# Representative Examples of Research Accomplishments at the 1890 Universities

Selected Major Accomplishments in
Agricultural Research in

North Carolina Agricultural and Technical State University

Dr. William Randall, Dean and Director of Research for the School of Agriculture and Environmental Sciences
Dr. Shirley Hymon-Parker, Associate Dean for Research, School of Agriculture and Environmental Sciences

Exotic mushrooms: the birth of an industry With tobacco in decline, North Carolina Agricultural and Technical State University went into overdrive in the early 2000s, researching alternative enterprises for its stakeholders in the small-scale and limited-resource farming community. Edible and medicinal exotic mushrooms emerged as a promising new venture. N.C. A&T researched and optimized an array of mushroom varieties. Now the project continues to research and develop spawn for North Carolina, and provides technical support for approximately 400 indoor and outdoor mushroom growers, who return approximately $1.2 million a year to the state's economy each year. The industry continues to expand.

Traditional hog husbandry finds niche market – As small-scale limited resource farmers struggled through the first decade of the 2000s to replace income lost to the tobacco buyout, several turned to pasture-based small-scale hog production, after N.C. A&T research indicated there is a niche market for pork from non-confinement operations. A&T researchers introduced small farmers to the practice, and helped establish a growers association that now provides farmers with a premium price. Since 2008, the Natural Hog Growers Association has returned approximately $1 million each year to the state's economy.

Adding value, eliminating allergens – With close to 2 million Americans suffering from peanut allergies, food scientists at N.C. A&T developed a process to address the problem. This patent-pending post-harvest technology is being expanded to examine wheat allergens, and researchers expect to bring it to bear on tree nut allergens as well.

Selected Major Accomplishments in
Agricultural Research in the

COLLEGE OF AGRICULTURE, HUMAN AND NATURAL SCIENCES

TENNESSEE STATE UNIVERSITY

CHANDRA REDDY, DEAN

**Improvement in Dietary Intake Data Collection Methods**: When members of the Food Surveys Research Group of ARS were seeking partners to work with them on evaluating methods used to collect dietary recall data, they contacted Dr. Sandria Godwin at Tennessee State University, who had many years of experience in conducting dietary interviews. Through the liaison formed between these two organizations, and its expansion to include the Centers for Disease Control in the Department of Health and Human Services, numerous portion size estimation aids were developed and tested, ultimately resulting in improved methodologies used to collect both the in person 24-hour hour dietary recall data for the National Health and Nutrition Examination Survey, and the follow-up recall information collected via telephone.

**Selected Major Accomplishments in Agricultural Research at the**

**FORT VALLEY STATE UNIVERSITY**

**Govind Kannan, Dean and Director**

**Biological Control of Internal Parasites in Small Ruminants.** Fort Valley State University is home to the Southern Consortium for Small Ruminant Parasite Control (SCSRPC), whose work has increased sustainability and profitability of small ruminant production systems in the USA and around the world. Dr. Thomas Terrill is the founder and director of this group, comprised of scientists and extension educators from 20 institutions throughout the southern USA and overseas, working together to find non-chemical (novel) solutions to control parasitic nematodes in sheep, goats, and other livestock. The greatest impact on producers has resulted from the consortium's work in validating the FAMACHA© system of anemia detection for use with sheep and goats in the USA, administering copper oxide wire particles (COWP), and feeding the high condensed tannin forage sericea lespedeza (*Lespedeza cuneata*) in different forms. Uptake and application of these technologies by farmers has been tremendous.

**Sheep Breed Evaluation.** Research by Dr. Will Getz and his team established that hair sheep genetics is better suited to the southern USA environment than traditional wool breeds in terms of overall productivity. Their work resulted in the establishment of additional flocks of sheep in the Southeast based primarily on hair breeds and their crosses.

**Performance Testing of Meat Goats.** Meat goat buck performance testing by Dr. Will Getz, studying growth and muscle development, internal parasite tolerance, behavior, and reproductive capacity of bucks of different breeds created awareness of the importance of using scientific data, in addition to physical appearance of animals, in selection programs. His work helped producers understand the extent of genetic differences within a herd and its relationship to performance.

**Nutritional Strategies to Produce Healthier Goat Milk.** Dr. Brou Kouakou's research group at Fort Valley State University has developed economically viable nutritional strategies that result in healthier goat products and sustainability of small goat farms. They demonstrated that lactating dairy goats consuming diets containing soybean oil produce milk with healthier fatty acid composition. Dairy goat farmers can potentially replace a large amount of corn with smaller amounts of soybean oil in goat diets. His work has also demonstrated that *Sericea lespedeza*, a leguminous forage fed to control internal parasites in small ruminants, also has nutritional advantages. Compared with alfalfa, sericea lespedeza-fed dairy goats produce milk with lower total fat and lower proportion of saturated fats without affecting yield and other milk components.

**Year-Round Breeding of Goats.** Work by Dr. Eugene Amoah on breeding of goats out-of- season using photoperiod manipulation, hormone combinations, and in vitro fertilization and embryo transfer technology has enabled farmers to breed goats year-round.

**Genetic Manipulation in Goats.** Dr. Mahipal Singh cloned and sequenced a previously unknown ~800 bp genomic fragment upstream of 5' promoter regulatory region of the goat myostatin gene. This work could potentially lead to production of goats with larger muscle mass. His work also demonstrated that following animal death, tissues stored up to 56 h under refrigerated conditions can be cultured and maintained indefinitely for potential future cloning.

**Year-Round Marketing of Dairy Goat Products.** Dr. Young Park's research proved the feasibility of freezing goat milk cheeses during milk production off-season, allowing year-round marketing of dairy goat products. His work has potential to increase sustainability of the dairy goat industry in the US and around the world. Among other recognitions for his research accomplishments, Dr. Park received the Land O'Lakes, Inc. Achievement Award from the American Dairy Science Association, and the Morrison-Evans Outstanding Scientist Award from the Association of 1890 Research Directors, Inc. His acclaimed book "Handbook of Milk of Non-Bovine Mammals," originally published in English, has been translated into two other languages.

**Chevon (goat meat) Technology.** Dr. Govind Kannan demonstrated that several postmortem technologies can be applied to improve the palatability of chevon. Although chevon is widely consumed around the world for its unique flavor and nutritional advantages, it is not a popular meat in the US. Dr. Kannan's work is expected to improve the perception of chevon and expand its market among mainstream American consumers.

**Non-Thermal Methods to Destroy Pathogens on Meat Surfaces.** Research by Food Engineers at Fort Valley State University has shown that sodium chloride in combination with low-intensity electricity destroys E. coli on goat carcasses. This inexpensive, non-thermal technology can be potentially implemented in small and very small goat processors, meat packers, and retailers, without causing any negative effects on meat quality characteristics.

**Animal Agriculture Development in Afghanistan.** Fort Valley State University faculty members have contributed to US animal health reconstruction efforts in Afghanistan. Dr. Seyedmehdi Mobini visited the nation and developed a book (and CD) entitled "Illustrated Manual of Infectious Diseases of Livestock in Afghanistan" in English, Dari, and Pashto. This book is being used by the US Army, USDA, USAID, and local Afghanis.

**Improved Farming Systems.** Research by Dr. Bharat Singh on winter cover crop based dry land and irrigated farming systems for the production of field and vegetable crops has contributed to increased use of winter cover crops in the cultivation of important cash crops, such as cotton and corn in Georgia. His work also demonstrated that the tillage component of any low-input farming system for light textured soils of the southeast must include periodic sub-soiling to allow roots to penetrate below the hardpan zone.

**Soil Quality Preservation.** Through long-term experiments, Dr. Bharat Singh's group demonstrated that cover crops improve soil quality by increasing soil organic nitrogen and carbon composition, and can also enhance spring soil microbial activity essential for release of nutrients for a subsequent summer cash crop.

**Carbon Sequestration.** Data produced by Dr. Bharat Singh's research team demonstrated that estimation of total carbon sequestered by the plant and the soil for important field crops with and without winter cover is essential for calculating the monetary value of these crops toward greenhouse gas remediation.

**Cellulosic Biofuel Feedstock Production and Harvesting System.** Dr. Bharat Singh's research has demonstrated that napiergrass, energycane and giant reed are the best suited cellulosic biofuel feedstocks for semi-tropical areas of the southern US. He has also generated comprehensive data on the quality and harvesting span for these grasses that may be valuable to feedstock growers and biofuel companies.

***Scutellaria* (skullcap) Research.** Dr. Nirmal Joshee and his collaborators have demonstrated specific anticancer activity of *Scutellaria* flavonoids in cell and rat models. Their research has potential for establishing scientific evidence-based usage of *Scutellaria* for developing novel adjuvant therapy for human malignant tumors. There are also possibilities for developing the plant as an organic cash crop for farmers through agronomic trials.

**Lignocellulosic biofuel research.** Research by Dr. Nirmal Joshee on the fast growing tree, *Paulownia elongate*, as a bioenergy feedstock crop has demonstrated that this tree can sequester 80-100 lbs of $CO_2$ annually and yield 50% cellulose content in two years. Because the genus *Paulownia* includes many species that grow across a wide climatic range, there is immense potential for this tree becoming an important biofuel feedstock worldwide.

**Peach Tree Short Life Syndrome.** More than 35 years of research lead by Dr. Anand Yadav on peach tree short life and rootstock accomplished wider understanding of biotic and abiotic stress factors responsible for reducing tree survival, orchard longevity, and fruit production. The group's biotechnological investigations, involving development of *in vitro* plant regeneration protocols amenable to genetic enhancement, indicated that peach is a highly recalcitrant species.

Selected Major Accomplishments in
Agricultural Research in the

RESEARCH STATION

UNIVERSITY OF ARKANSAS AT PINE BLUFF

JAMES O. GARNER, JR. DEAN/DIRECTOR

Indoor Hatcheries for Baitfish Production

Nathan M. Stone, leading aquaculture expert, was the first to develop a complete set of practical methods for large-scale indoor hatching of baitfish. The technology package transformed the baitfish industry in a matter of just a few years to one that was more intensive, based on skilled labor, and high efficiency. The new technology reduced costs dramatically, but more importantly, allowed the industry to manage their growout operations more efficiently and cost effectively. The significance of this research program was recognized by Stone's selection as recipient of the Excellence in Extension award by NASULGC for 2009.

Arkansas Baitfish Certification Program

Andrew Goodwin and Nathan Stone worked with the Arkansas Bait and Ornamental Fish Growers Association and the Arkansas State Plant Board to develop a certification program to ensure that live fish transported across the U.S. are free of important diseases and of aquatic nuisance species. This program has been used as a model approach to prevent the spread of disease and aquatic nuisance species while supporting an important sector of U.S. agriculture. The importance of this work was referenced in the award presentations to both Goodwin (2007) and Stone (2010) of the Joseph P. McCraren Award by the National Aquaculture Association.

Agriculture Regulatory Science Program

The Regulatory Science Center of Excellence was established in 1995 by the United States Department of Agriculture Animal and Plant Health Inspection Services – Marketing and Regulatory Programs Division. The Center is committed to education, research and technology transfer programs that ultimately train people about regulatory affairs and assist agri-business with regulatory issues. The Center is located within the Department of Agriculture on the University of Arkansas at Pine Bluff (UAPB) campus.

The Regulatory Science Center functions in a multidisciplinary environment. It merges the experience of University faculty and Federal agencies in conducting research and outreach education programs. The Regulatory

Science Center through its Regulatory Science graduate and undergraduate programs prepares students and practitioners to address important regulatory issues in agriculture, environmental biology and industrial health and safety, and conduct risk assessments. The efforts of the Regulatory Science Center help provide safe, high quality commodity and food products, and healthy work and living environments. Our staff has expertise in the fields of regulatory compliance, food safety, biotechnology, natural resource systems, and natural resource policy and is nationally recognized for their efforts.

The Center's mission is to support research and understanding in regulatory sciences and risk analysis. The Center also supports a multidisciplinary program designed to prepare students for careers and professionals to conduct risk assessments and develop regulatory strategies in agriculture, environmental biology, and industrial regulations. It combines the experience of university faculty and federal agencies in conducting research and outreach education that advances understanding of and compliance with the federal, state and local government statutes.

An Agricultural Regulations graduate program was created in 2008 to further serve the needs of clientele by increasing the number and diversity of qualified graduates available to work in the growing regulatory affairs profession that affects the agricultural industry, the environment, human health and homeland security.

Selected Major Accomplishments in
Agricultural Research in the

COLLEGE OF AGRICULTURE AND FOOD SCIENCES

FLORIDA A&M UNIVERSITY

SAMUEL L. DONALD, INTERIM DEAN AND DIRECTOR
MOSES T.K. KAIRO, ASSOCIATE RESEARCH DIRECTOR AND
DIRECTOR CENTER FOR BIOLOGICAL CONTROL
SUNIL PANCHOLY, DIRECTOR CENTER FOR WATER AND AIR QUALITY
STEPHEN LEONG, DIRECTOR CENTER FOR VITICULTURE AND SMALL FRUITS RESEARCH

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**Arsenic Removal Method from Drinking Water.** The removal of arsenate and arsenite from drinking water poses challenges, especially when arsenite is present in a significant amount. A method was developed by Amita Jain, et al., to remove both arsenate and arsenite from drinking water to meet the drinking water standard of 10 µg $L^{-1}$. The combined use of potassium ferrate and aluminum chloride salts reduced arsenic concentration from 500 µg $L^{-1}$ to < 2 µg $L^{-1}$ at pH 6.5. A low molar ratio of 6:1 for ferrate+Al salts to arsenite was required to meet drinking water standard. This method is very effective, economical, and practical.

**Ultraviolet Light Disinfection of Drinking Water: An Alternative to Chlorination.** Several FAMU faculty, O.S. Mbuya, C.S. Gardner and L.A. Latinwo and a collaborator from Teknikon North Gauteng, South Africa, B.J. Mankazana, examined the effectiveness of UV light to inactivate waterborne pathogens (e.g., *Escherichia coli*, *Streptococcus faecalis*, *Salmonella typhi* and *Shigella flexneri*) under laboratory conditions. Results have shown that UV light irradiation reduced bacterial counts in water to non-detectable levels. UV irradiated bacteria did not photoreactivate when exposed to visible light for 24 hours. However, water turbidity decreased the disinfecting effectiveness. These results suggest that UV light disinfection is appropriate for point-of-use drinking water systems. There is potential application of these UV light drinking water disinfection systems in rural communities and

developing nations. Work is being undertaken to develop and apply low-cost UV disinfection technology to drinking water supplies in Tanzania and South Africa.

**Development of a "Mesh-Bag" Method to Quantify Soil Erosion.** Yuch. P. Hsieh and his co-workers have developed the "mesh-bag" field method to quantify soil erosion and the resulting nutrient loss. This is the only practical field method that can quantify soil erosion and soil deposition without obstructing the natural runoff pattern of a field with sensitivity good enough for event-to-event observations. The development of mesh-bag method fills a big gap in the soil and water conservation research. The method is now being tested under natural rain-fed as well as irrigated conditions in field crops such as cotton and peanut. It is a useful tool in predicting soil erosion under forest conditions and estimating possible silting of the water bodies.

**Discovery of Environmental Indicators in coastal salt marshes of SE US.** Yuch Ping Hsieh, discovered the cause of barren formation in salt marshes of SE US and how it can be used to determine the rate of present-day sea-level rise. Salt barren is formed by the interaction between tides and climate conditions such that a narrow salinity maximum belt, 5-10 times of the surrounding marshes, inhibits vegetation grow. The position of salt barrens is moved in sync with the rate of the present-day sea-level rise, a valuable indicator to environmental and climate change. Hsieh's work on sulfur chemistry of salt marshes also explains the fraction heavy metals, including mercury, which is bioavailable and potentially could enter into the food chain of coastal waters.

**Decipher the dynamics of stable/active soil organic carbon pools in temperate soils**. Yuch Ping Hsieh, was among the first scientists to demonstrate that soil organic carbon in temperate soils consists of active and stable pools with huge separation of turnover times (decades vs. thousands y.). He applied the $^{14}C$ and $^{13}C$ techniques onto the analysis of long-term agricultural experimental station soils (Morrow Plots of Illinois and Sanborn Field of Missouri) and determined the size and turnover times of the two pools. This understanding is critical to the knowledge of the role of soil organic carbon on global carbon cycle.

**Development of the multi-element scanning thermal analysis (MESTA) for solid environmental samples**. Yuch Ping Hsieh has developed the MESTA, which provides a practical solution to the difficulty of characterizing organic matter in complicated solid environmental samples such as soils and sediments. MESTA has been used to quantify black carbon/organic carbon in aerosols, soils and sediments. MESTA also is the only tool that can direct analyze organic sulfur. Before the MESTA, organic sulfur in environmental samples can only be quantified by the difference between total and inorganic sulfur.

**Combating Major Pests Threatening Vegetable Farmers.** Tomato spotted wilt virus is the most important pest problem facing vegetable farmers in the southeastern USA. It is transmitted by tiny insects called thrips. Research conducted by several of the first graduate students in the Center for Biological Control at Florida A&M was instrumental in the development of successful management programs by the University of Florida and USDA-ARS for thrips and tomato spotted wilt virus. The students, who conducted their research under the direction of Dr. Stuart Reitz, demonstrated the effectiveness of biological control and cultural controls in suppressing thrips and tomato spotted wilt virus. These management programs have an estimated economic benefit of >$75 million per year in terms of prevention of direct yield loss and reduced pesticide use by growers.

**Biological Control of Tropical Soda Apple in Florida.** Stephen Hight USDA/ARS/FAMU-CBC was part of the collaborative team that brought about the successful control of tropical soda apple, *Solanum viarum*, in southern Florida. He was one of the first to release the approved biological control agent *Gratiana boliviana* into Florida. The collaborative team received the "2010 Achievement Award for Team Research on Tropical Soda Apple" presented by the Florida Entomological Society, Jupiter Beach, FL. In 2010, Nandkumar Divate and Michael Thomas quantified the

economic impact of the biological control program although the analyses is not complete, their data suggest a cost savings of approximately 50% statewide. If these savings are verified, it could lead to a state-wide savings of between $3.25 to $8 million annually, or assuming the savings are permanent, $108 to $266 million in total saving.

**Sustainable Solutions to Pests of Honey Bees.** Lambert Kanga has been leading the development of alternative management options for varroa mite and the small hive beetle based on fungal pathogens. A *Metarhizium anisopliae* mycopathogen for varroa is undergoing final field testing. Other research is focused on studying miticide resistance patterns in varroa populations with a view to develop effective strategies for resistance management.

**Taking the War Against Invasive Pests Offshore.** Alien invasive pests pose a major threat to agriculture and the environment. Moses Kairo and colleagues from USDA APHIS have established a strategic research initiative focused on insects that have a high risk for entry into the U.S. This research has for instance identified biological control options for the management of the highly polyphagous passionvine mealybug, *Planococcus minor*. When this insect was discovered in Florida in 2010, adequate knowledge for its management had already been accumulated allowing more effective response. This approach has been expanded to other high risk insect pest threats.

**Web-based Digital Insect Identification:** Since 2002, several FAMU faculty including, Muhammad Haseeb, R. Wills Flows and Charles O'Brien have been at the fore front of developing digital insect identification tools. Since then, two tools have been deployed online: 1) Identification Tool for Weevil Biological Control Agents of Aquatic and Terrestrial Weeds in the United States and Canada and 2) Potentially Invasive Weevil Species from the Caribbean Countries to the United States. In addition, national symposium to discuss progress, challenges, and opportunities for the development of such tools was organized in 2011 during the 59$^{th}$ Annual Entomological Society meeting held in Reno, Nevada. This research and training effort continues to expand.

**Control Tactics for the Containment of Invasive Cactus Moth.** Dr. Stephen Hight, USDA ARS/CBC FAMU and collaborators developed an autocidal control technique that is area-wide in scope, species specific, and environmentally benign. In support of the autocidal development, Dr. Hight identified that the moths mate only during the hour before sunrise, the females produce a sex pheromone to attract males, and that three insecticides registered for ornamentals are effective ovicides and larvacides of *C. cactorum*. A field cage study identified the Sterile Insect Technique (SIT) as a control strategy for *C. cactorum*.

**Improving knowledge of the ecology of important natural enemies.** Jesusa C. Legaspi, Research Entomologist at USDA, ARS, CMAVE and Courtesy Assoc. Prof. at the Center for Biological Control has completed a substantial body of work on the physiological ecology and life history of generalist predators, especially the spined soldier bug, *Podisus maculiventris*. Her studies on *P. maculiventris, Orius insidiosus, Delphastus catalinae, Geocoris punctipes* have led to the first known documentation of ovigeny in insect predators.

**Noxious Invasive Weed Produces Secondary Defense Compounds.** Raymond Hix and colleagues studied the effects that potential plant defenses would have on biological control agents such as *Gratiana boliviana* and vectors of plant viruses such as *Frankliniella occidentalis*. They determined that generalist herbivore feeding induced secondary plant defenses in the noxious invasive weed, tropical soda apple (TSA) *Solanum viarum*. Before this study, nothing was known about secondary plant defenses in tropical soda apple. They hypothesized that feeding by generalist and/ or specialist herbivores will induce secondary plant defenses in TSA.

**Distinguishing Bunch and Muscadine Grape Genotypes Based on Their Sugar Composition.** Mehboob Sheikh and Devaiah Kambiranda developed a chromatographic method for distinguishing muscadine and bunch grape genotypes based on their sugar content and composition. Selected commercial grape cultivars belonging to muscadine, bunch and Florida hybrid bunch market types were studied for content and composition of sugars in ripe berry. Berry sugars were analyzed by HPLC, and the amount of sucrose, glucose and fructose was quantified based on their peak area. Glucose and fructose were the predominant sugars in grape berries of bunch and Florida hybrid bunch grape genotypes and were present in almost equal amounts. In contrast, the muscadine berry contained sucrose, glucose and fructose. Sucrose was not detected in bunch and Florida hybrid bunch grape genotypes while sucrose constituted 17.0 to 47.0% in muscadine genotypes. The proportion of glucose and fructose was almost equal in all the three market categories while the level of sucrose varied widely among the muscadine genotypes indicating that sugar composition is distinct in muscadine and can be used to distinguish muscadine and bunch grape genotypes.

**Identification of Cellular Components Responsible for Low Sugar Content in Muscadine.** Drs. Mehboob Sheikh and Devaiah Kambiranda are investigating the reason for low sugar content in muscadine grapes and ways to increase its sugar content. Sugar accumulation is an important event in grape berry ripening and is an important characteristic essential for superior enological characteristics and product value. HPLC and enzyme assays revealed that muscadine grapes primarily contain sucrose, glucose and fructose compared to only glucose and fructose in bunch grapes. Our studies have revealed that invertase enzyme required for breakdown of sucrose is low in muscadine grapes compared to bunch grapes. Further analysis of low invertase activity in muscadine revealed the presence of invertase inhibitor in muscadine berry. Invertase-inhibitor was amplified using RT-PCR from Muscadine grape. Homology search revealed that Muscadine invertase-inhibitor nucleotide sequence had 95% similarity with *V. vinifera* invertase-inhibitor. Studying interactions between Muscadine invertase and invertase-inhibitor will help determine the role of invertase enzyme regulation and low sugar content in Muscadine grapes.

**Identification of Stilbene Synthase Gene in Muscadine Grape to Enhance its Nutraceutical Characteristics.** Mehboob Sheikh and Hemanth Vasanthaiah and Devaiah Kambiranda from the Center for Viticulture at Florida A&M University are investigating the potential of stilbene synthase gene to synthesize higher amount of resveratrol. Resveratrol encoded by stilbene synthase (STS) gene is one of the important phenolic compounds found in muscadine grape that has health benefits. Cloning and sequencing of STS gene has been done for the first time from muscadine grape and will aid in understanding resveratrol regulation in muscadine grapes and increase its nutraceutical value.

**Identification of Muscadine Berry Proteins Involved in Disease Tolerance.** Mehboob Sheikh, Devaiah Kambiranda and Ramesh Katam are studying the presence of plant defense related proteins in muscadine to understand disease resistance characteristics of muscadine grapes. Muscadine leaf and berry posses unique defense related proteins, which confer tolerance against leaf / fruit borne diseases. Proteomic studies in developing muscadine leaf and berry have revealed expression of defense related proteins like PR 10, polygalactauronase inhibiting protein, PR-4, NBS-LRR resistance proteins, Pinosylvin synthase, Pathogen induced defense protein 8, Prosystemin and NB-ARC domain containing proteins. Presence of these proteins in muscadines is detected for the first time and is responsible for its disease tolerance characteristics against various fungal and bacterial pathogens.

**Building Proteome Profiles of Muscadine Leaf to Improve Photosynthetic Efficiency.** Dr. Mehboob Sheikh and Dr. Ramesh Katam are studying proteome profiles of leaf proteins in muscadine (*Vitis rotundifolia*) using a high throughput two-dimensional gel electrophoresis (2-DE) to document complexity in their composition and to determine protein identity and function for enhancing photosynthetic efficiency of muscadine grape. 2-DE resolved muscadine

leaf proteins into 258 polypeptides with pIs between 3.5 and 8.0 and molecular weight between 12,000 to 15,0000 Daltons. Identity of some of these proteins included RuBisCO, glutamine synthetase, glyoxisomal malate dehydrogenase, ribonucleoprotein, chloroplast precursor, oxygen evolving enhancer protein, Hydroxypyruvate reductase. All the identified polypeptides (217) were grouped into seven categories according to their function as per the annotationin the *Viridi plantae and Vitis* taxonomic databases. Functional classification of identified proteins showed them to be associated with transport (18%), metabolism (19%), signal transduction (8%), energy (15%), cellular biogenesis (4%) and protein synthesis (12%). About 24% (52 of 217 polypeptides) of the proteins were grouped into unknown function category. The results suggested that the polypeptide composition of muscadine grape leaf is complex, and polypeptide number and amount vary widely among muscadine genotypes, and these variations may be responsible for differences in their physiology and stress tolerance characteristics.

**Identification of Xylem Components Associated With Pierce Tolerance in Grape.** Dr. Mehboob Sheikh and Dr. Hemanth Vasanthaiah from the Center for Viticulture at Florida A&M University are investigating the xylem sap proteins in grape to study disease tolerance characteristics. Pierce's disease (PD) is a destructive bacterial disease of grapes caused by *Xylella fastidiosa* which is xylem-confined. The tolerance level to this disease varies among *Vitis* species. Our research is aimed at identifying unique xylem sap proteins present in PD-tolerant *Vitis* species. The results showed wide variation in the xylem sap protein composition, where a set of polypeptides with pI between 4.5 and 4.7 and Mr of 31 kDa were present in abundant amount in muscadine (*Vitis rotundifolia*, PD-tolerant), in reduced levels in Florida hybrid bunch (*Vitis* spp., PD-tolerant) and absent in bunch grapes (*Vitis vinifera*, PD-susceptible). Liquid chromatography/MS/MS analysis of these proteins revealed their similarity to β-1, 3-glucanase, peroxidase, and a subunit of oxygen-evolving enhancer protein 1, which are known to play role in defense and oxygen generation. In addition, the amount of free amino acids and soluble sugars was found to be significantly lower in xylem sap of muscadine genotypes compared to *V.vinifera* genotypes, indicating that the higher nutritional value of bunch grape sap may be more suitable for *Xylella* growth. The data suggests the presence of these unique proteins in xylem sap is vital for PD tolerance in muscadine and Florida hybrid bunch grapes.

**Characterization of Drought Tolerance Related Protein in Peanut.** Mehboob Sheikh and Ramesh Katam are studying proteome profiles in peanuts to identify drought tolerance related proteins. Abiotic stresses cause water deficit in plant tissue resulting in various physiological, and biochemical changes brought about by altered expression of stress responsive genes that code for specific proteins. Peanut (*Arachis hypogaea* L.) plants were subjected to water stress (WS) for 7, 14 and 28 d and changes in seed polypeptide composition were determined. Results showed that WS had a variable effect on peanut seed polypeptide composition. WS affected polypeptides with apparent molecular weight ($M_r$) around 70, 35, 25, 20, 18 and 14 kDa, and isoelectric points between 4.0 and 6.0 pH. The maximum response to WS occurred between 0 to 7 d, and included over-expression, suppression, and appearance of new proteins in water-stressed seed compared to irrigated control. These data revealed that seed polypeptide composition of drought-tolerant peanut genotypes (Vemana and K-1375) was least affected while that of drought-susceptible genotypes (M-13 and JL-220) significantly altered due to WS. The proteins that were affected by WS are identified as Allergen Ara h1 (allergenic proteins) and methionine-rich proteins, arachin Ahy-3, 2S protein 1 and conglutin indicating over-expression of these proteins in drought susceptible genotypes will enhance its drought tolerant characteristics.

**Selected Major Accomplishments in**
**Agricultural Research at**
**Southern University A & M College**

**Kirkland Mellad – Vice Chancellor for Research**

**Application of Nanotechnology in Forest Health Management:** Dr. Yadong Qi and collaborating scientists from Southern University Research and Extension Center developed a technique for using cooper-core carbon-shell nanoparticles (CCCSNs) to provide long-term effective biological and physiological functions as fungicides and as wood preservatives. This approach can be regarded as a new generation of more stable functional and environmentally friendly nanomaterials. The CCCSNs enhance antifungal activities in trees. The project has developed suitable dosages of CCCSNs against blue-stain fungi and a white rot and a brown rot through in-vitro studies. The CCCSNs technology will result in developing a new wood preservative that is effective and more environmental friendly because of less usage of copper.

**Impact of Mixed Species Grazing Systems:** Dr. Sebhatu Gebrelul and his colleagues at Southern University have studied the effects of mixed-species grazing using goats and cattle, and demonstrated that mixed grazing enhanced resource utilization; reduced parasitic loads in goats, increased output per unit land and improved surface water storage. Soil compaction and water infiltration were improved when cattle and goats were grazed together. By adding two does per cow already on pasture without changing existing practices (except fencing) generated one, additional income of $200 to $455 per cow in the herd.

**Utilization of Post-Hurricane Urban Tree Debris:** Dr. Kamran Abdollahi and his colleagues at Southern University Agricultural Research and Extension Center have been assessing the contributions of tree-based waste as mulch on urban forest soils and canopy growth. Their research results indicate that tree-based mulch significantly increased soil respiration, soil temperature, soil moisture canopy net photosynthesis, and shoot elongation. As a result, the strategy of utilizing urban wood waste can positively impact the restoration of degraded or damaged urban forest ecosystems in Louisiana following hurricanes and other natural disasters by helping to extend the life of landfills by way of wood waste diversion.

**Understanding Tolerance of Certain Tree Species to UV-B Radiation:** Dr. Yadong Qi and collaborating scientists at Southern University Agricultural Research and Extension Center established laboratory protocols to localize and visualize UV-B absorbing compounds in the leaves of selected Southern tree species using the chemical reagent diphenylboric acid 2-aminoethylester and fluorescence microscopy. The research has generated new knowledge that discovers UV-B screening strategies and biophysical and biochemical mechanisms of UV-B tolerance in selected southern trees. The information is useful in tree species selection in urban forestry and forest regeneration for the southern states in the USA.

Selected Major Accomplishments in
Agricultural Research in the

WEST VIRGINIA STATE UNIVERSITY

Dr. Orlando F. McMeans, Dean and Director of the
WVSU GUS R. DOUGLASS LAND-GRANT INSTITUTE

**Re-Birth of Agricultural Research and Extension Programs at WVSU.** Founded in March 1891, WVSU was one of the original six 1890 land-grant colleges. Despite serving its stakeholders well, the WV State Legislature voted in 1956 for WVSU to surrender its designation as a land-grant institution. However, after a concerted effort by university

officials, alumni and stakeholders, WVSU officially regained its land-grant status in March 2001. This historical accomplishment has had a tremendous impact on University programs and the local economy, with thriving research and outreach programs and more than $75M infused directly into the state's economy in the 10 years following reinstatement.

**Evolution of Microbial Anaerobic Digestion Research at WVSU.** The first research program at West Virginia State University evolved around a 10,000 gallon pilot plant anaerobic digester. What started as a small agricultural poultry waste management project has become a fully integrated environmental biotechnology program addressing issues surrounding the economic and environmental impacts of organic waste products from agricultural industries. Researchers have scientifically validated the use of anaerobic digestion as a viable technique to effectively manage poultry waste. Pathogen control, liquid and solid effluent as fertilizers, and biogas production are some of the findings and added benefits this technology can bring to poultry producers in West Virginia and the Nation. The programming, facilities, technology and infrastructure that this project has brought to campus has also provided education, work and technical experience for dozens of students; and played a contributing role, in the establishment and delivery of the University's Master of Science in Biotechnology program.

Selected Major Accomplishments in Agricultural Research in the
College of Agriculture and Human Sciences

Prairie View A&M University

Dr. Freddie L. Richards, Sr., Dean

Dr. Richard W. Griffin, Acting Dean and Acting Research Director
Dr. Alton B. Johnson, Associate Dean and Administrator – Cooperative Extension Program

**Impacting the World: Birth of the International Goat Research Center.** In the late 1970s, a survey conducted identified Texas with having more than 90% of the U.S. goat population. This survey prompted a needs assessment for priority research and outreach to meet the concerns of these goat producers in the areas of reproduction, nutrition, veterinarian service and marketing; resulting in the establishment of the International Goat Research Center. Serving as the prototype for other institutional goat programs and garnering international recognition via training and technology transfer in the Caribbean, South America and Africa, the Center was the first to expand its research to the Boer goat. Hence, the vision continues.

**Using Goat Milk Casein to Aid in the Nutritional Value of Beverages.** Research scientist, Dr. Adele Mora-Guiterrez, received an innovative patent in 2010 for her research on bioactive complex composition using dairy goat milk casein to aid in the nutritional value of clear beverages without producing a cloudy appearance but improving palatability by masking bitterness and off flavor. This research further augmented the bioavailability of phospholipids, Omega 3 rich oils, and minerals for applications ranging from memory enhancers to oral care.

**Doubling Crop Yield.** Dr. Godson Osuji, research scientist, recently concluded a long-term study focusing on the use of biotechnology to enhance crop yield and silencing the mRNA that causes allergenicity in peanuts by encoding the allergens. The research resulted in lowering the allergen of peanuts to 10% and enabled the oil extracted from the peanut to be used as a source of bio-energy while using the meat of the same peanut for human consumption. This study has the potential of providing economic relief to farmers and revolutionizing the peanut industry.

Selected Major Accomplishments in
Agricultural Research in the

COLLEGE OF AGRICULTURE, FOOD SCIENCE, AND SUSTAINABLE SYSTEMS

KENTUCKY STATE UNIVERSITY

MAC STEWART, PROVOST and VICE PRESIDENT
TEREFI TSEGAYE, DEAN and DIRECTOR

**On-Farm Bioremediation of Herbicide Residues in Runoff -** Approximately 1,200 water body impairments across the US are attributed to pesticides. The Division of Environmental Sciences in the newly formed College of Agriculture has developed a biobed system for retarding runoff water and herbicide residues arising from agricultural fields in Kentucky, where most of the arable lands are highly erodible. Biobeds were successful in reducing the concentrations of the two herbicides dimethazone and trifluralin in runoff water. Biobed systems can be built on the farm land using locally available materials which is topsoil, peat, and straw (Biomix). The use of biobeds in on-farm bioremediation of pesticide residues in surface runoff water might provide a potential solution to contaminated runoff and seepage water arising from agricultural production operations.

**Chicken Manure Increased Concentration of Organic Sulfur Compounds in Field-Grown Onions** - The scientific community has become interested in the pharmaceutical properties of Allium vegetables like onion and their chemical constituents in relation to stomach cancer prevention and cardiovascular diseases. The Kentucky State University Division of Environmental Sciences has indicated that chicken manure could be exploited in growing onions with health-promoting properties. Concentration of two organic sulfur compounds (dipropyl disulfide and dipropyl trisulfide) in onion bulbs was greatest in plants grown in chicken manure and lowest in plants grown in yard waste compost. No reports in the literature have documented the importance and value of chicken manure in increasing organic sulfur compounds in onion.

**Growing Hot Pepper for Cabbage Looper, *Trichopulsia ni* (Hübner) and Spider Mite, *Tetranychus urticae* (Koch) Control -** Kentucky State University Division of Environmental Sciences in the new College of Agriculture has prepared crude extracts from hot pepper, *Capsicum chinense* fruits, that can be explored for developing natural products for use as biodegradable alternatives to synthetic pesticides. Using repellent chemicals for crop protection is a unique way to prevent insects and spider mites from laying eggs on target plants and preventing leaf and fruit damage and provide alternatives to farmers dealing with the sharply-escalating production costs associated with the increasing costs of energy and pesticides. A simplified recipe has been prepared as a new natural pesticide formulation for use on farm and home garden vegetables.

**Trichomes Importance in Plant Defense and Plant Breeding -** In evaluation of wild tomato plants, *Lycopersicon hirsutum* as a potential source of biorational pesticides, research at Kentucky State University Division of Environmental Science in the newly formed College of Agriculture has shown that an average three-month-old plant of *L. hirsutum* produced high concentrations of four naturally occuring compounds (2-tridecanone, 2-dodecanone, 2-undecanone and 2-pentadecanone) in their glandular trichomes (plant hairs). Disappearance of field applied 2-tridecanone, the most effective compound against insects, from leafy vegetables indicated that 2-tridecanone is a potential pesticide within the conventional and organic production systems.

**Genetic Studies in Koi** - Dr. Boris Gomelsky performed a series of studies on genetics of koi, a popular ornamental fish in the United States and all over the word. Genetic mechanisms controlling inheritance of multi-color traits in koi have been found in these studies. A technique for producing gynogenetic koi whose inheritance is under control of only maternal chromosomes was developed. This work could potentially lead to production of koi with improved color traits and cloning of koi with valuable color patterns.

**Genetic Studies in Crappie** - Dr. Boris Gomelsky performed a series of studies on genetics of black crappie, a popular sport fish in the United States. A technique for producing crappie all-female populations was developed. Raising of all-female progenies prevents overpopulation which is the main problem in managing crappie in water impoundments.

**Paddlefish Reservoir Ranching to Produce Meat and Caviar** - Dr. Steven Mims's research group at Kentucky State University has stocked paddlefish, native to United States, into water supply lakes owned by municipalities in Kentucky and are assessing reservoir ranching for meat and caviar production. They have demonstrated paddlefish, as filter feeders, grow rapidly up to 2 kg per year, and can produce black roe in eight years for processing into valuable caviar. Currently over 2250 acres of water have been stocked with paddlefish with a potential value of over ten million dollars in retail meat and caviar products. Use of additional lakes in the United States could support sustainable caviar and meat industries, coexist with recreational activities and protect wild paddlefish populations against unsustainable harvest.

**Reuse of Decommissioned Wastewater Treatment Plants to Produce Food Fish.** More than 50% of seafood is being produce through aquaculture. Aquaculture requires high capital investment. Dr. Steven Mims and his team have been investigating the reuse of resources (tanks and reclaimed water) at a wastewater treatment plant for increasing fish seed stock availability, expanding the aquaculture industry and lowering capital investment for economic viability as an agribusiness. Reclaimed water has been found to be a reliable source for fish culture. Fish have demonstrated low bioaccumulations of heavy metals and pesticide levels which insure consumer-safe food fish. Their work has resulted in the establishment of several unused wastewater treatment facilities to be used for fish culture.

Selected Major Accomplishments in
Agricultural Research in the

AGRICULTURAL EXPERIMENT STATION

UNIVERSITY OF MARYLAND EASTERN SHORE

JURGEN SCHWARZ, ACTING DEAN

**Predictive models for *Vibrio* bacteria**: Dr. Salina Parveen and her research team at the University of Maryland Eastern Shore in partnership with US Food and Drug Administration, University of Tasmania, Australia and the Maryland Department of Environment developed predictive models for the growth of *Vibrio* bacteria in oysters harvested from Chesapeake Bay, MD and Mobile Bay, AL. The results of this study have been shared with the United Nation's Food and Agriculture Organization/World Health Organization risk assessment group in response to a call for data in 2010 to fill the gap in international risk assessment for this bacterium in oysters. In addition, FDA is planning to use these research findings is designing and implementing *Vibrio* control plan.

Selected Major Accomplishments
South Carolina State University

Dr. Mahtabuddin Ahmed

**Diabetes may modify human DNA** – Research at SC State University suggests that diabetes, one of the nation's most chronic and life-threatening diseases, can modify the DNA of persons affected with the disease. The researchers derived their finding from three years of in-vitro experiments and tests using human urine and DNA samples, specifically examining the pathogenic significance of damage that diabetes causes to DNA and RNA through glycoxidation and lipoperoxidation reactions. Researchers hope continued research in this area will lead to the discovery of a biomarker for diseases which results from complications from diabetes, such as blindness, renal failure, coronary heart and Alzheimer diseases.

Dr. Rizana Mahroof

**'Sex Scents' could lead to insect-free foods** – SC State entomologist Dr. Rizana Mahroof has identified a "smelly" solution that may keep pesky insects from infiltrating the nation's food supply, a common problem that occurs at any point in food production systems – from farm to table. The sustainable pest management technique uses a high concentration of insects pheromones through a dispenser in stored-product environments to disrupt the mating process of a common stored-product beetle. First-year testing of the pest management solution shows greater potential for reducing and/or controlling the beetle infestations in stored-product environments such as food processing plants, warehouses and feed mills. The collaborative research project involves a partnership with Kansas State University and some of the nation's pest control industries.

Dr. Rahina Mahtab

**Research may be useful in Alzheimer progression** - Chemistry professor Dr. Rahina Mahtab and her research team are investigating methods that will increase the chances of early detection and prevention of plaque formation in the brain, which is thought to be responsible for the onset of Alzheimer's disease, the most common form of dementia, for which to date there is no cure. They are also studying to develop new nanomaterials sensors to target neurodegenerative diseases which cause many to suffer memory loss and debilitate daily life. As part of the study, Mahtab's team surface-coats the gold nanoparticles with new chemicals and binds them to amyloid beta. They then observe the effects of adding the combined element to amyloid beta, noting the occurrences in which the gold nanoparticles mixture reduces the accumulation of amyloid beta. Preliminary results are very promising, showing that the use of the coated gold nanoparticles slow down the aggregation of amyloid beta.

Selected Major Accomplishments in
Agricultural Research in the

COLLEGE OF AGRICULTURAL, LIFE AND NATURAL SCIENCES

OF

ALABAMA A&M UNIVERSITY

DR. LLOYD T. WALKER
INTERIM DEAN AND RESEARCH DIRECTOR

**Revealing the Secrets of the Plant Pathogen, the Reniform Nematode.** The reniform nematode, *Rotylenchulus reniformis*, is a devastating pest of over 300 plant genera including cotton. Many traditional cultural and advanced chemical approaches have been used to control this organism without effective results. *Dr. Ramesh Kantety* and other

researchers in the Department of Biological and Environmental Sciences at Alabama A&M University are using 2nd generation Genomics approaches to sequence the entire organism's genome that reveals the full genetic code of this devastating pest. Thus far, over 10X the coverage of the nematode's genome has been generated, revealing the ancient secrets of the way the nematode pathogens work against the plants; by defeating their innate defense mechanisms against such attacks. A greater understanding of the pathogen's design will enable the research community to develop effective strategies to develop durable resistance against such nematode attacks. The full genome sequence and expressed gene sequences of this nematode, in over twenty-four (24) different conditions, have been made available worldwide through the GenBank, the world resource for biological information.

**Whole Chromosome Sequencing – New Approaches for Solving Big and Complex Problems in Plants**. The expertise and research of *Dr. Ramesh Kantety*, discern that plant genomes are generally large, polyploidy and complex in nature. In order to study the fundamental backbone of the plants, he recognized that something had to be done quickly. Modern agriculture depends more on the existing genetics information that may or may not be available in all related genomes, let alone species. This resulted in the development of a novel method that combines the laser capture microdissection (LCM) technique with the 2nd generation sequencing, to enable sequencing of individual chromosomes from any organism. This technique might be especially suitable for plants as they are generally under explored, not sequenced, and are difficult to assemble during de novo procedures. A chromosome can be sequenced and characterized from multiple genotypes/species; or the complement of single chromosomes from a genotype can be sequenced and assembled more effectively. The technique is established and whole chromosome sequencing of many plant species is under way using this approach including cotton, corn, oat, peanut and oak.

**Genomic tools to improve the root crop yam (*Dioscorea spp*) production to sustain global food security**. The present world population of 7 billion is projected to reach 9 billion by 2025. This overwhelming expansion of the human population is threatening the availability of basic world resources including the fundamental needs for food. Thus food insecurity has become a serious worldwide concern. Yam (*Dioscorea spp*) consumption of 18 million tons annually is currently the food base for more than 400 million people worldwide. Yet yam production is suffering from several limitations. Research Associate Professor, *Dr. Koffi Konan* and others in the Department of Food and Animal Sciences at Alabama A&M University have developed reliable tools to allow the enhancement of yam genomics, and to improve the agronomic and nutritive characteristics of this crop. Specifically, we have developed 1) a method for a large scale yam seed production for yam farmers, 2) Organogenesis and Agrobacterium-mediated yam genetic modification, and 3) Isolation and sequencing of expressed sequence tags to identify key genes involved in metabolic activities in yam.

**New Theory on Ion Adsorption in Nanopores – C.P. Schulthess, R.W. Taylor, D.R. Ferreira 'The Nanopore Inner Sphere Enhancement Effect on Cation Adsorption: Sodium and Nickel'.** *Dr. Robert Taylor,* professor in the Department of Biological and Environmental Sciences of Alabama A&M University (AAMU) collaborated with Drs. Christian Schulthess, developer of the theory, and D.R. Ferreira, both of the University of Connecticut, to work toward the completion of this ion adsorption theory in the Biological and Envronmental Sciences labs of AAMU. The *Soil Science Society of America Journal* featured the work as the cover page graphic for the March-April 2011 edition. The image showed hydrated Na+, K+, Ca2+, and Ni2+ ions competing for adsorption sites on a nanoporous ZSM-5 zeolite mineral. The ions were retained predominantly inside the pore channels. According to the nanopore inner-sphere enhancement (NISE) theory, weakly hydrated monovalent ions will shed their hydration spheres in order to fit inside these channels, strongly out competing the hydrated multivalent cations. The NISE effect applies to channels that are smaller than the hydrated dimensions of the ions, particularly those pores that are close to the size of the ionic dimensions of the ions (< 0.55 nm), and can reverse the commonly observed retention strength of the cations by a mineral.

**Effect of Forest Management Practices on Wildlife Community.** Forest ecosystems are complex entities involving complicated relationships between biotic and abiotic components. Historically, management of forests by government agencies and private industry revolved around timber production. A new policy is emerging which places greater emphasis on ecosystem management, and whose goal is to continue using forests for timber production while maintaining ecosystem integrity. In collaborating with USDA Forest Service, *Dr. Yong Wang*, professor in the Department of Biological and Environmental Sciences, Center for Forestry, Ecology and Wildlife has been conducting studies with other departmental researcher, of forest management practices on the wildlife communities in Jackson County, since 2002. Recently, this study has been expanded to *Bankhead National Forest* to examine the interaction of prescribed fire and logging on the wildlife communities; the study is a part of the large project (Center for Forest Ecosystem Assessment) funded by National Science Foundation. The results from this study will help landowners and government agencies to develop ecologically sound forest management strategies. The research also supports the teaching activities of Forest Major and Wildlife Minor in the Department of Biological and Environmental Sciences of AAMU and outreach functions through landowner and resource manager trainings and workshops.

**Hydrolysis of organic phosphate by commercially available phytase: Biocatalytic potentials and effects of ions on their enzymatic activities.** Commercially available phytases from wheat and fungus *Aspergillus ficuum* have been used in environmental and agricultural phosphorus study. These enzymes hydrolyze phytate, the dominant form of organic phosphorus in the environment. These enzymes are usually added to animal feedstuff to improve phosphate bioavailability of monogastric animals. In vitro experiments have been conducted to better understand the biochemical functionalities of these two phytases. This research by *Drs. Irenus Tazisong* and *Zachary Senwo* in the Department of Biological and Environmental Sciences has revealed that: (a) these phytases are substrate specific to phytate, (b) demonstrate broad range of thermostability and pH; (c) hydrolysis other phosphate compounds other than phytate; and (d) tolerate methyl, ethyl, isopropyl, and phenyl groups. The broad thermostability and pH ranges make phytase favorable for industrial processes and the ability to function in the gaastrointernal system of monogastric animals.

Selected Major Accomplishments in
Agricultural Research in the
**School of Agriculture, Research, Extension and Applied Sciences (AREAS)**

## Alcorn State University

**Barry L. Bequette, PhD, Dean and Director of Land-Grant Programs**

**Development of Value-Added Specialty Sweetpotatoes**

The Center for Biotechnology & Genomics at Alcorn State University has been working to develop value-added specialty sweetpotatoes that are better suited for making quality chips or fries. The Center has successfully identified traits of sweetpotatoes that critically impact sensory and texture qualities of chips and fries. Some of their newly bred lines breeding lines that possess desired traits are now being tested by Dr. Ming Gao, Center director.

**Saving Our Food**

At Alcorn State we are striving towards finding ways to grow organic food crops with no chemicals or with the minimal use of them that would not interfere with the environment and animal diversity. We are looking at non-chemical "safe" compounds which will kill insects, but are non-toxic. These compounds have a biological origin; thus, called biological pesticides or "biopesticides."

We are utilizing insect behavior, especially their attraction to light and different colors. Insect traps of different colors are used to predict field populations and when to control them. Some crop varieties are naturally resistant to insect feeding, because of chemical contents within them, which are non-preferred by insect feeders. In addition, we are studying those compounds to determine their role in providing such resistance. Our ultimate goal is to promote the organic production of vegetables and other crops without any harmful insecticides and to enhance the income potential of small farm families by reducing production costs, according to Dr. Tahir Rashid, assistant professor of entomology.

**Swine Development Center**

Scientists in the Department of Agriculture are making their mark in the heart disease prevention arena with their published findings that vegetable purslane leaves lower the risk of cardio-vascular disease in humans. Heart disease continues to be a leading cause of mortality and morbidity in the United States. As a result of these concerns for potential side effects and consequent increase in health care costs, there is a growing demand for non-traditional and/or diet related approaches to lower blood lipids and cholesterol, and prevent cardiovascular disease and stroke. In a feeding trial conducted at Alcorn State, scientists explored the efficacy of purslane leaves in lowering cardiovascular diseases risk in patients with high blood cholesterol and other blood lipids.

The study was conducted for five weeks to evaluate whether or not adding a small quality of freeze-dried purslane leaves (3 grams each at lunch and dinner) in the diets of free-living human subjects with elevated blood cholesterol level, a cardiovascular disease risk factor, can lower blood fat and/or confer other health benefits.

The study demonstrated that using a novel food product rich in omega-3 fatty acids, pectin, and other essential nutrients, produced a marked improvement in the lipid profile of the patients, LDL-cholesterol (bad cholesterol) was reduced by 27%, suggesting a remarkable improvement in heart disease risk, a primary culprit in the development of cardiovascular disease and stroke.

At the end of this study, purslane seeds and planting directions were disseminated to farmers during agricultural and swine field days.

Dr. Micheal Ezekwe, professor and Center director as well as Dr. Samuel Besong (Delaware State University) and Mrs. Edith Ezekwe (Alcorn State) collaborated on this project. The research study has been published in the *International Journal of Nutrition and Metabolism*.

**Conservation Research Center**

The Conservation Center has sent C-factor (cover and management) data on seven horticultural crops of Brassica species to the USDA/ARS of North central region for multivariate analysis and publication in international journals, according to Dr. Girish Panicker, director.

**Technical Assistance Support for Mississippi Farmers**

The Mississippi Small Farm Development Center provided comprehensive technical assistance to approximately 5,000 farmers and farm families that included farm planning, risk management, access to resources, production technology, value-added product development, food safety, and marketing. The Center approved an additional 10 loans totaling $200,000 last year and serviced approximately 200 existing loans for small-scale farmers and ranchers. Since 1996, the Center has approved loans totaling $3,200,000 that have had economic impact exceeding $13,000,000.

**Experiment Station: On-Going Research**

Currently evaluating the effects of progesterone supplementation on the survival of transferred embryos; and elucidates the mechanisms use by progesterone to alter survival of the embryos in cattle. The strategy evaluated and recommended by our scientists to supplement progesterone is now being used by many farmers practicing embryo transfer as a means to improving the fertility and genetics of herds. Dr. Patrick Igbokwe serves director.

Investigating new biological insecticides or biopesticides to control insect pests, a reliable insect pest monitoring system is helping to minimize expensive chemical insecticide applications by avoiding unnecessary treatments; thus, reducing production costs and increasing profitability.

The Experiment Station is looking at ways to reduce the high cost of sweetpotato production by limiting the number of harvesting operations through reduced vine growth. Further, we have expanded the market for sweetpotato through increased industrial utilization and human consumption. Technology has been developed to process sweetpotato into high quality chips, and is now being prepared for patent and transferred to industry.

A feasibility study on obesity is currently underway in Fayette, Mississippi with middle school- aged children. Focus group discussions were conducted with adult women (28 women from Warren, Claiborne, and Jefferson Counties), and children in Jefferson County (63 males and 99 females). The feasibility study exposed 287 middle school-aged children to nutrition education focused on following the Dietary Guidelines for Americans. One conclusion drawn from the focus groups is that there is a significant need for marketing to encourage these cultural groups to utilize the website, Mypyramid.gov.

**Delta Obesity**

The Department of Human Sciences **s**ecured a grant through Delta Obesity Prevention Research Unit (OPRU), Adaptation and Adoption of the Dietary Guidelines by African-American Children in Southwest Mississippi. The project is currently on-going. The project promotes investigation of the impact of nutrition education (alone or combined with physical fitness) on the adoption of the Dietary Guidelines for Americans (DG) among rural, limited-resource African-American middle school children. The project will add to the body of knowledge regarding low income, rural African-American adolescents' understanding of the DG as it applies to their individual lives and help identify if increased knowledge of the DG recommendations alone or paired with physical activity within its population can impact adoption of the DG. Dr. Mattie Rasco, serves as project director.

Selected Major Accomplishments in
Agricultural Research in the

AGRICULTURAL EXPERIMENT STATION
SCHOOL OF AGRICULTURE

VIRGINIA STATE UNIVERSITY

WONDI MERSIE, ASSOCIATE DEAN & DIRECTOR OF RESEARCH; JEWEL HAIRSTON, INTERIM DEAN & COOPERATIVE EXTENSION PROGRAMS ADMINISTRATOR

**Development of New Edamame Varieties.** Breeding work by Dr. Tadesse Mebrahtu (deceased) spanning over 26 years resulted in three (3) improved edible soybean (*edamame*) varieties and many elite lines with unique properties.

The three varieties: Asmara[1], Randolph[2] and Owens[3] have been registered by the United States Department of Agriculture and licensed to a seed company for introduction into the U.S. market. The new varieties will benefit U.S. agriculture by facilitating entry into the edible soybean market where it is currently underrepresented.

Selected Major Accomplishments
in Agricultural Research at

Langston University
Marvin Burns, Dean and Director

**Revised Nutrient Requirements of Goats**. Arthur Goetsch conducted a series of studies to determine energy and protein requirements of goats, resulting in a Special Issue of the journal Small Ruminant Research in 2004 (Volume 53, Issue 3) with ten articles. This work was adopted and recommended by the National Research Council in its 2007 book entitled "Nutrient Requirements of Small Ruminants - Sheep, Goats, Cervids, and New World Camelids." Furthermore, a web-based goat nutrient requirement calculation system was developed with the extension program for easy application of requirements, including "Technical" and "Producer" versions. The Technical version was translated into Arabic, Chinese, French, and Spanish.

**USAID George Washington Carver Agriculture Excellence Award**. Langston University places a strong emphasis on activities in developing areas of the world. Many projects include research of factors constraining food security and economic growth, and some entail strong components of transferring existing technologies to rural poor to enhance production and product utilization. Activities have occurred in Ethiopia, Armenia, Jordan, Israel, Palestine, Egypt, China, Mexico, France, Iraq, Kenya, and North Korea. Consequently, the team of Tilahun Sahlu, Roger Merkel, Terry Gipson, Steve Zeng, and Arthur Goetsch received the 2006 USAID George Washington Carver Agricultural Excellence Award.

**Goat Development in the Middle East**. For over a decade, Langston University has collaborated with research institutions in the Middle East. This began in 2000 with the grant "Multinational Approaches to Enhance Goat Production in the Middle East" supported by the Middle East Regional Cooperation program of USAID, which was completed in the fall of 2008. The project entailed collaborative research, training, and extension activities with the Desert Research Center, Egypt; Agricultural Research Organization and Kimron Veterinary Institute, Israel; Al-Quds University, Palestine; and the Jordan University of Science and Technology.

**Collaborative Egyptian Research**. Arthur Goetsch, Ryszard Puchala, and Terry Gipson collaborated with the Desert Research Center of Egypt in research addressing goat feeding and nutrition. Three grants were received from the U.S.-Egypt Joint Science and Technology Fund. The projects were "Effects of Acclimatization on Energy Requirements of Goats" (2005-2008), "The Grazing Activity Energy Cost of Goats" (2007-2010), and "Effects of Nutritional Plane on the Maintenance Energy Requirement of Goats" (2008-2011).

**Goat Cheese in China**. Steve Zeng has provided considerable training in China in dairy goat product technologies. In 2006, Dr. Zeng was invited as an Adjunct/Visiting Professor at the Harbin Institute of Technology in Heilongjiang Province. Dr. Zeng and three cheese experts from France conducted a week-long cheese manufacturing workshop. In 2007, Dr. Zeng traveled to the China Agricultural University in Beijing, Northwest A&F University in Yangling, and Zhejiang University in Hangzhou. Dr. Zeng held cheese-making workshops and conducted dairy and cheese sensory panel evaluations at the universities. Dr. Zeng continues to make one or two similar training visits annually.

**Technical Assistance Abroad**. Langston University faculty travel abroad to conduct various technical training

activities and workshops. Terry Gipson traveled to Mali in 2009 and 2010 and Haiti in 2011 as part of the Farmer-to-Farmer Program for training in goat artificial insemination. Steve Zeng was an invited speaker at cheese symposiums in Argentina in 2006 and again in 2008. In 2007, Dr. Zeng was invited to be a panelist and cheese judge at the international Cheese Celebration in Turin, Italy and an invited speaker at the Buffalo Milk Cheese School held at the Guangxi Buffalo Institute in Nanning, China in 2008. Dr. Zeng also assisted USAID through holding two cheese-making schools in the Republic of Georgia in 2009.

**Enhancing Ethiopian Sheep and Goat Production**. Langston University has collaborated with Ethiopian universities since the mid-1990s. From 2005 to 2011, Langston University provided technical activity direction and assistance for a 6.25 million dollar project entitled "Ethiopia Sheep and Goat Productivity Program," funded by USAID/Ethiopia. A Genotype component dealt with the introduction of Dorper sheep and Boer goats, nucleus and crossbreeding stations, and distribution of animals. The Production component entailed on-farm research and demonstration of useful feeding and nutrition practices. The Training component was to improve information delivery services and content to enhance the effectiveness of extension agents who work directly with farmers and pastoralists. A website, www.esgpip.org, was created to allow access to training materials and project information.

**Dairy Goat Production in Armenia**. From 2001 to 2003, Langston University provided training and technical assistance to the fledgling Armenian dairy goat industry through the USDA International Program's Marketing Assistance Project in Armenia. Technical assistance was provided in reproduction, herd health, dairy products, management, nutrition, and general production via training visits to Armenia. In 2001, five Armenian scientists and one USDA employee spent three weeks at Langston University receiving training in topics ranging from semen collection and freezing to farm management. Similarly, a livestock specialist was also training prior to travel to Armenia to administer the dairy goat project.

**Goat Production Educational Tools**. New producers, as well as some established ones, have an expressed need for current, correct information on how to raise goats and produce safe, wholesome products in demand by the public. Thus, Roger Merkel, Terry Gipson, and Steve Hart have developed educational tools for goat production. The USDA/FSIS awarded grants to develop a web-based training and certification program for meat goat producers and a printed version of the program, the Meat Goat Production Handbook. The handbook is currently being revised for the second edition. In 2010, Terry Gipson was awarded a USDA grant to develop low-literacy versions of the handbook in English and Spanish. In 2011, Roger Merkel was awarded a USDA grant to develop a comparable certification program, handbook, and e-book for dairy goat producers.

**Goat Skin Processing**. Roger Merkel has established a pilot tannery for goat skin processing, which is being used to study the influence of meat goat breeds and supplementation on skin and leather characteristics. Moreover, in 2007 a "Tanning Hides Workshop" was added to the Institute's extension program. The focus of the workshop is tanning hair-on hides for the hobbyist tanner, but the process of dehairing hides for leather or buckskin making is also discussed. Producers learn about skin structure, proper skinning methods, hide handling and preservation, tanning chemicals and procedures, and value-added products.

**Mortality Composting**. All livestock producers encounter mortality. Composting is an inexpensive, environmentally friendly method of disposing of animal mortality that is commonly used in the poultry and swine industries. In 2008, Langston University and Oklahoma State University conducted a mortality composting demonstration project for producers. Several different styles of composting bins were constructed, a workshop was conducted, and a fact sheet was developed. In 2009, Roger Merkel received an additional USDA grant to train farmer educators in the practices of mortality composting.

**Meat Goat Buck Performance Test**. Meat goat production represents the most rapidly growing animal industry in the U.S. today, and is becoming a mainstream livestock enterprise. To further genetic progress through the identification of superior sires in the industry, Terry Gipson and Steve Hart of Langston University and the Oklahoma Meat Goat Association have conducted an annual meat goat buck performance tests since 1997. In early 2000, the

Oklahoma meat goat buck performance test was designated by the American Boer Goat Association Board of Directors as an ABGA Approved Performance Test. In 2003, the Oklahoma meat goat buck performance test was sanctioned by the International Boer Goat Association, Inc.

**Internal Parasitism**. Increasing resistance of internal parasites to commercial anthelmintics poses a serious challenge to goat production in many areas of the U.S. and world. Experiments conducted by Zaisen Wang and Steve Hart have evaluated anthelmintic activity of substances such as garlic, Sericea lespedeza, copper oxide wire particles, copper sulfate, and cayenne pepper, as well as various levels and combinations of commercial anthelmintics. Recently, Dr. Wang received a USDA grant for the project "Effects of selected nutritional components on immunity to *Haemonchus* in goats" to address physiological aspects of the issue. Many producer workshops on internal parasite control are held annually throughout Oklahoma.

**Mohair Growth by Angora Goats**. Angora goats have great potential for mohair fiber growth and preferentially partition nutrients for that purpose. Thus, nutrition is very important in fiber production as well as for other important physiological functions. Tilahun Sahlu and Ryszard Puchala have conducted research focusing on amino acid supplies as well as regulation of fiber growth. Studies have shown the positive effects of dietary protein supply on rate of fiber growth and fiber diameter. Also, growing Angora goats partition nutrients to maintain mohair fiber growth with limited feed intake and decrease energy expenditure to lessen the energy requirement for maintenance, resulting in compensatory tissue growth upon re-feeding.

**Goats for Vegetation Management**. Because of unique plant preferences, goats can be used for vegetation management and rehabilitation. Relatedly, many cattle producers have interest in co-grazing goats to achieve profit from goats, increase total animal production per unit land area with low dietary overlap between species, improve vegetation conditions for cattle grazing, and lessen or avert costs of other means of vegetation management. Hence, Langston University conducts research and extension demonstrations involving use of goats to enhance vegetation conditions, such as in a USDA-supported project in collaboration with six Native American Nations and recent activities at water supply reservoirs and public urban areas, such as parks and water drainage systems.

**Reduced Methane Emission by Ruminants**. Methane emitted by ruminants is a loss of energy that could be otherwise used for productive purposes and contributes to global warming. Therefore, Ryszard Puchala and Arthur Goetsch have studied the effect of forages high in condensed tannins, such as Sericea lespedeza widespread in the region, on ruminal methane emission by goats. Forage condensed tannins markedly decrease methane emission, the effect per unit of tannins is greatest at low dietary levels, and effects are immediate on the first day of feeding. Feeding forages with condensed tannins may offer a means of increasing energy capture of forage energy as well as decreasing greenhouse gas emission by ruminants.

**Body Composition of Goats**. To determine most accurate nutrient requirement expressions, such as use of a more accurate net rather than metabolizable energy system, a complete understanding of the composition of tissue being accreted and mobilized is necessary. Hence, Arthur Goetsch conducted research determining that the composition of tissue being lost or gained by goats is not necessarily constant throughout feeding periods and can vary markedly, which must be considered for most appropriate feeding practices and accurate performance predictions.

**Energy Metabolism by Goats**. Energy is the most limiting factor in diets of most ruminants, including goats. Thus, Ryszard Puchala and Arthur Goetsch have performed considerable research addressing efficiency of energy metabolism by goats with an indirect open-circuit respiration calorimetry system, including attention to different physiological functions, goat breeds, and types of diets. Moreover, the grazing activity energy cost and factors influencing it have been addressed by measuring heart rate while grazing coupled with determination of the ratio of heat energy to heart rate with the calorimetry system.

Selected Major Accomplishments in

Agricultural Research in the

COLLEGE OF AGRICULTURE AND RELATED SCIENCES
AGRICULTURAL OUTREACH AND RESEARCH CENTER

DELAWARE STATE UNIVERSITY

DYREMPLE MARSH, DEAN AND DIRECTOR

**The Development of Molecular Genetics & Genomics Tools for Research, Teaching, and Outreach.**

Dr.Venu (Kal) Kalavacharla, along with his research group, focus on plant molecular genetics & genomics, molecular biology and bioinformatics, with a special focus on the interaction of plant hosts and fungal pathogens. Given the increased use of bioinformatics to hasten the rate of crop improvement, Dr. Kal and his team have recently identified large sets of transcriptomic sequences from the important legume, common bean (*Phaseolus vulgaris* L.). Parallel with the research, this team has successfully integrated its activity with teaching and outreach. This has resulted in the training of more than 60 students at undergraduate level, as well as graduate students and postdoctoral scientists. This model has successfully exposed young students to scientific research at an early stage and will be useful for collaborative approaches for research, teaching and outreach.

**Value-added, Environmentally-benign Reuse of Organic Waste.** Dr. Mingxin Guo, an environmental soil scientist developed a system to convert waste organic materials into valuable bioproducts for agricultural and environmental applications. Farm-based production of biochar, bio-oil, and syngas from agricultural byproducts through slow pyrolysis was developed and optimized. Quality evaluation of poultry litter biochars as a soil amendment was published in 2012 *Journal of Analytical and Applied Pyrolysis*. His pioneer work on agricultural application of organic waste-derived biochar for carbon sequestration and soil quality improvement is a novel, value-adding approach to byproduct recycling in agriculture.

**Creation of Novel Secondary Constituents in Polyploid Species for New Uses in Medicine and Flavor/Fragrance Enhancement.** Dr. Arthur O Tucker has many years of experience in the breeding, agronomic management, and characterization of essential oils in plants of flavor, fragrance, and medicine. With increasing consumer interest in the health benefits of secondary constituents, Dr. Tucker has identified the use of new methods for breeding, such as cytomixis and complement fractionation, to induce transgressive segregation and thus create novel secondary constituents in polyploid species. His methodology will be very useful for researchers and breeders in this and other genera.

**Value-added, Environmentally-benign Reuse of Organic Waste.** Dr. Mingxin Guo, an environmental soil scientist developed a system to convert waste organic materials into valuable bioproducts for agricultural and environmental applications. Farm-based production of biochar, bio-oil, and syngas from agricultural byproducts through slow pyrolysis was developed and optimized. Quality evaluation of poultry litter biochars as a soil amendment was published in 2012 *Journal of Analytical and Applied Pyrolysis*. His pioneer work on agricultural application of organic waste-derived biochar for carbon sequestration and soil quality improvement is a novel, value-adding approach to byproduct recycling in agriculture.

Selected Major Accomplishments in

Agricultural Research in the

COOPERATIVE RESEARCH PROGRAM

LINCOLN UNIVERSITY IN MISSOURI

STEVE MEREDITH, DEAN

**Producing safer rice.** Dr. John Yang, an environmental soil chemist, who has been conducting research targeting elevated levels of arsenic (As), one of the top hazardous substances in rice grains produced in the South-Central region of United States. His research has developed effective management practices that substantially reduce the As accumulation by rice through cultivar selection and water management. This would improve quality and safety of US-produced rice. His publication entitled "Arsenic accumulation in rice grains as affected by cultivars and water management" was regarded as one of the important research articles in 2011 by the Journal of Environmental Engineering Science.

**Reducing health and ecological risks of soil lead.** Research conducted by John Yang, an environmental soil chemist, aims to stabilize lead (Pb), the top hazardous substance in urban and mine tailings/soils of the Missouri Superfund sites. His research has proven that the risk reduction by the *in situ* soil treatments using soluble phosphate amendments would be sustainable and environmentally sound. This work provides a remedial alternative to restore the impaired mining sites and safeguard human health and ecosystem in the mining community. The methods developed by this researcher are being applied in similar sites nationwide.

**Understanding Early Sunfish Production**. Research in the laboratory of Dr. Thomas R. Omara-Alwala has identified the best management practices for the culture of sunfish larvae in water re-circulating systems. The research has identified a suitable commercial starter feed for sunfish larvae. Additionally, the investigation has revealed the optimum weaning time in relationship to larval size for optimum sunfish production. The significance of these findings is that until now there has been limited information on the production of sunfish larvae indoors. Bluegill, a popular sunfish in sport fishing, has been identified by the North Central Region Aquaculture Center as a potential food fish for the North Central Region of the United States.

**Specific and targeted detection of viable *Escherichia coli O157:H7* using a sensitive and reusable mobile impedance biosensor:** The outbreak of disease, and food recalls in the US, brings to the forefront the importance of detection of food borne pathogens at a very early stage, to prevent ill effects on human health and mitigate the possibility of disruption in the food supply chain. The detection of pathogens using current technologies requires testing carried out, generally at an off-site facility. The main reasons attributed to this are: 1) the testing equipment is cumbersome, expensive and needs trained personnel 2) the sensors (antibody/enzymatic) degrade because of environmental conditions. The proposed technology in this research is analogous to the glucose sensing of blood sugar in diabetic patients. The following will be the

properties of the proposed device: 1. A detection system that is mobile 2) Easy to use 3) The cost effectiveness will make it possible for it to be owned by every farmer 4) The sensor can be customized to detect specific pathogens and 5) The use of DNA/Peptides sequence as an alternate to antibody, alleviates the effect of environment, that make the antibody sensor unfeasible with outdoor farm conditions. Dr. Majed Dweik's laboratory has been working on successful targeted detection of pathogens in the lab, and is now moving this technology to a viable field test product.

**The Birth of Center for Bioenergy and sustainable algal biomass production.**

Dr. Keesoo Lee, a microbiology professor and director of Center for Bioenergy, initiated the project producing algae-based alternative fuels and materials with USDA Evans- Allen program funding, in collaboration with Missouri University of Science and Technology. The research activities since 2008 were not only directed at many aspects of microalgal biotechnology but also at reduction of green house gas emission. A pilot-scale demonstration of the algal biomass/biofuel production using the flue gas carbon dioxide from coal-fired power plant emission was successfully carried out with the support of two local electric co-ops (Associated Electric Cooperative Inc/Central Electric Power Cooperative). This resulted in tremendous exposure of the project to the public (more than 50 articles published on different news media), more than 1 million dollar of external research funding during a 3 year period, and the newly discovered methods and processes submitted for journal publications and patent application. The project continues to provide the opportunity for graduate and undergraduate students at Lincoln University to engage in hands-on laboratory and field experiments in the area of bioenergy.

**New Nanoscale Biosensor for Detection of Luteinizing Hormone in Small Ruminants to Determine Optimum Breeding Time**

Dr. Zahra Afrasiabi

Luteinizing hormone (LH) in the blood of sheep and goat is one of the most common and measurable parameters that occur in the blood prior to ovulation. At lower concentrations of LH, the chance of success for artificial insemination decreases drastically. Neither ewes nor goats have distinct behavioral or physically identifiable changes that signal optimum time to breed; a physiological change must be detected by using a sensor. Therefore, the detection and measurement of LH in sheep and goat is important in small ruminant production.

Current method of analysis of LH involves immunoassay using antibodies specific towards LH. Much of earlier research works were focused on development of solid-phase radioimmunoassay for LH. These methods utilized antibody-coated polystyrene tubes for capturing LH, followed by counting the radioactive $^{125}I$ attached with the tube. Even though this method is highly accurate and efficient, the analysis required skilled labor and sophisticated laboratory setting. Thus, there is a strong rationale to develop a portable, calorimetric sensor for detecting LH under field conditions.

Gold nanoparticles (AuNPs) have been used extensively in the design of biosensors. AuNPs possess excellent user-friendly characteristics, which include ease of surface functionalization, high extinction coefficients, and unique distance-dependent plasmonic absorption. Interactions of minuscule quantities of biomolecule (or antigen) of interest with functionalized AuNPs have resulted in visual color change enabling the detection of extremely low concentrations of analyte.

In this study, we have developed a simple colorimetric method for the detection of LH utilizing peptide functionalized AuNPs. This novel approach depends on densely functionalized peptide on the surface of gold nanoparticles. The short 12 amino acid peptide sequence was identified from LH of sheep and selected for this study. We have selected a peptide sequence from the major IgE-binding eptiope from Ara h2, which is attached on the surface of AuNPs. There are several advantages on utilizing peptides as biomarkers, which include the following: (i) synthesizable under laboratory conditions; (ii) ease of surface conjugation to gold *via* incorporation of thiol molecules; (iii) high specificity towards biomolecule of interest; and more importantly, (iv) highly stable and easily portable.

**Selected Major Accomplishments in**

**Agricultural Research**
**GEORGE WASHINGTON CARVER AGRICULTURAL RESEARCH STATION**
**COLLEGE OF AGRICULTURE, ENVIRONMENT AND NUTRITION SCIENCES**

**TUSKEGEE UNIVERSITY**
**WALTER A. HILL, DEAN AND DIRECTOR**

**The Sweetpotato: Natures nutritious and energy crop.**

Sweetpotato research at Tuskegee University (TU) that was initiated by Dr. George Washington Carver in the late 19$^{th}$ century has been at the cutting edge of science and technology at all levels. Dr. Carver developed several varieties, production systems and novel uses for sweetpotato including over 200 products. This legacy continues to be carried on today by scientists who employ the latest technologies in advancing the science and the development of the sweetpotato. Tuskegee University scientists have developed efficient production systems for growing sweetpotatoes not only on earth but for growing them in soilless culture for space application and environment. Scientists at TU have developed and named the only sweetpotato variety adaptable for growth in a hydroponic system; they have received two patents for designs used for hydroponic production of root crops; proved that sweetpotato cuttings can grow successfully in microgravity environment without adverse impact on cell amyloplasts and starch grain; successfully flew two space shuttle flights of sweetpotato cuttings; increased by genetic engineering, sweetpotato storage root protein 500 fold using artificial storage protein gene; developed and processed products including a sweetpotato drink, sweetener, flour, nodules and ready to eat cereal for astronauts; developed recipes using sweetpotato greens that are found to reduce cholesterol and reduce cardiovascular diseases; developed varieties for bio-ethanol production; train under the program in the past 20 years over 350 minority undergraduate and over 80 graduate students and provided the foundation for the implementation of the current Integrated Biosciences (IBS) PhD program at Tuskegee University.