

2011 North Carolina A&T State University Research Annual Report of Accomplishments and Results

Status: Accepted

Date Accepted: 05/18/2012

I. Report Overview

1. Executive Summary

OVERVIEW

The School of Agriculture and Environmental Sciences (SAES) continues to focus on its six strategic program initiatives that have been realigned to correspond with NIFA's top five priorities: (1) Human and Community Development, (2) Sustainable Energy [SAES-Biotechnology and Biodiversity], (3) Climate Change [SAES-Soil and Water Quality], (4) Food Safety [SAES-Agromedicine, Nutrition and Food Safety], (5) Global Food Security and Hunger [SAES-Small Scale Agriculture, and International Trade and Development], and (6) Childhood Obesity. Overall, 2011 was a productive year with highlights and accomplishments in the following areas:

Program Growth

Once again, the Agricultural Research Program (ARP) in the School of Agriculture and Environmental Sciences (SAES) at North Carolina A&T State University (NCA&TSU) exceeded the previous year's extramural funding and achieved the highest amount ever received by the program. Outside funding grew by 25 percent over the previous year. This occurred, in large part, due to our success with meeting or exceeding funding goals for the six program initiatives. It also occurred as a result of the school's success in receiving 53 grants and the full complement of the School's allotted initial Evans-Allen state grant funding.

The SAES is in its sixth year as a partner in the new North Carolina Research Campus (NCRC) at Kannapolis. The NCRC is funded by the North Carolina General Administration for the 16 state-funded universities. Our laboratories are fully staffed and operational. The opportunity to participate in this new research consortium grew as a result of our active and successful research and demonstrated capacities involving the Food Safety Initiative. Our primary research focus is on post harvest technologies, with specific emphasis on fruits and vegetables. Several tours and seminars are conducted each year to introduce SAES faculty and NC legislators to the NCRC consortium and engage faculty in the various research initiatives of the consortium. In addition, researchers located at NCRC are involved with collaborative research efforts with on campus research faculty and with training students in experimental and laboratory procedures. Bio-mass utilization from by-products obtained from production of fruits and vegetables and economic analyses of potential commercial uses of those products are leading areas for SAES faculty research.

The program is in a growth phase with the addition of Dr. William Randle as the new SAES Dean and the involvement of new researchers from across the School and NCA&T Extension. Under the leadership of Associate Dean for Research, Dr. Shirley Hymon-Parker, Evans-Allen research continues to be strong, thus leading to innovative ideas and practical application for farmers and others in the field of agriculture.

A goal that was not met this past program year was the hiring of an evaluation specialist. Budgetary limitations and an unsatisfactory pool of applicants resulted in a delay in filling this position. Efforts to find a suitable person will continue this next year.

This is the last individual annual report submitted by NCA&TSU. In 2013 NCA&TSU and NCSU

will submit a joint report based on the 2012-2016 Plan of Work.

Breakthroughs and Developments

Coordination with Cooperative Extension

One of the major goals of SAES is the continued integration of the Cooperative Extension and the Agricultural Research Programs. Past integrated activities have yielded positive impacts on issues facing North Carolina. With the combining of NCA&TSU's Plan of Work with that of North Carolina State University the result should be a larger set of impactful outcomes. Critical to this development, however, is the need to attract research scientists with similar or related interests to current research faculty and to foster greater collaboration among current research scientists and Cooperative Extension Specialists to pursue research and agricultural support services consistent with the mission of SAES and NCA&TSU. One productive strategy this past year was to coordinate an Evans-Allen project investigating the potential uses of Moringa as source of phytochemicals for reducing infection in livestock, as a possible food supplement for decreasing pig gut microbial colonization, and possible applications as a human food supplement. The project brought together researchers from animal science, plant science, food science, and Extension to pursue preliminary studies to provide a basis for preparing a NIFA Foundational grant.

Regional Projects

Currently, research scientists are involved in two regional projects: (1) Economic Impacts of International Trade and Domestic Policies on Southern Agriculture (SCD331); and (2) Genetic and Functional Genomic Approaches to Improve Production and Quality of Pork (NC 1037)

HIGHLIGHTS FROM PLANNED PROGRAMS

Human and Community Development

Work continues on creating coordination among the Community Based Organization (CBO) in the Southeast US to address issues facing the region. A major conference, "Nonprofits in the Service of Communities: Experiences from the Field" was held that focused on data sharing and collaboration. Participant evaluations indicate that the workshop was successful. The project developed a database of CBOs involved in collaborative efforts to address poverty and gathered descriptive data on collaboration efforts among the groups.

Understanding personality influences affecting food shopping behavior has the potential to inform the development of breakthrough educational and lifestyle interventions. Findings from a survey designed to identify consumers shopping personality as it relates to food purchase behavior suggest there are six dimensions that affect food purchase behavior: perfectionist (quality conscious) brand conscious (price equals quality); price conscious (value for money); store loyalty; health and environment conscious and reliance on mass media for information about food that define an individual's food shopping personality, which, in turn, drives actual shopping behavior.

An evaluation study was conducted of the effectiveness of the Parenting Matters curriculum which provides parent education training for parents mandated by the courts or referred by social service agencies. A sample of 141 parents from 10 North Carolina counties participated in a longitudinal study to assess impact. Preliminary data suggest that the curriculum positively affect participating parents' behavior. Parents gained knowledge and skills needed to help strengthen their families while helping their children to grow and develop into positive productive citizens. In addition, the study found good fidelity in the delivery of the curriculum across course instruction sites. Other results include the development of a video demonstration of the Parenting Matters curriculum and county agent instructors' reports of their experience with the curriculum research project.

NC home loan lending patterns from the Federal Financial Institution's Examination Council's Home Mortgage Disclosure Act (FFIEC HMDA) database for 2005-2006, were analyzed to determine if there

were differences among borrower characteristics, loan type, and housing type between home lending activity to applicants from urban and rural areas.

The analysis revealed that rural area applicants were more likely to live in manufactured housing, to have loans for home improvement and to have low-income levels compared to those in urban areas. Rural area applicants also received smaller loan amounts than those in urban areas; those with higher incomes were likely to receive larger loan amounts. Applicants living in high minority areas received smaller loan amounts than ones in low minority areas. Asians were more likely to receive larger loan amounts than whites; Hispanic or Latinos received smaller loan amounts in comparison with non-Hispanics/Latinos.

Sustainable Energy [SAES- Biotechnology and Biodiversity]

Animal waste remains a major problem in NC that negatively impacts quality of life for many rural citizens and profitability of the livestock industry. Researchers are investigating a hydrothermal liquefaction process that is anticipated to have positive impact on both of these problems by converting waste into usable biofuels.

Bio-fuel winter canola and summer sweet sorghum crops were introduced to farmers through field demonstrations. This project is contributing toward the Fueling North Carolina's Future committee recommendation for the state to locally grow and produce biomass for the production of 10 percent of North Carolina fuel consumption by 2017.

Researchers investigated the thermal degradation characteristics of bio-oils derived from swine manure, the mixture of swine manure and crude glycerol, and the mixture of swine manure and free fatty acids by using TGA/DSC technology. Results show that thermochemical conversion of hog waste into biofuel provides a significant foundation for further investigating the development of manure-based bioasphalts. These results demonstrate potential for an effective and economical strategy for waste management and energy production from animal waste.

An investigation into the feasibility of converting cattails into cellulosic ethanol was conducted resulting in successful production and the development of a novel Lewis acid pretreatment process that can successfully enhance the biomass fractionation and produced a more efficient fermentation process for converting C5 sugars and glucose to ethanol by *Escherichia coli*.

Investigation of innate immunity associated genes encoding Toll like receptors (TLRs) and Natural resistance associated macrophage protein 1 (NRAMP1) in ruminants has found that there are differences in the expression of genes associated with innate immunity in sheep, cattle and goats and within breed. This indicates greater susceptibility to infection for some types of vectors. Sheep had higher percentages of eosinophils in peripheral blood when compared to co-grazed goats. Goats had higher levels of infection than sheep. However infection levels with coccidia and *Haemonchus* remained low in both species. Dietary influences on immunity also were found: bifidobacterium genus specific DNA was amplified in rumen fluid and digesta of goats fed a *Sericea lespedizia* free diet but not in samples from animals fed different levels of *Sericea lespedizia*. Diet also impacted cytokine secretion.

Alternative feed ingredients such as oats and barley are now finding their place as major players in the swine and poultry feed industry. Potentially up to 35% of the corn in the diet of growing pigs could be replaced with mixtures of oats, barley and sugar beet pulp with better productivity. The benefits, healthier pigs and higher feed conversion efficiency, which means that pigs will reach market weight at a much earlier age, thus improving the profitability of hog production.

Climate Change [SAES - Soil and Water Quality]

Researchers are continuing their work using the NCA&T University farm to develop and evaluate

ways to improve soil and water quality in the state. Specifically, the focus is on sustainable tillage practices as well as on providing alternative ways for small farmers to treat hog wastes.

Management of vegetable pests (cowpea, tomato, eggplant, collard greens) in small farms in North Carolina using biorational pesticides -- Agroneem, Azatin, Neemix, Spinosad, and a low risk synthetic neonicotinoid, Thiamethoxam (Actara) were evaluated.

The best management practice for multiple pests on collards was a mixture of spinosad against Lepidoptera and Actara against sucking pests other than mites. Insecticide (Thiamethoxam and Agroneem) application on tomato and cowpea is threshold-driven, indicating that just one application may be needed potential savings from both an environmental safety and production cost standpoint. Yields from all the treatments in these experiments were comparable to the untreated control.

Food Safety [SAES - Agromedicine, Nutrition and Food Safety]

Peanut skins are a by-product of the peanut processing industry with reportedly little or no economic value. However, they are rich in polyphenols, including procyanidins, catechins, phenolic acids and resveratrol. The results of two studies suggest alternative value-added utilizations of peanut skins as a dietary supplement and food preservative. These studies indicate that (1) long term ingestion of peanut skin correlate with improved serum profile in test rats and (2) peanut skin extracts exhibited significant antibacterial effect in raw ground beef.

The development and characterization of naturally occurring and safe functional (bioactive) compounds from agricultural sources such as grapes, peanuts and sweet potatoes will not only help in the national effort to reduce the incidence of diet-related chronic diseases, but also add value to the US agricultural sector. This is especially so since the global functional foods market is estimated to be \$48 billion per year, with the United States leading the world with its \$18.25 billion annual sales. Furthermore, agricultural by-products offer plentiful and inexpensive sources of bioactive compounds for the growing needs of the functional food market. Both grape seed and skin contain potent antioxidants that may be used as natural preservatives in foods to prevent lipid oxidation and rancidity development.

Food scientists developed non-toxic, low cost, and broadly effective alternative plant-based produce washes that provide long-lasting protection against foodborne pathogens throughout processing and distribution, leaving only residues that possess health benefits instead of toxicity. The natural antimicrobial formulations developed will be suitable for decontamination of produce immediately after harvest and for use by grocery stores or consumers. The washes may be used by farm workers, food handlers, food service workers, or households to effectively remove enteric pathogens including E. coli, salmonella and listeria.

Researchers are also producing a high quantity of alpha-galactosidase and beta-galactosidase for health benefits. They are working on developing a new technology that could be applied in the food industry to ensure food-grade probiotics of over expressed alpha-galactosidase and beta-galactosidase. This research team is interested in **response surface methodology** as a tool to optimize the production of these enzymes. They are also interested in using chemical mutagenesis to produce high enzyme producing mutant for potential application in food products.

Findings from a study of consumer food choices in North Carolina found that fruit and vegetable consumption was associated positively with increased availability of supermarkets and full service eating places, and negatively with fast food eating places. Availability of gas and convenience type food store outlets was not significantly associated with increased fruit and vegetable consumption. The findings reinforce the notion that the existence of 'food deserts' may be exacerbating the obesity problem by limiting access to healthful foods. Community and public policy interventions directed at improving food outlets conducive to increasing access to fruits and vegetables may be necessary to attenuate the high

rates of overweight and obesity.

Increasing levels of levels of alpha-galactosidases and beta-galactosidase in the human gut has potential health benefits. A study investigating how to increase the presence alpha-galactosidase and/or beta-galactosidase enzymes using *Lactobacillus reuteri* (commonly used in dairy product) was conducted. Results show that specific strains of *L. reuteri* produced higher enzyme activity. Different carbohydrate and protein sources were found to significantly affect the growth and enzyme activity of probiotics. Raffinose and lactose were the best carbohydrate sources to produce alpha and beta-galactosidases, respectively. Yeast extract was the best protein source to produce both enzymes.

The administration of therapeutic and sub-therapeutic antimicrobials to animals has become a serious problem worldwide. This is due primarily to the emergence and spread of multiple antibiotic resistant zoonotic bacterial pathogens. An alternative approach using medicinal mushrooms grown in Sorghum grain was tested as a feed supplement for laying hens during molting to reduce their stress from food intake reduction and reduction in disease protection (no antibiotics). Preliminary results show that medicinal mushroom supplementation produces higher beta glucan levels which is associated with higher immunity levels and thus may reduce and possibly eliminate the need for drugs/antibiotics in broiler chickens.

Current corn prices are hurting limited resource hog farmers. Small grains (barley, oats, and wheat) may be a suitable partial replacement. These grains offer the advantage of including prebiotic factors that facilitates the establishment and proliferation of desirable bacteria in the large intestine of animals and the addition of fiber. The potential of small grain supplementation of sows' diets during gestation to improve sow and litter performance was investigated. Results show that weight gain of gestating sows fed treatment diets that were 2.5 times higher in fiber than in the standard gestation diet improved indicating that these sows were able to utilize the dietary fiber. In addition the birth and weaning weights of litters from the supplemented grain fed sows were higher indicating a positive impact of those diets. This suggests that small grain supplementation had positive health benefits for the piglets at birth and up to weaning. In addition to the potential health benefits to sows and their litters, the results suggest that replacing higher cost feed with small grains sources may be a way to decrease production costs.

The potential antioxidative capacity and inhibitory activity of three essential oils (*Pelargonium capitatum*, *Laurus nobilis*, *Artimisia herba-alba*) in terms of antioxidative capacity and inhibitory activity was tested against seven different bacterial species. Findings show the plant essential oils contain bioactive compounds capable of interfering with the growth and proliferation of foodborne pathogens used in the study. The results also revealed that the oils' effectiveness is likely enhanced if used in combination.

Efforts to a better understand the potential hazards associated with swine confinement - in particular the effects facility dust has on swine airways have resulted in work that has produced a new method for characterizing porcine airway morphology and a new method for producing the isolation and expansion of porcine tracheobronchial cells. The importance of this work is reflected in the finding that comparison of airway morphologies of pigs reared indoors compared to outdoors show that differences exist even when there are no apparent signs of adverse effects in pigs reared in these two environments. The researchers are pursuing an application of invention disclosure.

An investigation of the nutritional content of grape pomace (GP) from two North Carolina wine grapes was conducted with the aim of developing more healthful high fiber foods to improve health and help curb obesity. Proximate composition of GP suggest that the skins have potential to be used as an ingredient to provide minerals, while seeds have greater potential to be used to produce food oil rich in polyphenols and unsaturated fatty acids. Results also show that GP is rich in polyphenols, but the composition is variety dependent and differs from skins to seeds.

Global Food Security and Hunger [SAES -Small Scale Agriculture & International Trade and Development]

A survey focusing on the determinants of small farm success in North Carolina was completed. Due to the declining numbers of small farm production in the state, it is critical to determine what can be done to reverse this trend. Previous studies have suggested that viable predictors of success for small farm operators included: education in the use computers (including programming and financial management), effective marketing strategies, enterprise diversification and income. A questionnaire/survey was developed to test previous findings and case studies were conducted for further verification. The result revealed that farmers rarely utilized computers and instead kept manual records. The findings also suggest that income may not be as important as believed. The overall "love of farming" seemed to be the driving force behind the farmer's view of success, not profit.

SAES researchers have found that there are alternative nutrient sources for enhancing profitability and environmental stewardship in livestock production. The target audiences of this study were limited resource and sustainable livestock producers across NC and other Southeastern US regions. This project provided insights into less expensive alternative feeds/forage for livestock. Pearl millet is a forage crop that is more tolerant to drought and at the same time has comparable nutritional value when compared to the traditional corn forage crop. Severe drought has and continues to be a dominant crop production constraint across the Southeastern US, especially for livestock producers. With increased climate change and variability, the risk of drought will likely also increase and the pattern of drought sensitive areas may become more irregular. Providing information on alternative feed source for livestock will help mitigate economic risk associated with reduced crop yield or total failure due to moderate or severe drought.

Shiitake mushroom strains cultivated for outdoors do not perform well under indoor cultivation conditions. However to take advantage of growing high yield high quality mushrooms during the colder months a better performing indoor strain is needed. A conventional breeding method of crossing selected monokaryons was used to successfully produce strains of shiitake that appear to outperform parent strains currently used in commercial cultivation. The results show that these strains are suitable for low temperature production and produce high yields.

The Edible and Medicinal Mushroom Project offered small-scale and limited-resource farmers -- especially tobacco growers -- a new alternative farm-based enterprises. Over 400 of North Carolina's small farmers have been trained to grow and market shiitake, maitake and other varieties of mushrooms. The project has assisted farmers and community organizations in qualifying for grant funding; spun a new biotech company, was critical in the formation of the North Carolina Mushroom Growers Association; spurred the development of a train-the-trainer.

Although major breakthroughs in marketing NC food and agricultural products abroad has been limited, there has been substantial study of the marketing opportunities for NC producers and sharing of this information with producers and potential entrepreneurs. This continued focus and effort is expected to yield future benefits for North Carolina producers.

An examination of the organic produce industry in North Carolina was conducted to identify established supply chains of the leading organic produce, evaluate the economic impact, and perform production analyses on the leading organically produce produced in in the state. Findings revealed that sweet potatoes and tomatoes were two of the top produce organically produced. Supply chains of the leading organic produce were analyzed and results are being shared with producers to increase their knowledge of regulatory requirements and market possibilities.

Strategically located trees on farms provide protecting natural resources by sequestering carbon, providing wild-life habitat and shade, ameliorating soil quality, and putting back percolated nutrients. The possibility of trees as a resource for fostering high yield vegetable production using high tunnel technology

was tested. Preliminary data shows that tomato yields were higher when plants were farther from the trees than closer. The results also showed that yields were higher with high tunnels than without high tunnels; these differences were greater for organic grown versus non organic grown tomatoes.

Childhood Obesity

SAES scientists have also derived data useful to understanding the impact of location on the access and affordability of food. Study results were presented to local and statewide planners and policy makers who were invited to attend a conference about the local food environment in Greensboro. Attendees were provided with information regarding food access in relation to availability and affordability of food in general, and fruits and vegetables in particular, in Greensboro. Data presented at the conference showed that the availability of fruits and vegetables is lower in low income areas of the city than in higher income areas. However, the quality of fresh fruits and vegetables available in low income areas were better or equal to higher income areas.

An on-going longitudinal study has been examining the food preferences, food selection, and eating practices of African American parents and their pre-school aged children. The goal of the project is to determine the factors that influence the food preferences, selections and eating habits of participants, and educate parents and children about healthy eating and physical activities that can improve their health and quality of life.

A study is being conducted to examine the use of social media in promoting healthy lifestyles and reduce the incident of childhood obesity. Impact of using social media to extend the impact of an educational curriculum designed to increase knowledge and promote healthy diet and physical activity behaviors among youth recruited afterschool extension program sites in 10 rural counties in NC was tested. Preliminary results show that social media applications served as a positive means of helping to reinforce information about healthy eating and physical activity behaviors. Twenty-six youth participants expressed enthusiasm about living healthier lifestyles via social media technologies including the importance of reducing sugar and fat intake and being more physically active.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	22.0
Actual	0.0	0.0	0.0	41.5

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

- Combined External and Internal University External Non-University Panel

2. Brief Explanation

The primary responsibility of the research director is to determine the need, priority, and scientific feasibility of the proposed projects and to develop and implement a procedure for project documentation, merit review, and selection. The aim of this procedure is to assure that the research proposals are scientifically sound, relevant to society's food and agricultural needs, and not duplicative of efforts undertaken elsewhere. Prior to a proposal's development, a determination is made the topic aligns with the needs of the state and the direction of the six program initiatives in the School of Agriculture and

Environmental Sciences is determined. Upon agreement between the department chair and the Associate Dean for Research that a proposal idea is in alignment with a program initiative, the principal investigator is permitted to prepare a proposal on the topic for submission through the program.

The merit review process includes a review by five peer reviewers from both within and outside the University who are knowledgeable in or familiar with the area of research. The principal investigator is responsible for incorporating suggestions made by the reviewers and must give reasons for any substantive suggestions not included or addressed. The proposal is then reviewed by the Associate Dean for Research who determines if additional review and substantive revision is necessary. Upon acceptance by the Associate Dean for Research, the proposal is submitted for budgetary review by the Office of Agricultural Research and then transmitted to NIFA/USDA for approval.

III. Stakeholder Input

1. Actions taken to seek stakeholder input that encouraged their participation

- Targeted invitation to traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Other (Grassroots Leadership Conferences)

Brief explanation.

There are on-going activities that encourage stakeholder participation. In addition to the formal meetings involving Agricultural Research Program administrators and stakeholders, the program conducts several outreach activities as a means for gathering input from those impacted by the school's research activities or who use the research results. One major event is the Small Farms Week, an activity jointly sponsored by the Cooperative Extension Program and the Agricultural Research Program. During this week, farmers, commodity group representatives, and consumers attend activities held both on and off campus involving Extension and research faculty and personnel. A second major event is the Grassroots Leadership Conference.

Administrators and researchers in the Agricultural Research Program participate in three conferences held in the three Extension programming regions of the state (eastern, central and mountain) to listen to the issues, concerns, and the needs of farmers, community leaders, residents, volunteers, members of the Strategic Planning Council, specialized committee members and county and staff members. These grassroots conferences also assist the Agricultural Research Program in needs assessment for proposal development and program priorities. Through these activities, SAES shares information about research underway at the University, and receives input from those that use the research results.

Other major outreach activities include field days that bring farmers, commodity groups, and consumers into direct contact with specific SAES scientists and research projects. Additionally, a series of workshops are held on the University Farm for NC homeowners, farmers, etc. Feedback is also sought about research and research related activities by the scientists, their research teams, and by staff associated with ARP and the University; the input is then shared with SAES and incorporated into future research activities.

A major statewide commission that continues to affect our research program and all aspects of the School of Agriculture and Environmental Sciences is UNC Tomorrow an initiative of the General Administration for the 16 public state universities. This initiative has identified goals for research and community engagement particularly related to concerns of global readiness and economic

transformation of communities. Our planned programs support multiple aspects of these concerns. Along with the University systems' plan of development the Agriculture Research Program is following the lead of NCA&T's new strategic plan: A&T Preeminence 2020 - Embracing Our Past, Creating Our Future. Consistent with ARP's mission to enhance the study and development of agriculture, the plan calls for "the active engagement of faculty technology transfer and translational research" and to "strengthen the quality of STEM-oriented graduate/professional degree programs and the number of overall graduate student enrollment."

2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees
- Use External Focus Groups
- Open Listening Sessions
- Needs Assessments
- Use Surveys

Brief explanation.

The individual and group stakeholders are identified by their membership in organizations that are agriculturally-related in the state. This includes all farmers and grower groups, cooperatives and community organizations. The dean, other administrators and many faculty members serve on various boards across the state that either serve stakeholders or have stakeholders on the boards.

Diverse methods (advisory groups, town hall meetings, conferences, workshops, etc.) of communication and information gathering are used to collect information and data on stakeholder needs. There is a proactive effort, including face-to-face meetings with groups as well as reading/reviewing current documents (strategic plans, newspapers, newsletters, etc.), that is used to identify research needs of individuals and communities in North Carolina.

2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Meeting specifically with non-traditional groups
- Other (Reading/reviewing documents by groups or about groups that describe needs)

Brief explanation.

The primary method for collecting the information is through meetings, but other means including surveys completed by the faculty as well as published reports and white papers are relied on as well.

3. A statement of how the input will be considered

- To Identify Emerging Issues
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities

Brief explanation.

Administrators and faculty use the input about stakeholder needs in determining the direction and nature of research projects as well as in hiring scientists needed in the identified subject matter areas.

Input from stakeholders is critical to the success of any research program. As part of our proposal development process we require that principle investigators seek input from stakeholders as they formulate their research projects. Additionally, Extension plays an important liaison role between research and the agricultural community. When applicable, principle investigators are encouraged to collaborate with Extension personnel to gauge potential user input of findings and to help shape projects so that findings will have maximal use for the user groups that can most benefit from the research.

Brief Explanation of what you learned from your Stakeholders

Major input from the stakeholders confirms their continuing concern about the funding issues: (1) biofuel development, (2) health, wellness and nutrition, (3) agricultural production, (4) food safety, (5) community development, (6) youth development, and (7) water quality and quantity.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	4131278

2. Totaled Actual dollars from Planned Programs Inputs				
Extension			Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	0	10972064
Actual Matching	0	0	0	3333591
Actual All Other	0	0	0	967168
Total Actual Expended	0	0	0	15272823

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	0	580258

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Human and Community Development
2	Sustainable Energy
3	Climate Change
4	Food Safety
5	Global Food Security and Hunger
6	Childhood Obesity

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Human and Community Development

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
601	Economics of Agricultural Production and Farm Management				20%
802	Human Development and Family Well-Being				25%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities				20%
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures				15%
805	Community Institutions, Health, and Social Services				20%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	4.8
Actual Paid Professional	0.0	0.0	0.0	5.2
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	1062891
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	588857
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	291012

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct research studies in the following areas: (1)) to conduct comparative analyses of home lending patterns to determine differences among borrower characteristics, loan type, and housing type between home lending activity to applicants from urban and rural areas; (2) to develop a database of community-based organizations (CBOs) by location, program priorities, capacity and method of operation to encourage collaboration among CBOs, policymakers, businesses and development agencies; and (3) to define factors that impact leadership development in rural areas that could lead to new or improved programs for developing future leaders and contributing to the sustainability of rural communities.

- Present findings at professional meetings.
- Publish research findings in professional journals.
- Share findings with Extension educators, end users, stakeholders, and with other groups that may use the information in improving collaboration and/or methods of information delivery.

2. Brief description of the target audience

- Individuals and families living in rural areas
- Underserved populations
- Rural communities
- Policy makers
- Community based organizations
- Scientific Community

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	435	447000	136	5000

2. Number of Patent Applications Submitted (Standard Research Output)
Patent Applications Submitted

Year: 2011
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	18	18

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # entries in database of community-based organizations

Year	Actual
2011	135

Output #2

Output Measure

- # presentations at professional meetings

Year	Actual
2011	9

Output #3

Output Measure

- # media occurrences

Year	Actual
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2011

7

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	# organizations accessing and using database of community-based organizations
2	% improved leadership development in rural communities
3	# policy makers using data to change policies affecting individuals, families and communities

Outcome #1

1. Outcome Measures

organizations accessing and using database of community-based organizations

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	35

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Community-based organizations need assistance in developing capacity to serve their communities.

What has been done

A questionnaire was created for measuring dimensions of consumers' decision-making styles to improve their diets and the adoption of healthy lifestyles.

Results

Updated a community-based organizational database for tracking the role community-based organizations have in supporting or promoting alternative food production systems.

4. Associated Knowledge Areas

KA Code	Knowledge Area
805	Community Institutions, Health, and Social Services

Outcome #2

1. Outcome Measures

% improved leadership development in rural communities

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	120

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Development of leaders and leadership behavior will benefit community development and the overall quality of life for people living and working in communities with persons with developed leadership skills.

What has been done

A 35-item Leadership Practices Inventory (LPI) was developed and administered to approximately 120 leaders going through leadership training across NC and VA. The LPI was administered using the 360 process which involves a pre/post test of the participant's leadership behaviors (SELF) and a pre/post test by three persons who observe the participant's leadership behaviors (PEER). A test of reliability revealed that both groups had an alpha range within the acceptable range of .7 to 1. For the validity, the PEER ratings for leadership behaviors were highly correlated with peer ratings of overall leader. Self ratings on the leadership behaviors were expectedly lower; however, 4 of the 5 scales are significantly correlated with at least one criteria measure. Based on the administration of the survey it was revised and field tested. Support materials including a scoring manual and feedback reports also were developed.

Results

The instrument will be administered as part of the Community Voices program to help develop local community leaders.

4. Associated Knowledge Areas

KA Code	Knowledge Area
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services

Outcome #3

1. Outcome Measures

policy makers using data to change policies affecting individuals, families and communities

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	9

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Increase consumer involvement in participation in the development and promotion of sustainable food production

What has been done

Provided local officials information on consumers attitudes toward food production systems and attributes of fresh fruits and vegetables and the role of consumer food shopping personality.

Results

Local city council made a land grant of about five acres for the development of a community based food production unit.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures
805	Community Institutions, Health, and Social Services

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Public Policy changes
- Government Regulations

Brief Explanation

The outcomes listed in the Human and Community Development Planned Program focus on long term attainment. The identified measures are very specific to studies in increasing the effectiveness of community based organizations, in developing rural community leadership and to change the lending practices of North Carolina home mortgage institutions. These initiatives take time to achieve the stated outcome.

There are also other research studies that are having impact in this planned program. However, outcomes and measures of these outcomes need development.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Studies are not yet complete.

Key Items of Evaluation

Expected targets of impact include identification of new leaders in rural communities, food related community-based organizations reporting progress in activities due to support from other organizations and from ideas regarding development from other organizations included in the database, and higher consumer involvement in local food production enterprises.

There are also other research studies that are having impact in this planned program. However, outcomes and measures of these outcomes need development.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Sustainable Energy

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
133	Pollution Prevention and Mitigation				20%
201	Plant Genome, Genetics, and Genetic Mechanisms				10%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants				10%
302	Nutrient Utilization in Animals				10%
308	Improved Animal Products (Before Harvest)				20%
311	Animal Diseases				10%
403	Waste Disposal, Recycling, and Reuse				20%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	3.2
Actual Paid Professional	0.0	0.0	0.0	6.3
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	275940
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	226449
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	57330

V(D). Planned Program (Activity)

1. Brief description of the Activity

Scientists conducted research to:

- Better understand the dynamic genetic mechanisms that affect the health of hogs and thus influence production efficiency and quality of pork;
- Compare the natural response to parasite exposure in sheep and goats through investigation of host infection status of sheep and goat rumen microflora and gene activation;
- Develop a fermentation process to produce for bioethanol from biomass derived C5 and C6 sugars;
- Identify microbial communities responsible for the Greenhouse gas emission and formulate strategies to reduce those emissions constructed wetlands;
- To identify agronomic practices such as no tilling and winter cover cropping that effectively sequester carbon, increase soil stability and decrease soil erodibility;
- Evaluate the effect/efficacies of the prebiotic factors of non-conventional feed ingredients on: digestibility and metabolism of nutrients of weaned pigs;
- Investigate whether feeding synbiotic combination of yeast culture (YC) and oat to gestational and nursing sows positively influences the growth performance and gut health of their offspring;
- Determine if swine facility dust contributes to porcine airway morphology differences in pigs raised indoors versus outdoors;
- Explore the potential of *M. oleifera* as a treatment source for infection and inflammation and as a supplemental food source for promoting growth and health in livestock;
- Investigate the potential of improving the efficiency of an established aseptic in vitro cultures protocol using seeds for germination of Alexandrian laurel;
- Evaluate yield potential of different varieties of canola and sweet sorghum grown in Piedmont soils as sources of bio-fuel crops;
- Assess use of biorational pesticides in the management of vegetable pests (cowpea, tomato, eggplant, collard greens) in small farms in North Carolina;
- Investigate effects of nutrients, including carbon, nitrogen, and metal ions on production of alpha-galactosidase and beta-galactosidase enzymes;
- Investigate the effects of various combinations of fungus (mushroom) myceliated grain supplementation on general health, fecal integrity, growth performance, foodborne pathogens (*Salmonella*, *Campylobacter jejuni*) and intestinal microbial profile in broiler chickens;
- Analyze the growth and performance characteristics of heritage breed crossbred offspring to be raised in a hoop facility;
- Determine the most effective combination of plant essential oils against foodborne pathogens in laboratory media and against human cancer cells in vitro;

- Identify outdoor shiitake mushroom strains for suitability for indoor cultivation and create new strains for commercial production;
- Compare vegetable production with or without high tunnels and whether near and far adjacent trees affect vegetable production with or without high tunnels;
- Assess the economic feasibility of producing switchgrass as biomass feedstock in North Carolina;
- Evaluate the interaction between polyphenols from grape pomace and major food ingredients and their impacts on the heat and pH stability of Muscadine polyphenols;
- Gave presentations at professional meetings and during various with Cooperative Extension programs
- Published findings in professional journals and in the Agricultural Research Program research magazine
- Seek patents for new discoveries
- Conducted tours, workshops and other activities to share findings with Extension educators and with companies that may commercialize products

2. Brief description of the target audience

- Companies involved in biotechnology applications
- Farmers involved in or considering producing agricultural products using biotechnology
- Consumers

3. How was eXtension used?

Extension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1245	347000	377	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	16	16

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # presentations at professional meetings

Year	Actual
2011	18

Output #2

Output Measure

- # media occurrences

Year	Actual
2011	7

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	# of licenses of current patents
2	# breakthroughs in new uses for biomass or other agricultural co-products in North Carolina
3	# improved plant production resulting from new propagation techniques
4	# technologies to prevent/treat animal diseases

Outcome #1

1. Outcome Measures

of licenses of current patents

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Develop commercially viable shiitake mushroom strains for indoor cultivation. 1. Screen shiitake mushroom strains from an existing culture collection for suitability in indoor cultivation. 2. Select the three best performing strains from Objective 1 to breed and develop shiitake strains with high market quality and high yield for commercial indoor cultivation. 3. Develop molecular markers for use in strain identification and license applications.

What has been done

Screen shiitake mushroom strains from an existing culture collection for suitability in indoor cultivation to select the best performing strains. Work has progressed on develop shiitake strains with high market quality and high yield for commercial indoor cultivation.

Results

Once the most promising strains are developed, molecular markers for use in strain identification will be identified and an application will be made to license this procedure.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
311	Animal Diseases
403	Waste Disposal, Recycling, and Reuse

Outcome #2

1. Outcome Measures

breakthroughs in new uses for biomass or other agricultural co-products in North Carolina

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

North Carolina ranks as the second largest hog farmer state in the country. Intensive confinement livestock farms produce large amounts of manure that need to be treated.

What has been done

A novel cattail to bioethanol process was successfully developed.

Results

Findings contribute to greater ethanol production in North Carolina, increased economic opportunities in rural areas, and reduction in US dependence on imported petroleum.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
302	Nutrient Utilization in Animals
308	Improved Animal Products (Before Harvest)
403	Waste Disposal, Recycling, and Reuse

Outcome #3

1. Outcome Measures

improved plant production resulting from new propagation techniques

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Outdoor pork production represents an important opportunity for small- scale, limited resources farmers across the state.

What has been done

This research has been extended to goats and has led to collaborative projects with other 1890 universities and Extension groups.

Results

The research will help small farmers to understand and apply best practices for production efficiency when raising hogs outdoors for animal welfare, and producers and consumer acceptance of pork productions systems.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants

Outcome #4

1. Outcome Measures

technologies to prevent/treat animal diseases

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Concern has been expressed over the years that the continued use of sub-therapeutic levels of antibiotics in animal feed could increase the risk of transfer of drug-resistant pathogenic bacteria from animals to humans. This had led to a push to identify compounds that can reduce the sub-therapeutic use of in-feed antibiotics as growth promoters. Moringa oleifera is a tropical plant that contains a variety of phyto-chemicals that may have great potential as a source for non- antibiotic treatments for diseases like mastitis.

What has been done

Preliminary work has been done to determine the antimicrobial activities of Moringa oleifera extracts against methicillin-resistant Staphylococci isolated from bovine, clinical, and food sources. In addition, a pilot immune modulation study investigating the proliferation and differentiation of B and T lymphocytes exposed to Moringa in vivo and in vitro (using a mouse model) has been completed

Results

Sun dried Moringa leaves were pulverized to a fine homogeneous powder and used to prepare an extract using the Soxhlet method. Extracts were used to treat whole blood and isolated neutrophils from cows, sheep and goats (3 each). The effect of Moringa exposure on white blood cell differential counts, isolated neutrophil viability, RNA purity and concentration and secretion of cytokines was examined. Further, the immunomodulatory role in exposure to bacterial lipopolysaccharide or peptidoglycan was evaluated in isolated neutrophils. Analyses are underway to identify potential effects; refinement and replication of procedures are planned.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Public Policy changes
- Government Regulations

Brief Explanation

Based on a study designed to better understand the potential hazards associated with swine confinement facility dust new methods for characterization of airway morphology were developed. One method involving isolation and expansion of porcine tracheobronchial cells has developed and tested to the level that an application for invention disclosure has been initiated.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The range of work has shown promising progress in animal disease prevention/reduction in terms of identifying effective sources of diet supplementation, feeding practices that reduce reliance on antibiotics, and removal of environmental contaminants that stress and weaken immune systems. Research activities have led to several collaborative projects with other universities and organizations.

Key Items of Evaluation

Determination of impact includes the development of methods that are adopted that lead to prevention/treatment of animal disease, identification of promising preventive/treatment practices, and reduction of loss of animal production, and improve animal performance in the absence of illness/disease.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Climate Change

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships				34%
112	Watershed Protection and Management				22%
133	Pollution Prevention and Mitigation				8%
205	Plant Management Systems				28%
403	Waste Disposal, Recycling, and Reuse				8%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	2.3
Actual Paid Professional	0.0	0.0	0.0	8.9
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	438292
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	235958
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Scientists conducted research studies to develop low-cost water filtration systems using nutshell-based activated carbons; determine and measure the effectiveness of cover crops in meeting the nutrient needs in organic cropping systems; use constructed wetlands for treatment of swine wastewater; and assess how soil management practices, especially no-till approaches, affect soil quality over time.

- Presented findings at professional meetings.
- Published research findings in professional journals.
- Shared findings with Extension educators and with other groups that may use the information to improve the viability of small scale agricultural operations.

2. Brief description of the target audience

- Extension educators
- Small-scale and limited resource farmers
- Environmental groups interesting in preserving soil and water quality

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	917	515200	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	7	7

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # field days

Year	Actual
2011	4

Output #2

Output Measure

- # presentations at professional meetings

Year	Actual
2011	13

Output #3

Output Measure

- # workshops on improved soil and water management practices

Year	Actual
2011	4

Output #4

Output Measure

- # media occurrences

Year	Actual
2011	8

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of farmers adopting improved soil and water quality management practices
2	Development of water treatment (wetlands) for small-scale farmers

Outcome #1

1. Outcome Measures

Number of farmers adopting improved soil and water quality management practices

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	17

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Intensive tillage and limited reintroduction of low organic matter are two major factors contributing to soil degradation in the southeastern United States. Small-scale vegetable growers need information on pre-determined combinations of practices they can adopt that will rapidly and effectively improve soil quality and crop productivity.

What has been done

Research has been completed that has contributed to the knowledge base in using no tillage, cover crops and compost to improve soil quality. A workshop was held to share this information with small-scale producers.

Results

Seventeen producers attended the workshop. All participants reported that the information presented was most useful and helpful in their on-farm operation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse

Outcome #2

1. Outcome Measures

Development of water treatment (wetlands) for small-scale farmers

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	12

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Hog operations in North Carolina use anaerobic lagoons and spray fields to store and dispose of wastewater flushed from swine houses in a system that threatens ground and surface water quality, particularly during prolonged periods of heavy rain. Therefore constructed wetlands are being researched for their ability to reduce the nutrient concentration in swine waste.

What has been done

A series of demonstration wetlands have been constructed to test various means of removing usable components (i.e., nitrogen and phosphorus, from swine wastewater to determine effective means of recycling material from the wastewater and reducing contamination of clean water sources from runoff wastewater.

Results

In addition to showing that the constructed wetland can reduce the negative effects of wastewater spillage and runoff, it has been demonstrated that plants such as cattails can absorb a substantial amount of concentrated nutrients released in these wetlands and can be harvested and transported away as a ?solid? source of fertilizer. A&T researchers also are looking into the biofuel potential of cattails as well.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Government Regulations

Brief Explanation

Biofuel replacement for fossil fuels continues to be both a promising but as of yet unfulfilled goal. Investigation in the development of biofuel sources including consideration of sources from waste streams (e.g., swine waste water), non-commercialized plants like switchgrass that can be grown on unused farmland, and seed oil (e.g., canola and soybean) show promising leads to possible commercial sources of biofuel feedstock.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The progress in this area have included strategies for small hog farmers to address spillage and wastewater overflows, value added uses for "by-products" of swine wastewater, and production of bio-sources for biofuel production.

Key Items of Evaluation

Indicators of impact include reduction of nutrient composition of water flowing the constructed wetlands, economic gains (or loss avoidance) from the use or sale of "by-products" recovered from plants (i.e., grasses) grown in the wetlands, and bio-energy development potential.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Food Safety

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
204	Plant Product Quality and Utility (Preharvest)				10%
502	New and Improved Food Products				30%
503	Quality Maintenance in Storing and Marketing Food Products				10%
701	Nutrient Composition of Food				18%
703	Nutrition Education and Behavior				12%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins				20%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	5.7
Actual Paid Professional	0.0	0.0	0.0	10.6
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	592313
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	488993
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	196247

V(D). Planned Program (Activity)

1. Brief description of the Activity

Scientists conducted studies to determine functional food ingredients from selected North Carolina agricultural by-products; to evaluate select plant extracts as potential food preservatives and anticarcinogens; to enhance the microbiological quality of probiotic supplements; to determine food knowledge and practices among different population subgroups and develop targeted and focused intervention methods for maximum effect; and improve healthy eating and physical activity of Hispanic women.

- Present findings at professional meetings and with Cooperative Extension agents and programs
- Publish research findings in professional journals and Agricultural Research Program's research magazine.
- Seek patents for new discoveries.
- Conduct tours, workshops and other activities to share findings with Extension educators and with companies that may commercialize products.

2. Brief description of the target audience

The target audience for this research is the following:

- Extension educators for use in programs and outreach activities
- Companies involved in health and nutrition related products and/or food safety
- Consumers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1050	554100	171	0

2. Number of Patent Applications Submitted (Standard Research Output)
Patent Applications Submitted

Year: 2011
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	25	25

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # presentations at professional meetings

Year	Actual
2011	20

Output #2

Output Measure

- # media occurrences

Year	Actual
2011	5

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	# of companies purchasing licenses for food and food safety related patents
2	# breakthroughs in new technologies to address food safety
3	# new food products that industry can manufacture to improve health

Outcome #1

1. Outcome Measures

of companies purchasing licenses for food and food safety related patents

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

How to develop a cost effective utilization of grape pomace to deliver the health benefits of its bioactive compounds to consumers? Inclusion of ground grape seed in food products such as bakery and meatball could be an economic way of utilizing health promoting components of grape pomace, and provide easy and affordable way for consumers to access the bioactive health promoting polyphenols in grape seeds.

What has been done

Investigation of the proximate composition and components of grape pomace (PM suggests that the GP skins have potential to be used as an ingredient to provide minerals, while seeds have greater potential to be used to produce food oil rich in polyphenols and unsaturated fatty acids. Also while GP is rich in polyphenols, the polyphenol composition of GP is variety dependent and differs from skins to seeds.

Results

New knowledge about the nutritional content of grape pomace from two North Carolina wine grapes has been gained. The findings show potential for developing healthy high fiber foods while also establishing a value-added use for this underutilized byproduct.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2

1. Outcome Measures

breakthroughs in new technologies to address food safety

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

It is widely acknowledged that probiotics have a positive impact on longevity. But with aging comes an increase reliance on prescription drugs that might interfere with the prevalence and effects of these bacteria. To address this question an investigation of the impact of exposure to commonly administered medical drugs of elderly on the death rate of Bifidobacterium microbiota was conducted.

What has been done

The project has just started. Currently detailed protocols for production of Bifidobacterium spp. are being developed along with a complete standard operating procedure (SOP) for different growth conditions of the Bifidobacterium spp. to optimize interaction of the bacteria during the drug test activities.

Results

None available yet

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #3

1. Outcome Measures

new food products that industry can manufacture to improve health

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The addition of alpha-galactosidase and beta-galactosidase enzymes for health promotion benefits is a common practice in dairy production. However, beneficial bacterial strains that normally reside in the human digestive system and can produce these enzymes and could be a more efficient natural alternative to supplementation. Therefore, selection of probiotics which are safe for human use and capable of producing high levels of alpha-galactosidases and beta-galactosidase inside the gut and thus producing beneficial bacteria ?on-site? could be of great significance.

What has been done

Conducted laboratory studies investigating the use of LAB and bifidobacteria for a consistent production of alpha-galactosidase and beta-galactosidase.

Results

Preliminary results indicate that lactic acid bacteria produce higher alpha/ beta-galactosidase activity than bifidobacteria. Different carbohydrate and protein sources have significantly effects on the growth and enzyme activity of probiotics. Raffinose and lactose may be the best carbohydrate sources to produce alpha and beta-galactosidases, respectively. Yeast extract has been found to be the best protein source to produce both enzymes. L. reuteri CF2-7F strain was the best producing strain on all tested conditions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
502	New and Improved Food Products

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Populations changes (immigration, new cultural groupings, etc.)
- Other (National public health problem)

Brief Explanation

These outcomes are long-term in nature. Current studies are focused on these outcomes. Broader outcomes and measures need to be developed for this planned program.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Progress on projects covered in this area show potential for development of healthier foods, improved probiotics, and new uses for under-utilized food sources.

Key Items of Evaluation

Indicators of project success include development of new food products, food safety methods, and health impact potential.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Global Food Security and Hunger

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
202	Plant Genetic Resources				10%
205	Plant Management Systems				15%
401	Structures, Facilities, and General Purpose Farm Supplies				20%
604	Marketing and Distribution Practices				15%
610	Domestic Policy Analysis				20%
611	Foreign Policy and Programs				20%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	3.8
Actual Paid Professional	0.0	0.0	0.0	10.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	8551120
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	1778710
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	398012

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct studies in the following areas: (1) defining opportunities for rural entrepreneurs and connecting them with small-scale agricultural enterprises, existing rural businesses and prospective entrepreneurs; (2) determining viable alternatives to tobacco for small scale producers including floriculture production in tobacco greenhouses, outdoor and indoor mushroom production, and specialty melons and other crops; (3) seek improved methods for washing green leafy vegetables for use especially by small-scale farmers; (4) identify factors influencing successful small farm operations in North Carolina that can be developed into a protocol for evaluating the predicted success of small farm operations; (5) economic assessment of changes in trade agreements; (6) bioterrorism threats and economic fuel requirements on various industry sectors; and (7) new domestic and international markets for North Carolina producers with particular emphasis on small scale operations.

- Present findings at professional meetings.
- Publish research findings in professional journals.
- Share findings with Extension educators and with other groups that may use the information to improve the viability of small-scale agricultural operations, and use to assist small scale producers in finding markets for their products.

2. Brief description of the target audience

The targeted audiences include the scientific community, the general public, small-scale farmers and operations, small businesses, producers of small-scale agriculture, and traditionally underserved populations and communities in North Carolina.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2771	511625	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	21	21

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # presentations at professional meetings

Year	Actual
2011	17

Output #2

Output Measure

- # media occurrences

Year	Actual
2011	8

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increase in number of producers/growers of alternative crops/enterprises
2	# of small farmers and businesses trained and becoming involved in export of their products
3	% of increased income by farmers and businesses served by the International Trade Center
4	% of stakeholders who use the information and policy research in their decision making

Outcome #1

1. Outcome Measures

Increase in number of producers/growers of alternative crops/enterprises

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

of small farmers and businesses trained and becoming involved in export of their products

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

% of increased income by farmers and businesses served by the International Trade Center

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

% of stakeholders who use the information and policy research in their decision making

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations
- Other (negotiations at the WTO)

Brief Explanation

A major challenge with producing feedstock sources for biofuels of the development of a sustainable means for supporting the production of specific feedstock, including markets, places for storage of the produced materials, and outlets for the sale and distribution of the processed biofuel. Effective management of production and sales of

feedstock is essential for a successful enterprise.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Results show that the project was able to contribute to the expansion of two major cooperatives and the development of interest among a group of 40 farmers in producing canola seeds for biofuel production.

Key Items of Evaluation

Indicators of impact include the extent to which the production enterprise is economically feasible, if there is sufficient supply and demand to maintain the enterprise, and if there is sufficient involvement by enough growers to maintain the collaborative enterprise.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Childhood Obesity

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
703	Nutrition Education and Behavior				60%
724	Healthy Lifestyle				40%
	Total				100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	0.5
Actual Paid Professional	0.0	0.0	0.0	0.5
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	51508
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	14624
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	24567

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct research that will: (1) identify food preferences, food selections, and eating practices of African American parents and their pre-school aged children; and (2) determine factors that influence the food preferences, selections and eating habits of African American parents and their pre-school aged

children.

- Present findings at professional meetings.
- Publish research findings in professional journals.
- Share findings with parents, healthcare professionals, Extension educators and other groups that may use the information to improve the viability of small scale agricultural operations, and use to assist small scale producers in finding markets for their products.

2. Brief description of the target audience

The targeted audiences include parents, the scientific community, the general public, and healthcare professionals.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	417	416111	1800	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	4	4

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # presentations at professional meetings

Year	Actual
2011	4

Output #2

Output Measure

- # media occurrences

Year	Actual
2011	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of youth participating in educational intervention programs and activities
2	Development of educational intervention programs and physical activities for youth
3	% youth showing improved knowledge of nutrition and appropriate physical activities
4	% youth employing healthy eating and physical activities in their lives

Outcome #1

1. Outcome Measures

Number of youth participating in educational intervention programs and activities

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	62

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Obesity has become a disease of an epidemic proportion and with profound negative physical, psychological, and social consequences for both children and adults in the United States.

What has been done

Study 1: A Community Health Assessment identified two of the top 12 health concerns of the identified county (Halifax) as lack of recreation and youth activities and overweight and obesity.
Study 2:

Results

Study 1: The primary aim of the proposed study is to develop a tailored healthy nutrition model that is culturally and developmentally appropriate for African American families living in rural communities. Project has only recently been implemented. Study 2: 36 youth participants learned the importance of eating healthy and being physically active. Twenty-six youth participants participating in social media expressed enthusiasm about living healthier lifestyles via social media technologies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #2

1. Outcome Measures

Development of educational intervention programs and physical activities for youth

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	62

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Study 1: To what extent can structured programs, educational and activity interventions designed to instruct, communicate, and change nutrition knowledge and related behaviors and physical activity patterns among rural youth be enhanced by using social media forums? Study 2: Can nutrition/physical activity program aligned with the federal initiative "We R Movin'on childhood obesity? be effective in bringing awareness and motivation change dietary and physical activity patterns the rural African-American youth.

What has been done

Study 1: A culturally and developmentally appropriate healthy nutrition model designed for African American youth and their families living in rural communities was developed. Study 2: A model for identifying how the availability, accessibility and quality of nutritious foods in grocery stores, convenience stores, and or farmer's markets, as well as in school cafeterias, impacts the physical activity and healthy eating behaviors of children and families in rural communities was developed

Results

Study 1: An instructional program that combined face-to-face nutrition and physical activity lessons and social media reinforcement for use with youth in rural areas was developed. Study 2: Programmatic activities have not been implemented.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #3

1. Outcome Measures

% youth showing improved knowledge of nutrition and appropriate physical activities

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	62

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Obesity has become a disease of an epidemic proportion and with profound negative physical, psychological, and social consequences for both children and adults in the United States.

What has been done

Study 1: A Community Health Assessment identified two of the top 12 health concerns of the identified county (Halifax) as lack of recreation and youth activities and overweight and obesity.

Results

Study 1: Thirty-six youth participants and 26 of their parents communicated prior knowledge concerning the benefit of eating healthy to reduce diseases such as obesity and diabetes. Study 2: Programmatic activities have not been implemented.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

Outcome #4

1. Outcome Measures

% youth employing healthy eating and physical activities in their lives

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Obesity has become a disease of an epidemic proportion and with profound negative physical, psychological, and social consequences for both children and adults in the United States.

What has been done

Study 1: A Community Health Assessment identified two of the top 12 health concerns of the identified county (Halifax) as lack of recreation and youth activities and overweight and obesity.

Results

Study 1: Follow-up data determine impact of the program have not yet been collected.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Public Policy changes
- Government Regulations

Brief Explanation

The influence of cultural, environmental and familial influences of obesity among African-American children can help inform parents, educators, and appropriate groups about the need for actions to help children make healthier food choices and engage in a physically active lifestyle.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Preliminary results indicate that programming selected to teach healthier food choices and physically activity lifestyles has been received well by participating children and their families. The projects have not been operating long enough to determine impact beyond the period in which program activities/information was presented.

Key Items of Evaluation

Indicators of successful impact include low rates of program dropout, adoption of healthy food diet and exercise patterns, family involvement in supporting children's healthy diet and exercise habits and involvement of community members in supporting healthy eating and exercise for other youth in the community.