a particular food crop. Development of these nutritional regimes will provide information needed for the whole plant management system to establish the optimum practices for local growing environments, identify the farming methods needed to help shorten the production life-cycle, and improve the overall economic value to food crops.

Identification of the precise nutrient requirements for each crop will extend the shelf life of fruits, vegetables, and flowers, while minimizing chemical usage and discharge. By increasing the uptake and accumulation of beneficial minerals such as potassium, selenium, zinc and iron, and lowering the harmful minerals such as sodium, nitrate and heavy metals in edible plant tissues, Dr. Pitchay seeks to identify the specific nutrient formulations needed to increase the nutritive value of fruits and vegetables. This research will help millions of people worldwide to enjoy the healthy benefits from mineral nutrient fortified food crops.

Dharma Pitchay

Defeating Nursery Pests

Biopesticides and Powdery Mildew

Production of ornamental plants are often hampered by diseases and pests that reduce the market value of infected plants. Chemical pesticides provide a remedy for disease and pest problems, but this practice increases production costs and creates potential hazards to people and the environment. Pesticides also kill microorganisms indiscriminately and erode the friendly organisms that naturally protect plants against diseases.

It is important to find effective alternatives to conventional pesticides that can control diseases and pests without the negative side effects. **Dr. Margaret Mmbaga** conducts research to identify biopesticides and disease resistance as alternatives to conventional pesticides. Biopesticides are generally more environmentally friendly, safer for workers, and are more pest-specific than conventional pesticides. The goal of Dr. Mmbaga's research is to develop a biological control-based integrated pest management system that will reduce or eliminate the use of conventional pesticides.

Thousands of microorganisms have been isolated from wild dogwood trees. These microorganisms are potential sources of biological agents for controlling dogwood diseases. Two fungi, two bacteria and two yeasts have been identified that have a superior effect in suppressing powdery mildew on dogwood. These organisms are undergoing additional examination to provide novel microorganisms that are environmentally friendly and effective in controlling diseases without using conventional pesticides.

Dr. Mmbaga's group is also fighting disease with genetics: they have identified dogwood genotypes that have resistance to disease, and they are also developing new genotypes through breeding and plant selection. Two dogwood plants selected for their superior powdery mildew resistance are being developed for new cultivar release.

Margaret Mmbaga

The developed products from this research include biological control agents from selected microorganisms, biopesticides and plants that have natural resistance to diseases. Using these products individually or in combination as an integrated pest management system will reduce conventional pesticide usage, accidental pesticide exposure, and result in environmental preservation and reduced pesticide exposure for nursery workers.

Animal Production

The landscape across Tennessee is suited for a variety of livestock operations. TSU researchers are working to increase efficiency and productivity on small farms.

Meat Goat Production

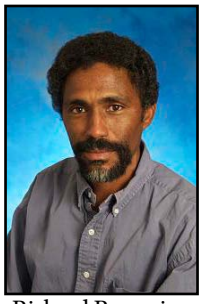
In the last two decades, there has been a large influx of immigrant populations into the United States, with many families now calling Nashville and Middle Tennessee their new home. Goat meat is a traditional part of the diet for many new Americans, and for good reason - goat meat is a healthy meat – it is lean and a good source of protein. The demand for goat meat in the US is at an all time high. While the importation of goat meat has increased from 156 tons in 1987, to 11,200 tons in 2007, supply is still not keeping up with demand. Small farmers in Tennessee have a prime opportunity to supplement their income by adding meat goat production to their operation to fulfill market demands.

Unlike traditional livestock sectors, the meat goat industry has not had the benefit of extensive research to improve basic production issues. In addition, most of the limited meat goat research has been conducted in drier regions of the country, and is not necessarily applicable to goat producers in the Southeastern US. The most evident gap in research is in the area of genetic assessment for economically important production traits.

Dr. Richard Browning and his students have studied various goat performance areas including reproduction, growth, meat yield, and animal health. Female fitness (health and reproductive performance) is the main research focal point as a principal determinant of profitability and sustainability in a meat goat enterprise. Finding the right genetics to optimize health and reproduction under Tennessee's humid climatic conditions is critical.

In Dr. Browning's research, the multi-breed herd of meat goats is managed in a low- to moderate-input, forage-based production system. A systematic diallel mating scheme of various breeds has involved the three primary meat goat breeds (Boer, Kiko, and Spanish). Recent modifications to the mating scheme have been made as three new genotypes have been added to the genetic evaluation program (Boer F1, Myotonic, and Savanna). Daily herd health, annual reproductive output, and young stock growth are summarized annually to determine genetic and environmental influences on whole-herd meat goat performance.

Internal parasitism is the greatest impediment to sustainable and profitable goat management. Indicators of internal parasitism are monitored through daily herd observations and diagnostic analysis of episodic blood and fecal collections. Evaluations under environmental challenges are providing a novel, objective, and comprehensive look at genetic variation between and within meat goat breeds for economically important performance traits.



Richard Browning

- Research results have challenged the industry-wide conventional wisdom that the Boer goat is the superior meat goat breed and have helped to fuel a change in approach to breed selection and genetic management in the commercial meat goat sector
- Greater industry attention is being directed towards doe performance as a modulator of long-term commercial herd viability
- Use of on-farm performance recording protocols have become more visible among breeders and breed associations following outreach demonstrations of the TSU research herd model of performance testing for economically-important traits
- Producers have acquired education and skills for marketing high quality meat goats

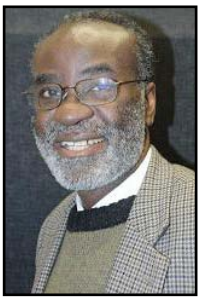
Tennessee ranks second nationally in meat goat production, yet most operations are small with less than 15 head per farm.

The IMPACTS:

- Knowledge of available marketing channels and information on outlets such as wholesale markets and retail stores has increased
- Producers have enhanced direct sales locally, on-farm, at auctions, and through processing facilities
- Tennessee producers now team up to coordinate shipping truckloads of meat goats seasonally to markets in different states
- Producers enhanced their understanding of pricing strategies for live goats, carcass, and various choices and cuts of goat meats
- Students gained hands-on experience in Agricultural Economics enabling them to acquire skills in conducting research, collecting data, analyzing data and presenting data

Meat Goat Marketing

Research performed by **Dr. Enefiok Ekanem** is addressing the need to establish an efficient marketing program for goat meat in the state of Tennessee. Dr. Ekanem's research designs marketing strategies to improve the competitiveness of Tennessee producers and analyzes issues that are important to meat goat producers. Some of the marketing issues include: lack of producer education, lack of information about consumer preferences, lack of insights on marketable weight of live goats, carcass and various meat cuts, buying seasons, holidays, special occasions, and when goat meat is in greatest demand. Producers are also limited in skills for developing market niches and market connections with potential goat meat buyers. Other problems include a lack of organized markets, marketing channels, slaughter and processing facilities and related meat goat marketing infrastructure.



Enefiok Ekanem

Available marketing data sets are collected and analyzed; selected meat goat consumers, ethnic groups and immigrant communities are identified and connected with existing and potential markets. Additionally, visits to meat goat farms, processing facilities and markets provide the basis for marketing training and workshops. Selected training needs and focus areas identified include: developing and implementing training on marketing niches, market differentiation, understanding consumer needs and meeting the market demand for goat meat, appropriate pricing strategies for live, whole, carcass, and various meat cuts and value added meat products.

Proteins

Several proteins associated with fat deposition have been identified. They include vimentin, apolipoprotein, aspartate aminotransferase and anexin. A number of genes, such as the fibroblast growth factor receptor 3, insulin-like growth factor binding protein 2 and gremlin1 also appear to play a role in mediating fat accretion. These specific proteins and genes will be the focus of additional research aimed at preventing fat accretion in poultry.

Genes

Evaluation of about 28 million gene sequences from the guinea fowl have identified gene sequences translating to molecules associated with the growth process that lead to excessive fat deposition. These findings can be used to better understand and ultimately prevent excessive fat deposition in poultry, other food animals and humans.

Profiles

Established optimum species-specific nutritional profile for guinea fowl rations to maximize growth and production performance.

Making Healthier Poultry Meat

Americans are eating more poultry than ever before. The United States is the world's largest poultry producer. With over 43 billion pounds produced annually, retail sales are valued at over $45 billion dollars per year. Production and sales have been steadily increasing in recent years as more people turn to chicken as a healthy alternative to beef. However, extensive genetic selection for rapid growth and high feed conversion rates has led to increased fat accumulation in broilers. Fat accumulation has the potential to decrease the obesity-reducing value of chicken as a healthier, lower-fat alternative to red meat. To prevent increased fat accumulation, genetic manipulation of animals for reduced fat content is important to both consumers and poultry industry producers. Research performed by **Dr. Samuel Nahashon** and his students use biotechnology to target individual genes and proteins as the keys to controlling fat deposition and improving long-term poultry quality.

Dr. Nahashon's research is identifying the genes for specific traits such as egg output, growth rate, feed conversion and fat content. His research is uncovering knowledge about the genes and proteins that govern chicken fat tissue

Breeding for disease resistance and lower fat content requires an understanding of how the genes for these quantitative traits interact, limiting the usefulness of traditional breeding strategies. Development of molecular markers are expected to deliver better and faster results from breeding efforts. **Dr. Xiaofei Wang** is using a genomics approach, genetic variations are evaluated in a massive parallel manner, thus genes underlying disease resistance, fat accumulation and other important agricultural traits can be rapidly identified, and examined for breeding applications.

Dr. Wang's research team is interested in identifying genetic variations in chicken and evaluating how these variations affect chicken development, fat accumulation, disease resistance and growth. His team employs state-of-the-art techniques and high-tech equipment, such as genome-wide expression profiling, high throughput genotyping and next generation sequencing to detect DNA variants that contribute to increased fat accumulation, growth and disease resistance.


Xiaofei Wang

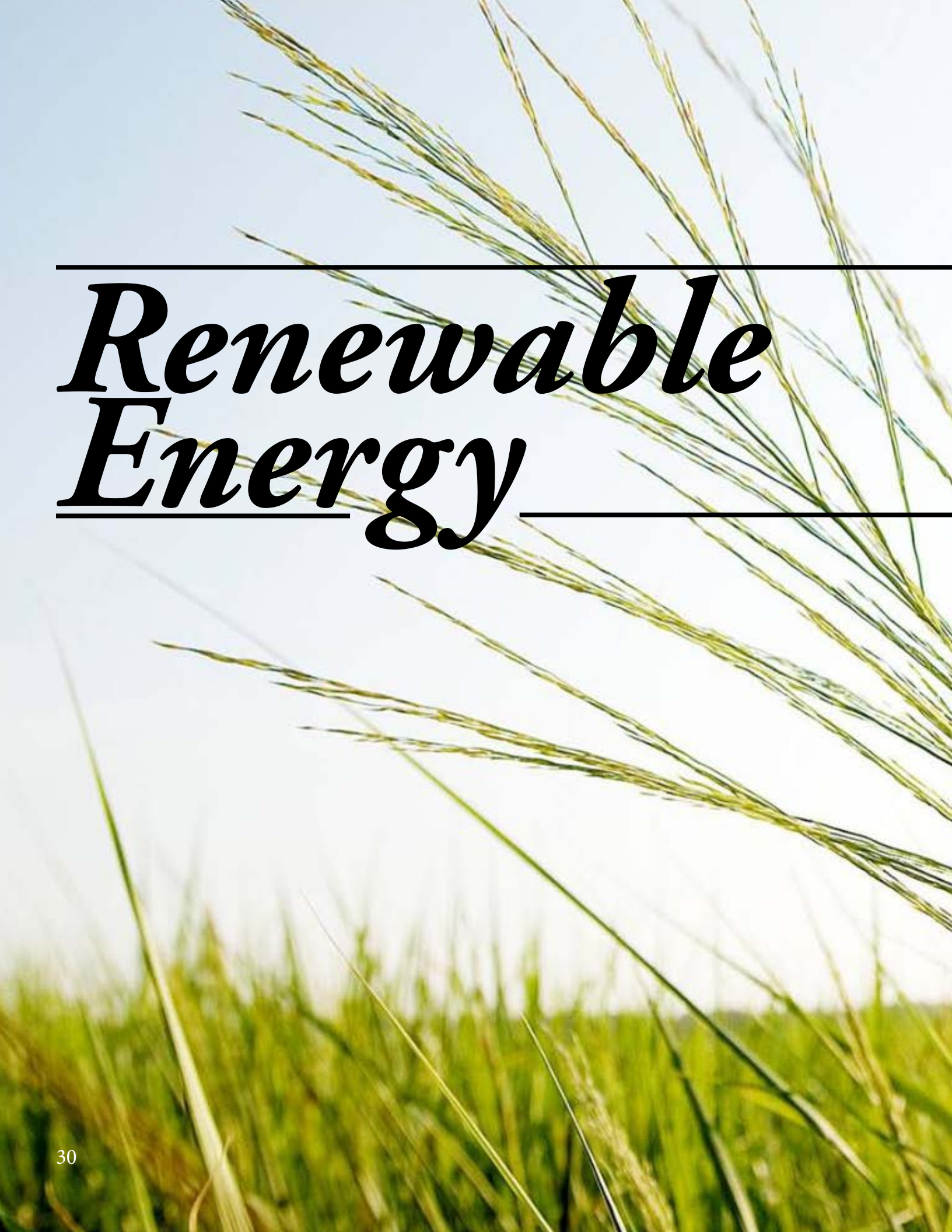
Impacts

- Identified DNA structural variants, involving gene duplication and/or deletion in chickens
- Identified genes that display differential expression in fat tissue between fat birds and lean birds; these genes could potentially contribute to fat accumulation

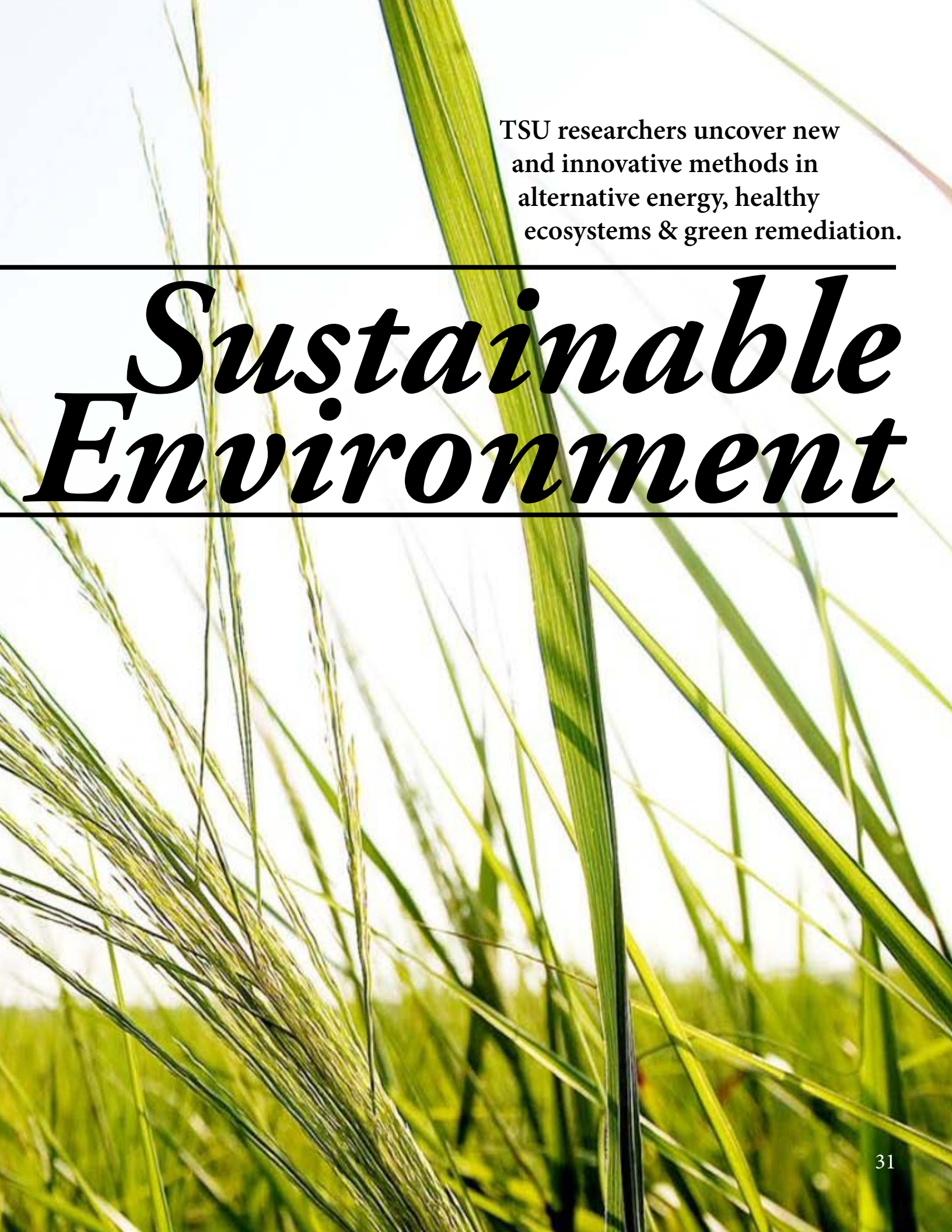
accumulation and efficiency of feed utilization. In addition to the high-tech equipment in Dr. Nahashon's laboratory, one of his most important tools is an animal – a type of poultry called the Guinea Fowl. Guinea meat is higher in protein and is leaner than regular poultry. By comparing the genes carried by Guinea Fowl to those of other poultry, Dr. Nahashon and his students are able to narrow the search for the genes responsible for the traits of interest for healthier chicken meat.

In addition to his research in poultry genetics, Dr. Nahashon's research group is active in developing Guinea Fowl as an alternative for small farmers who moved out of tobacco farming, and are seeking an alternative income source. Because feed costs are the largest single cost of producing Guinea Fowl, Dr. Nahashon is performing research to determine the optimal feeding regime to maximize the efficiency of Guinea Fowl production.


Samuel Nahashon



Renewable Energy



TSU researchers uncover new and innovative methods in alternative energy, healthy ecosystems & green remediation.

Sustainable Environment

Bioenergy Crops: Switchgrass

Discovering alternative energy sources at Tennessee State

Questions about energy independence, rising and unstable energy costs, and protecting our environment from the effects of pollution from fossil fuels are causing great interest in a very promising answer: biofuels. Future biofuel standards will likely require a system of production that creates bioenergy feedstocks (the raw materials used to create biofuels) of specified quality and quantity. Currently, corn serves as the feedstock for producing 95 percent of ethanol, the biofuel used as a gasoline additive in the US. However, because of expensive input requirements such as land, chemicals and water, ethanol derived from corn is not a sustainable option. Additionally, the use of corn for biofuel production has sparked an intense debate about the relative practicality and wisdom of using agricultural resources for food production versus biofuel production. The production of ethanol from sources other than corn has the advantage of avoiding the food versus fuel debate. The U.S. government has identified switchgrass as a "model" bioenergy crop and it has great potential in meeting the demand for biofuel feedstocks.

Dr. Jason de Koff is working to help farmers by identifying optimal timing of harvest to improve the quality of switchgrass feedstocks. This information will help producers, specifically small farmers who want to diversify, to produce optimal switchgrass feedstocks for biofuel production.

Optimal production techniques are established by harvesting different switchgrass varieties at different times during the growing season and then analyzing the harvest for changes in specific qualities that could have an effect on processing efficiency and energy production.

Jason de Koff

Reducing costs

Pinpointing optimal harvest dates may reduce feedstock variability and reduce the costs of testing.

When feedstock purchase price is based on quality characteristics, this research may help the farmer to prevent income loss caused by lower quality products.

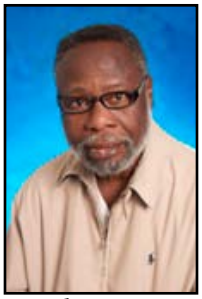
Preventing loss

A Winning Combination

TSU scientist **Dr. Kudjo Dzantor** is performing research to find ways to use switchgrass, eastern gamagrass and big bluestem as feedstock for biofuels. These grasses are notable for high biomass productivity, robust root systems, and ability to tolerate a broad range of environmental stresses including droughts, flooding, and physical or chemical degradation processes. Accordingly, development of enhanced strategies for their production on stressed land can save premium land for food production. In addition to grasses, Dr. Dzantor investigates algae for use in production of biodiesel, and performs research and development on the use of natural systems to clean contaminated and degraded environments which serve to restore and reclaim them for productive use. Dr. Dzantor has targeted plant systems, namely grasses and algae, as bio/phytoremediation agents, because they use limitless energy derived from the sun to produce appropriate types and levels of biomass needed for environmental cleanup.

The potential for using biomass for transportation fuels is an important emerging development in the current climate of soaring fuel prices; the need to develop renewable biofuels to reduce the nation's unsustainable dependence of fossil and foreign fuels cannot be overstated.

As part of her research program, **Dr. Suping Zhou** has been working towards developing a protocol for isolating pure DNA from goat ruminal fluid to determine the microbial populations inhabiting goat rumens. This is very important for understanding the mechanisms goats use for digesting the high-fiber diets they consume. Information of this type may be useful in determining new processes for the conversion of feedstocks into biofuels.



Kudjo Dzantor

Suping Zhou

The IMPACTS:

- Increased awareness about alternative biofuel feedstocks and sustainable production strategies, especially on marginal, degraded or disturbed lands
- New information generated about the production of multiple-use, saleable products from biomass, namely forage, feed, and biofuel headstocks
- To date, our programs have contributed to the training of 12 undergraduate, 3 masters and 2 doctoral students in the multidisciplinary fields of soil and environmental sciences, soil microbiology, plant sciences and environmental and aeronautical engineering
- Significant contributions in helping improve and strengthen minority participation in agricultural and environmental sciences

Water Smart

Watershed Academy for County Agents in Tennessee

With increased demand on the world's water resources and the impact of global climate change, farmers and other people who are interested in safe, reliable water sources are paying attention to the availability and cleanliness of surface water and groundwater. Farmers, landowners, and homeowners use chemicals such as pesticides and fertilizers for farming, gardening, lawn care, and pest management. These chemicals can have significant impacts on water quality in rural and urbanizing watersheds.

Dr. Sam Dennis is integrating research, extension, and education resources to solve water quality problems at the local scale. By increasing the awareness and knowledge of the impact their activities have on watersheds, environmental stewardship efforts of farmers, landowners and homeowners will be enhanced. The focus of this project is to educate Tennessee's Agriculture and Natural Resource County Agents, enabling them to communicate technical issues in water resources to clientele.

Impacts:

- Reduction of environmental pollution and water quality degradation
- Effectively communicate technical issues on pollution abatement strategies
- Provide local expertise and facilitation to watershed associations and stakeholders addressing water resource issues
- Work with decision makers in improving land use and restoration plans in rural and urbanizing watersheds
- Enhance our students' expertise in agricultural and natural resource issues as they will be encouraged to participate in the workshops and webinar sessions

Sam Dennis

Improving Nitrogen and Water Use Efficiency to Reduce Greenhouse Gas Emissions

Recent drought conditions and increased fertilizer costs in the US have caused producers to be interested in more efficient irrigation and fertilization management. However, in corn production systems, water and nitrogen use efficiencies remain generally low because irrigation and fertilizer scheduling are seldom based on real-time plant water needs and nitrogen demand. Much of the excess nitrogen from over-application is emitted into the atmosphere or leached into groundwater. Our overall research goal is to develop an online decision support system to schedule irrigation and nitrogen use, and to reduce greenhouse gas emissions and fertilizer leaching from corn cropping systems.

Dr. Junming Wang is conducting research to quantify the effects of irrigation and nitrogen use management systems on plant growth, denitrification, and greenhouse gas emissions. He is working to develop a user-friendly, web-based decision support tool that growers can use to schedule irrigation and fertilization with real-time, local climate conditions to maximize irrigation efficiency, and minimize nitrogen loss.

Remote sensing will be used to monitor real-time plant stress and evaluate and adjust scheduling.

Anticipated outcomes from Dr. Wang's project and follow-up research include:

1) Reducing pollution from leaching of nitrogen and greenhouse gases;

2) Building research, teaching, and extension capacity in air quality and water quality, global climate change, bio-energy, agricultural meteorology, and remote sensing;

3) Improved knowledge of greenhouse gas and water conservation conditions in crop production systems; and

4) Better trained minority students who are ready to contribute in significant ways to future environmental work.

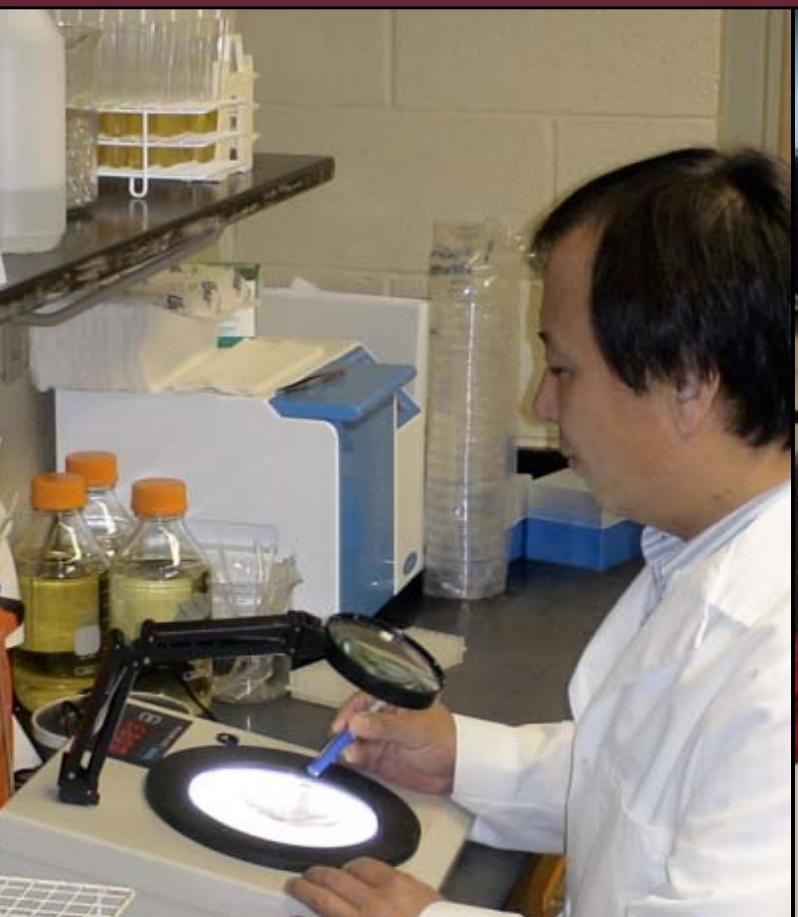
Junming Wang

Food Safety

In an effort to protect food and human health, researchers at TSU have made great strides in food safety and security.

The IMPACTS:

- Listeriosis is a serious infection that sickens an estimated 2,500 people per year and is the cause of death of approximately 500 people annually. Of the nineteen high-risk foods, deli meat sliced for over-the-counter sale at retail establishments presents a comparatively higher risk of listeria relative to deli meat that is prepackaged at processing plants for retail sale. Dr. Sandria Godwin's research was instrumental in helping the Food Safety and Inspection Service (FSIS) of the USDA and the FDA protect public schools from listeriosis, a food-borne illness. The FSIS utilized TSU survey data to update its "deli meat pathway model" which provides deli-meat risk managers with a practical decision-support tool to understand and evaluate such relative risk between these two particular forms of RTE meat.
- **Take Control of Food Safety**, a booklet produced by this program, incorporates food safety information into an attractive and entertaining guide. It is being used to help seniors avoid life-threatening foodborne illnesses by consuming fewer potentially hazardous foods, using a refrigerator thermometer, and storing foods properly.
- Health care providers are better informed about food safety, and are sharing the educational materials prepared by TSU researchers with the older adults that they care for. Equipping health care providers with information on foodborne illness prevention and working with them to disseminate this information to older adults will result in safer food consumption and handling practices among older adults.
- A complete educational curriculum was developed on the topic of food safety during disasters: "**What Will You Do When A Disaster Strikes? A Quick Reference Guide To Help Keep You And Your Food Safe**". This material is being used by extension agents and community educators throughout the United States. Consumers report being better prepared for disasters and feeling more confident that they will avoid getting sick from eating food that was not handled properly during and after a disaster.
- Data from our fruit and vegetable cleanliness studies were part of the evidence-based library developed by the USDA and DHHS when revising the food safety recommendations for the 2020 Dietary Guidelines.



Preventing Food from Contamination

As Director of the Didactic Program in Dietetics in the Department of Family and Consumer Sciences, **Dr. Sandria Godwin's** research focus is on food safety.

Did you know:

- Perishable food in your refrigerator should be thrown out if a power failure lasts more than four (4) hours?
- Older adults are more likely to get sick from eating contaminated foods?
- A food thermometer should be used to measure the internal temperature of all cooked meats?

Safe food handling and cooking food products properly are primary ways that consumers can lower the risk of foodborne illness. However, many consumers do not follow recommended practices for safe storage, handling, and preparation of many food products. In the past decade, TSU researchers have become national leaders in the field of food safety, with special emphasis on improving consumer knowledge and practices.

Since the incidence and rate of illness and mortality associated with foodborne illnesses increases with age, much of TSU's recent work has focused on older adults. As the number of persons living to older ages increases, it is important to ensure this at-risk population and those who provide care for them have access to quality food safety education. Research directed by Dr. Godwin found that although older adults identified health care providers as a desired source of information on food safety, previous research suggests that physicians who treat patients at high risk for foodborne illness do not routinely provide information on food safety or the resulting illnesses. TSU's goal was to integrate food safety education into preventive health care for adults aged 60 and older. Incorporating the best available official guidance, TSU prepared an educational brochure entitled, "Food Safety Because You Care!", and a website containing information available for printing and distribution by healthcare providers.

With funding from FDA and the USDA National Integrated Food Safety Initiative, TSU researchers coordinated with a national team of scientists from RTI International and Kansas State University to conduct a national survey of U.S. adults, examining consumer practices related to the storage and consumption of ten categories of refrigerated ready-to-eat foods.

Sandria Godwin

Protecting Food from Contamination

Saving your food from everyday harm

The IMPACTS:

- Microbiological assessments of consumer refrigerators indicated poor sanitation and improper storage of leftover foods are a common source of contamination
- Several food samples and surfaces in the refrigerators analyzed contained high levels of *Staphylococcus aureus* and *Bacillus cereus* - these organisms may cause foodborne illness
- Situations needed for improving food safety at home, and the essential information needed to develop effective intervention strategies, were identified
- Information on proper storage of refrigerated leftovers to reduce the chances of cross contamination was disseminated to study participants during home visits

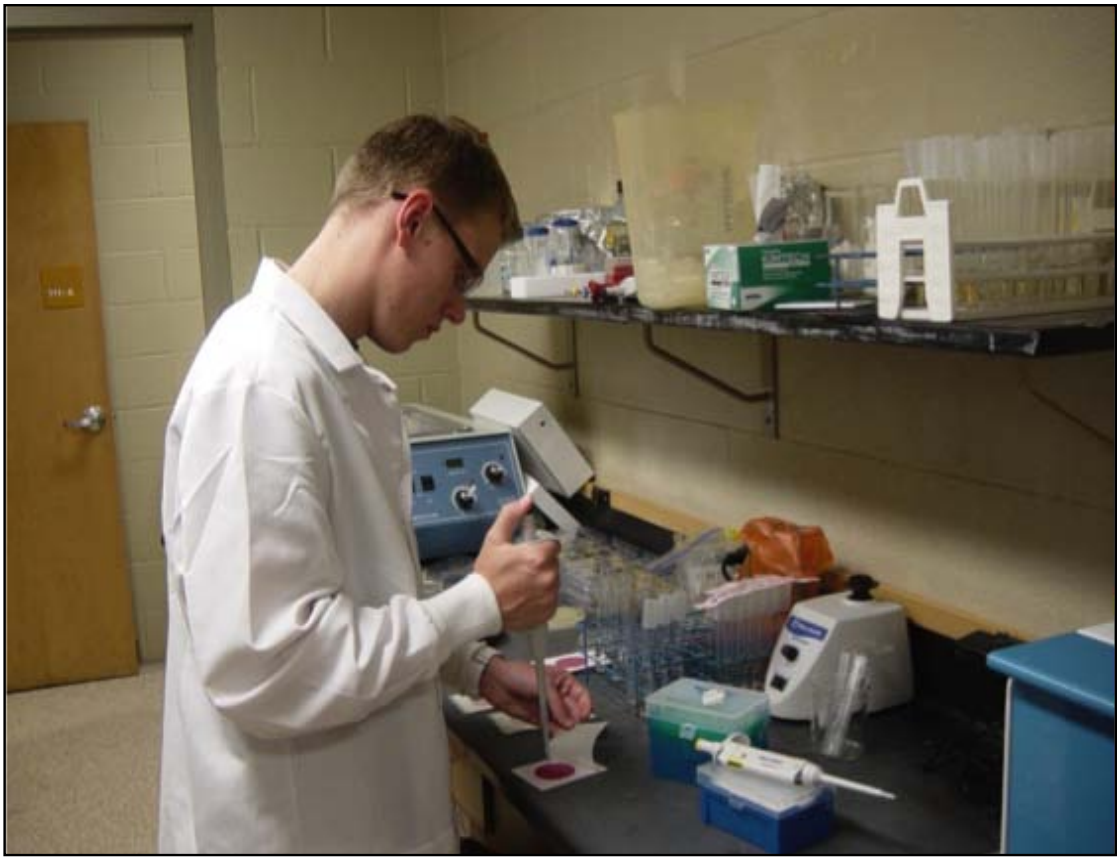
Food safety matters to every one of us, every day, and is a priority research area for USDA. According to new estimates from the Centers for Disease Control and Prevention, about 48 million people (1 in 6 Americans) get sick, 128,000 are hospitalized, and 3,000 die each year as a result of foodborne diseases. Home refrigerators can harbor pathogenic bacteria that pose the potential to contaminate foods. Consumers should be knowledgeable about safe handling of refrigerated foods and proper cleaning of home refrigerators to reduce the risk of food contamination.

The goal of research performed by TSU expert **Dr. Fur Chi Chen** is to improve consumer food safety practices to minimize the risk of foodborne illnesses associated with improper handling and storage of refrigerated foods.

Using a combination of microbiological studies and in-home observations and surveys, Dr. Chen and his students measure the risk of mishandling and cross contamination of foods, assess microbial survival and growth, and determine the factors that may promote bacterial transfer during refrigerator storage. Based on this research, risk communication messages are developed and disseminated to the public to minimize the risk of foodborne illnesses associated with improper handling and storage of refrigerated foods in the home.

Fur Chi Chen

> *"Consumers should be knowledgeable about safe handling of refrigerated foods and proper cleaning of home refrigerators."*
>
> *—Dr. Fur Chi Chen*



Alex Frederick, student in the Department of Family and Consumer Sciences, performing microbiological analysis of food samples.

Fighting Bacterial Illness

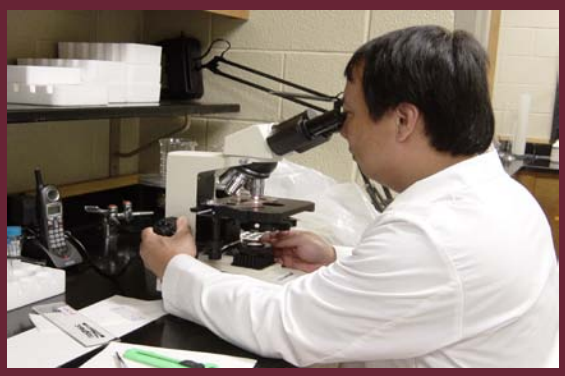
Dr. Chen and his staff also perform research on ways to detect foodborne pathogens. Incidences of foodborne illness have caused significant concerns about the safety of foods in the United States. To protect people from contaminated foods, there is an urgent need to explore new methods to detect contaminants in the food chain. The bacteria *Campylobacter* is the leading cause of bacterial diarrheal illness in the United States. In response to this threat, Dr. Chen is working to develop an innovative detection method utilizing phage displayed recombinant antibodies for rapid detection and identification of *Campylobacter*.

Using microbiological analysis of proteins produced by the bacteria, *Campylobacter* surface antigens will be used to screen a phage displayed antibody library and to develop an innovative technology for immunochemical fingerprinting of *Campylobacter*.

The IMPACTS:

- The methods developed are intended to be used by regulatory agencies and meat and poultry producers and processors to facilitate identification of dangerous foodborne pathogens in processing facilities and final products.

- Results from this project will enable researchers to secure support funding from interested industrial partners and to continue research activities to validate the developed technology and to incorporate it into microarray, biosensor and other advanced instrumentation to improve current detection methodologies.



Detecting and Identifying Contamination

Improving food safety and reducing illness.

Research performed by **Dr. Agnes Kilonzo-Nthenge** and her students is focusing on the prevalence of antibiotic-resistant bacteria in retail meats, fresh produce, domestic kitchens and farm environments in Middle Tennessee. Due to the use of antibiotics in animal production, antibiotic resistant bacteria are becoming increasingly widespread in the environment. Resistant bacteria in food animals can be transmitted to humans through meat products. Dr. Kilonzo-Nthenge and her students are educating consumers about the principles of proper meat handling, preparation and storage to decrease the incidents of foodborne illness. Using the laboratory results, educational materials are being designed to educate consumers on safe hygienic food handling practices and judicious use of antibiotics in agriculture. Farmers are also being educated about judicious use of antibiotics in animal production.

Kilonzo-Nthenge

The IMPACTS:

- A database of characterized antibiotic resistant microorganisms from retail meats, fresh produce and domestic kitchens has been constructed and will be used for risk assessment purposes. This resource will help explain the threat of bacteria in retail meats, fresh produce, and domestic kitchens and in the dissemination of antibiotic resistance to human populations.

- Booklets on safe handling practices of raw meats and fresh produce have been developed and distributed to the community. Consumers are using this information to enhance their food-handling practices. Knowing what alternative treatment options are available, farmers are becoming more judicious users of antibiotics.

- Graduate students have been trained in the isolation and identification of antibiotic resistant bacteria in retail foods and farming environments. Students have also gained hands on experience and skills in conducting food safety research, collecting data, analyzing data and presenting data.

Health and Nutrition

To advance health and nutrition awareness, TSU researchers create educational and informational programs for people across the state.

Improving Your Food/ Ending Childhood Obesity

Using new and old foods to keep people healthy

Weiguang Yi

Herbs have a long and fabled history of containing beneficial health properties. Antioxidant, anti-inflammatory, antibacterial, and antitumor benefits are just a few examples.

Traditionally, herbs have been dried with heat to eliminate bacteria and fungi, and enable their long-term preservation. While the drying process may not have much effect on taste of the herbs, storage and drying conditions can have an impact on the chemical and biological activity of herbs.

Research performed by **Dr. Weiguang Yi** is addressing how herbs should be handled to maintain optimum quality. What is the best method to dry herbs? Are fresh herbs superior to a dried product? Is it possible to have herb products with long shelf life, while still maintaining their biochemical and biological activity?

Dr. Yi's research team has been evaluating the effects of various herb drying conditions, extraction protocols, and biochemical activities on three specific culinary and medicinal herbs: rosemary (*Rosmarinus officinalis)*, motherwort (*Leonurus cardiaca*), and peppermint (*Mentha piperita*). Leaf tissues are dried and preserved by different methods, and then tested for overall effectiveness of bioactive compounds; for example, antitumor activity is assessed using SW-480 human colon cancer cells.

Ending Childhood Obesity

In the laboratory of **Dr. Ying Wu**, research is focused on the development of food products with health-promoting benefits. One of Dr. Wu's interests is to develop food products with high dietary fiber content. Dietary fiber has been well recognized as beneficial in maintaining good health. It remains a challenge for industries to produce products with acceptable taste and texture qualities, especially with a high percentage of dietary fiber. Local agricultural resources will be explored to develop products with high dietary fiber content.

The IMPACTS:

- Results to date indicate that drying techniques do have an effect on the amount of biologically active compounds found in the herbs
- Research conducted on peppermint extracts shows a significant ability to inhibit the growth of cancer cells.
- For the three herbs tested, 80 percent ethanol extraction of fresh tissue had a significantly higher level of bioactive ingredients than 80 percent methanol extraction
- In general, our research found that herbs dried it the sun or dried at low temperature had significantly higher total polyphenol content, antioxidant capacity, and antitumor activity than fresh samples. This research shows that properly dried herbs can result in a product with long shelf life, improved antioxidant capacity, and antitumor activity

3 TIMES

The obesity rate is 3 times the rate from one generation ago.

17

percent of all children and adolescents in the United States are affected by obesity

Based on this research, an anti-obesity agent is being identified for further development as a potential food or beverage supplement, and used to help reduce the prevalence of obesity in children and adolescents.

Several molecular pathways associated with **fat metabolism** have been applied to understand how the **anti-obesity** chemicals prevent obesity development.

About **50** chemicals from different plants, including soybeans, chocolate and American ginseng, have been evaluated for their effects on fat cell growth and fat deposition in single cells and animals. These findings can be used to select anti-obesity chemicals and/or plants to prevent excessive fat deposition in children.

Healthy Living Using Modern and Traditional Foods

Hongwei Si

Obesity is one of the most profound public health problems for young Americans today. In 2010, more than 40 percent of American children were overweight or obese. The long-term research goal of TSU scientist **Dr. Hongwei Si** is to develop an anti-obesity agent – a food or beverage to reduce the prevalence of obesity among children and adolescents.

While exercise and diet are considered to be the most effective ways to control body weight, an easier, convenient and cost-effective means may be more effective in preventing childhood obesity.

Dr. Si and his colleagues are screening various extracts from soybeans, cocoa and American ginseng that exhibit anti-obesity effects. In addition to the technical instrumentation in Dr. Si's laboratory, one of his most important tools he uses are live cultured human cells in combination with laboratory animals to test the effects of plant-derived chemicals on obesity prevention.

In addition to his research in screening anti-obesity chemicals from plants, Dr. Si's research group is active in understanding the molecular mechanisms of these plant-derived chemicals in obesity prevention.


RIDGID

A Tennessee — Desert

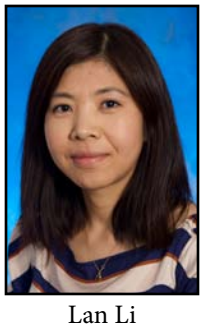
Improving access to local, affordable and nutritious foods

The White House Task Force on Childhood Obesity set a target date of 2020 to increase the availability of fruits and vegetables in the American food supply by 70 percent, and eliminate food deserts. A food desert is a place with restricted access to healthful foods. The access may be due to a number of reasons, including lack of access to food retailers, availability of nutritious foods, or affordability of foods. These challenges provide opportunities for local producers and businesses to expand production of fruits and vegetables and to build and strengthen local and regional food systems.

Current research performed by **Dr. Lan Li** identifies and characterizes trends and changes in farm distribution and supplies of fruits and vegetables in the U.S., and assesses factors that contribute to the growth of the produce industry; in particular, factors associated with market environment and marketing opportunities. Dr. Li also examines the food environment and demand for fruits and vegetables in Davidson County—the second largest food desert cluster in Tennessee.

This timely research provides knowledge on food desert conditions and the relationship between food environment and demand for healthy foods. The knowledge gained will be conducive to effective policy and program design, community planning, decision-making, and behavioral changes. Results from this research has implications for eliminating food deserts, improving access and affordability of fruits and vegetables, building and strengthening local and regional food supplies, promoting fruit and vegetable consumption, reducing obesity, and improving nutrition, health, and wellness.

Dr. Li's research will also build and strengthen local food systems and lead to increasing the supply of affordable and nutritious foods for consumers. Insights and knowledge gained will assist in informed decision-making by stakeholders (policymakers, researchers, educators, producers, businesses, and consumers) to evaluate needs and opportunities and to effectively design and implement programs.



Lan Li

Serving Beyond the University

The knowledge and expertise of faculty in the College of Agriculture, Human and Natural Sciences extends beyond our classrooms and laboratories. Our scientists are sought out to provide service and counsel to a wide range of government and private organizations across the country.

Dr. Chandra Reddy, Dean of the College of Agriculture, Human and Natural Sciences is a member of the National Agricultural Research, Extension, Education, and Economics Advisory Board. This Board advises the Secretary of Agriculture and Land-Grant colleges and universities on top national priorities and policies for food and agricultural research, education, extension and economics. Appointed by U.S. Department of Agriculture Secretary Tom Vilsack, Dr. Reddy has served the Board since 2010.

"We appreciate the contributions that these individuals are making to help advance agricultural research, education, extension, and economics within the Department, their expertise and advice is valuable in the development of long- and short-term research, extension, education, and economic priorities in the food, fiber, and fuel systems," said US. Secretary of Agriculture Tom Vilsack.

A food researcher in the Department of Family and Consumer Science in the College of Agriculture, Human and Natural Sciences, **Dr. Fur-Chi Chen** is a member of the USDA Meat and Poultry Inspection Group. He was chosen for the committee by the USDA and will serve a two-year term. Established in 1971, the purpose of the committee is to provide advice to the Secretary of Agriculture concerning state and federal programs involving meat, poultry and processed eggs over inspection, food safety and other matters.

Dr. Surendra Singh, Department Head of Agricultural and Environmental Sciences, is a board member of the U.S.-India Knowledge Initiative in Agriculture Teaching, Research and Outreach. In addition, Dr. Singh was appointed by the USDA in 2009 to serve as a member of International Task Force to provide input into how concepts and ideas such as globalization and competition can be incorporated into undergraduate agribusiness programs.

In addition to their duties working at Tennessee State University, a number of faculty and staff members serve on national committees and boards -- carving a path of innovation in their industries.

The Southern Nursery Association represents the $54 billion nursery and landscape industry in the Southeastern U.S. **Dr. Nick Gawel**, superintendent of the Otis L. Floyd Nursery Research Center in McMinnville, TN, is the Director of Research for the SNA. Appointed to the position by the SNA Board of Directors in 2008, Dr. Gawel coordinates the annual SNA Research Conference and edits the conference proceedings.

Professor **Sam Comer** is a member of the International Committee on Programs, a part of the Association of Public and Land-Grant Universities. As a member of this committee, he is on the Board of Directors of the "Leadership For the 21st Century" program. The primary purpose of this program is to develop leaders in land grant institutions and their strategic partners who link research, academics, and extension.

Nursery Research Center entomologist **Dr. Jason Oliver** is the Research Representative on the National Plant Board (NPB) Japanese Beetle Regulatory Treatment Review Committee. The purposes of the committee are to review and make recommendations using scientific data on the addition or removal of insecticide products and other treatment options in the Domestic Japanese Beetle Harmonization Plan.

The Tennessee Department of Agriculture (TDA) has appointed **Dr. Alicia Bray** and **Dr. Jason Oliver** as members of the Thousand Cankers Disease and Emerald Ash Borer Technical Committee. Joining other committee members from the U.S. Forest Service, USDA-APHIS, TDA, and University of Tennessee, these Otis L. Floyd Nursery Research Center entomologists make decisions on the management, detection, and prevention of new invasive insect species in Tennessee.

Dr. Lan Li, Assistant Professor in Agricultural and Environmental Sciences, serves on the Economic Statistics and Information Resource Committee of the Agricultural and Applied Economics Association (AAEA). The AAEA is the leading organization in the world for professional advancement in and dissemination of knowledge about agricultural, development, environmental, food and consumer, natural resource, regional, rural, and associated areas of applied economics and businesses. Dr. Li was appointed by the Executive Committee for the 2012-2015 term.

Community Outreach


Tennessee
Farm!
TRADITION
PICK

Agricultural / Family and Consumer Sciences Contacts

Agricultural Researchers

Dr. Dalia Abbas
Research Assistant Professor
615-963-5616
dsaleh@tnstate.edu

Dr. Karla Addesso
Research Assistant Professor
931-815-5155
kaddesso@tnstate.edu

Dr. Ahmad Aziz
Research Associate Professor
615-963-1595
aziz@tnstate.edu

Dr. Richard Browning, Jr.
Research Associate Professor
Animal Science
615-963-5837
rbrowning@tnstate.edu

Dr. Fitzroy (Roy) Bullock
Extension Professor
Agriculture Program Leader
615-963-5449
fbullock@tnstate.edu

Dr. Alicia Bray
Postdoctoral Research Associate
Entomology
931-815-5160
abray@tnstate.edu

Dr. Carter Catlin, Jr.
Associate Dean of Research
615-963-5819
ccatlin@tnstate.edu

Dr. Arvazena Clardy
Extension Assistant Professor
Ornamental Horticulture, 4-SET and
NRCS Outreach Coordinator
615-963-4887
aclardy@tnstate.edu

Sammy L. Comer
Assistant Professor
Director of International Programs
615-963-5820
scomer@tnstate.edu

Dr. Jason P. de Koff
Extension Assistant Professor
615-963-4929
jdekoff@tnstate.edu

Dr. Sam O. Dennis
Research Associate Professor
Soil and Soil Water Quality
615-963-5822
sdennis@tnstate.edu

Dr. C. Korsi Dumenyo
Research Assistant Professor
615-963-5634
cdumenyo@tnstate.edu

Dr. Desh Duseja
Professor
615-963-5439
dduseja@tnstate.edu

Dr. E. Kudjo Dzantor
Associate Professor, Soil Microbiology/
Biochemistry, Environmental Toxicology
615-963-1839
edzantor@tnstate.edu

Dr. Enefiok Ekanem
Research Professor
615-963-5823
eekanem@tnstate.edu

Dr. Nick Gawel
Superintendent
Otis L. Floyd Nursery Research Center
931-668-3233
ngawel@tnstate.edu

Dr. Solomon G. Haile
Extension Assistant Professor
Forestry/ Agroforestry Extension
615-963-5445
shaile@tnstate.edu

William F. Hayslett
Assistant Professor, Academic Coordinator
615-963-5438
whayslett@tnstate.edu

Dr. Prabodh Illukpitiya
Research Assistant Professor
615-963-1877
pilukpi@tnstate.edu

Dr. Makonnen Lema
Associate Professor
615-963-1391
mlema@tnstate.edu

Dr. Lan Li
Research Assistant Professor
615-963-4935
lli@tnstate.edu

Dr. Latif Lighari
Associate Dean of Extension
615-963-5526
llighari@tnstate.edu

Dr. Margaret T. Mmbaga
Research Professor
931-815-5143
mmmbaga@tnstate.edu

Dr. Samuel N. Nahashon
Research Associate Professor
Poultry Science
615-963-2575
snahashon@tnstate.edu

Dr. Jason B. Oliver
Research Associate Professor
Entomology
931-815-5145
joliver@tnstate.edu

Dr. An Peischel
Extension Assistant Professor
Small Ruminant Extension Specialist
615-963-5539
apeishel@tnstate.edu

Dr. Dharma Pitchay
Extension Assistant Professor
615-963-4890
dpitchay@tnstate.edu

Dr. Chandra Reddy
Professor, Dean and Director of Research,
Administrator of Extension
615-963-7561
creddy@tnstate.edu

Dr. John C. Ricketts
Extension Associate Professor,
Agricultural and Extension Education
615-963-7620
jricket1@tnstate.edu

Agricultural / Family and Consumer Sciences Contacts

Dr. Allen Roberts
Research Assistant Professor
615-963-1495
arober14@tnstate.edu

Dr. George Smith
Extension Assistant Professor
615-963-1233
gsmith6@tnstate.edu

Dr. Susan Speight
Research Assistant Professor
615-963-5183
sspeigh1@tnstate.edu

Dr. Roger J. Suave
Research Professor
615-963-5828
rsuave@tnstate.edu

Dr. Fisseha Tegegne
Research Professor
615-963-5830
ftegegne@tnstate.edu

Alvin Wade
Associate Extension Specialist
Community Resources and Economic Development
615-963-5533
awade@tnstate.edu

Dr. Junming Wang
Research Assistant Professor
615-963-5017
jwang2@tnstate.edu

Dr. Ying Wu
Research Assistant Professor
615-963-5824
ywu@tnstate.edu

Dr. Weiguang (Abe) Yi
Research Assistant Professor
615-963-7651
wyi@tnstate.edu

Dr. Suping Zhou
Research Associate Professor
615-963-2146
zsuping@tnstate.edu

Family and Consumers Science Researchers

Sue Ballard de Ruiz
Assistant Professor
Design Program Coordinator
615-963-5623
aballard@tnstate.edu

Dr. Fur-Chi Chen
Research Associate Professor
Food Science
615-963-5410
fchen1@tnstate.edu

Rita E. Fleming
Assistant Professor, Health Education
615-963-2135
rfleming2@tnstate.edu

Dr. Sandria Godwin
Professor, Director
Didactic Program in Dietetics
615-963-5619
sgodwin@tnstate.edu

Dr. Geraldean Johnson
Professor and Department Head
615-963-5617
gejohnson@tnstate.edu

Mary Johnson
Interim Director/ Lead Teacher,
TSU Early Learning Center
615-963-5614
mjohnson@tnstate.edu

Dr. Agnes Kilonozo-Nthenge
Research Assistant Professor
615-963-5437
akilonzontheng@tnstate.edu

Dr. Margaret E. Machara
Assistant Professor
Child Development and Family Relations
615-963-5628
mmachara@tnstate.edu

Dr. Graham P. Matthews
Associate Professor
Early Childhood Education
615-963-5627
gmatthews2@tnstate.edu

Dr. Tyrone Miller, Jr.
Extension Assistant Professor, Leadership and Organizational Development
615-963-1843
tmiller11@tnstate.edu

Dr. Veronica J. Oates
Assistant Professor
615-963-5625
voates@tnstate.edu

Dr. Hongwei Si
Research Assistant Professor
615-963-5443
hsi@tnstate.edu

Leslie Speller-Henderson
Extension Assistant Professor
615-963-4888
lspeller@tnstate.edu

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College of Agriculture, Human and Natural Sciences
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