FY2002
Annual Report of Accomplishments and Results

Partnerships Unit
Cooperative State Research, Education, and Extension Service
United States Department of Agriculture
Washington, DC 20250

Submitted by

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March 1, 2003

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AGRICULTURAL RESEARCH PROGRAM

I. PLANNED PROGRAMS

A. *Goal 1: An agricultural system that is highly competitive in the global economy*

1. Overview

North Carolina A&T State University reports the following research areas under Goal 1: agricultural competitiveness and profitability, biotechnology, and small farm viability. The following summary describes the projects and overall activities conducted by the Agricultural Research Program in addressing these areas. Information on activities and the impact of specific projects appear in the Key Theme section.

Agricultural Competitiveness and Profitability

A major research emphasis is assisting farmers to market products profitably in the state and beyond. Major efforts have focused on studying global issues and North Carolina farmers as well as concentrating on ways to produce greater yield from farming efforts (tilling methods and use of cover crops as fertilizer options).

The impact of globalization on prices of farmland in North Carolina is being assessed. Collection of data on the impacts of globalization was begun and is ongoing, in collaboration with other members of a group project. A study of limited resource and minority owners of woodlots is underway in selected counties in North Carolina and one county in Virginia. The study seeks to address the management and Extension needs of the woodlot owners through a needs assessment. An additional collaborative study is assessing methods for enhancing the profitability and survivability small and medium-sized farms in selected states.

Southeastern NC Piedmont soils are highly susceptible to erosion because of their soil physical and chemical composition and because of their topographical nature. A study is evaluating the effects of tillage and wheel-traffic compaction in a no-till system on soil loss, runoff, and crop growth. Soil erosion subplots, similar in design to the unit plots used for runoff and soil loss data collection, for development of the universal soil loss equation, were installed within each experimental plot. Treatments are conventional tillage (CT), strip tillage (ST), no tillage with traffic control (NC) and no tillage with a fully trafficked surface (NF). A reduction in soybean yield was observed as a result of traffic compaction in no-tillage. No differences in yield were observed between tillage treatments. Total

runoff increased as a result of wheel-traffic compaction in no-tillage and was generally slightly higher in conventional tillage compared to no-tillage with controlled traffic.

Research is underway to reduce input of nitrogen fertilizer and further protecting water sources from nitrate pollution. Crimson clover and rye mixed cover crops can provide adequate nitrogen for sweet corn and cucumber crops. These crops are being tested for impact of need for nitrogen fertilizer. A cover crop of crimson clover and rye will reduce fertilizer costs, soil erosion, pests, weeds, diseases as well as supply nitrogen to special melons and sweet corn.

Biotechnology

Current, alfalfa is not a viable production option in Appalachia and other regions of the state. Researchers have been screening the alfalfa cultivars of Medicago sativa for acid and aluminum tolerance and were able to identify and propagate two cultivars, ALATS 42 and ALATS 43, which hold vast potential for crop and livestock throughout the state.

Development of acid/aluminum tolerant alfalfa could lead to many new livestock production options in areas where soil amendments are impossible or the cost of amendments exceed the value of the crop.

The dollar value of tolerant alfalfa would be immense in Appalachia and throughout the world.

Small Farm Viability

In North Carolina, small-scale agriculture faces the continuing challenge of surviving in agricultural production. A particular focus of North Carolina A&T State University is assistance to African American farmers.

Researchers are continuing to refine a database with names and addresses of over 1500 African American farmers in North Carolina. This list was developed from a producer survey. Current activities involve expanding and enhancing the uses of the database in assisting farmers in their production and viability.

Survival of the small farm is particularly a concern since the main crop of tobacco is diminishing as a viable farming base. The combination of quota cuts and other market factors are forcing many tobacco farmers to look for additional sources of income and alternative use for their greenhouses. North Carolina has approximately 35 million square feet of tobacco transplant spaces. Only about 50% of this space is being used to group tobacco transplants. Profits from additional and/or alternative crops that can be grown in tobacco greenhouses could replace some of the income lost as a result of tobacco quota cuts. Diversification could also decrease the potential negative impacts of quota cuts. Research is underway to identify and test the viability of selected alternative crops

to grow and produce using tobacco transplant greenhouses. Specifically, the study will evaluate the suitability and feasibility of several cut flower species for production in a tobacco transplant greenhouse. In addition, research will determine the suitability and feasibility of several cut flower production systems for each species.

Alternatives to tobacco are being sought in raising pasture pork and growing mushrooms (described further under Goal 4). Building on Evans-Allen research findings, research is underway to study and demonstrate small farm production for pasture pork. Funding has been received through the tobacco settlement funds in the state. Ten farmers for each of the last two years have received hogs and instruction and are now pasture pork producers.

Total Expenditures: Section 1445 and State Matching Funds = $1,087,258

FTE's: 11.1

2. Key Theme – Agricultural Competitiveness and Profitability

a. Project: *Impact of trade agreements and economic policies on Southern agriculture*

Description: Researchers are documenting the impact of globalization on social and economic changes within agricultural and natural resource systems; identifying the mechanisms by which globalization affects farms and communities; assessing the various strategies used by households to respond to global restructuring; and assessing ways in which federal, state and local policies amplify or mitigate the consequences of globalization. Census and other secondary data are being used to assess macro-level changes associated with globalization. Survey data are being collected and used to assess the various coping mechanisms employed by households.

IMPACT: Evidence on how domestic consumers perceive and buy food in the global market place will help to increase the competitiveness of domestic food producers through enhanced provision of more desirable food attributes. Changes in farmland values brought about by globalization entails across the board decreases in farm assets. Farmland price declines will result in decreased property tax receipts for rural communities and a reduction in public services. The ability of 350 small woodlot owners to optimize returns from their holdings will be enhanced.

The North Carolina A&T State University International Trade Center continues to assist in connecting North Carolina companies with companies trading internationally. Last year, with the help of the International Trade Center, a NC-based manufacturer of flour, corn meal, mixes and feed, attended a trade show, where they established leads that have developed into lucrative contracts. The company and A&T International Trade Center representatives established contact

with companies trading internationally, which recently ordered 43,200 pounds of corn meal and 43,200 pounds of flour from the company. This year, the Center assisted a Duplin County wine maker in securing trade opportunities with China. The North Carolina company imports selected wine bottles from China and then exports the wine to China. Another wine company in NC has contacted the Center for assistance in locating trade sources for their wine also (underway). In addition, food exports to Canada have been obtained.

Source of Federal Funds: Evans-Allen, 1890 Capacity Building Grants Program, National Research Initiative Competitive Grant Program, Foreign Agricultural Service

Scope of Impact: State Specific

b. Project: *Environmentally sound cropping systems for enhancement of farm income*

Description. Three field experiments are being conducted over a three-year period to develop and test farm management practices for the production of small grains and vegetables. These practices will be aimed at increasing productivity while protecting the environment. Conservation tillage is a soil management practice that has grown rapidly in North Carolina. Results from this study will evaluate crop growth and changes in soil physical properties as affected by different tillage systems.

No-till practices, in the soils of the Piedmont region of North Carolina, were more effective in maintaining and/or increasing crop yield than conventional tillage methods.

A field experiment was conducted to evaluate the nitrogen cycling by green manures, by adding crimson clover and a rye mixture to the production of sweet corn and cucumber. Green manures were established in the fall and allowed to grow until spring. The cover crops were mowed and incorporated for decomposition and nitrogen release.

IMPACT: Crimson clover and rye mixed cover crops provide adequate nitrogen for sweet corn and cucumber crops, reducing the input of nitrogen fertilizer. This project has shown that the use of these cover crops is an alternative and sustainable production practice thus further protecting our water sources from nitrate pollution.

Source of Federal Funds: Evans-Allen

Scope of Impact: State Specific

3. Key Theme – Biotechnology

Project: *Improving performance in two acid/aluminum tolerant alfalfa cultivars*

Description: Researchers used selection methodology to screen cultivars of Medicago sativa for acid and aluminum tolerance. Using hematoxylin stain, scientists are able to identify specific individual plants, at germination level, which have the required tolerance. Subsequently, scientists were able to identify and multiply two cultivars. An independent company is testing the cultivars; the plants tested well in disease and insect resistance. The testing is currently in the second year of a three-year testing period.

IMPACT: Researchers identified and propagated two cultivars, ALATS 42 and ALATS 43, which hold vast potential for alfalfa and livestock production in Appalachia and other regions where alfalfa production is not a viable option. As a result, these acid-tolerant alfalfa strains will help livestock producers operate in previously unusable areas and increase existing profit margins. Exact impact will be measured by actual use by farmers after strains are market available.

Source of Federal Funds: Evans-Allen

Scope of Impact: State Specific

4. Key Theme – Small Farm Viability

Project: *Exploring survival issues among minority farm operators in North Carolina*

Description. Researchers have been actively engaged in soliciting information from the developed database of African American farmers in North Carolina. Efforts to survey farm operators continue to intensify as scientists seek to gather specific information about farmers' enterprise mix, management practices, use of technology, off-farm employment, and various socio-economic factors, and different possible barriers to the use of government assistance. In addition to the surveys, listening sessions have been incorporated and held with selected farmers and brief profiles are being developed. Additionally, the working relations developed with state and local agencies and grass root organizations that are actively involved with farmers and rural communities have been embellished via a number of town hall meetings and other outreach activities. A sampling frame now exists to foster future collaborative work.

IMPACT: During the past two years, the project has achieved a number of noteworthy accomplishments resulting from the producer survey and development of a database of over 1500 African American farmers in North Carolina. Project objectives have drawn keen interest from several agencies, including the Rural Advancement Foundation, the North Carolina Chapter of Black farmers and Agriculturalists Association, Conservation Council of North Carolina

International, and the Carolina Farm Stewardship Association. Many of these agencies have become contributing partners. The database provides an important avenue to gather information from African American farmers concerning their needs and also to disseminate possible policy and informational that addresses their needs and concerns.

Source of Federal Funds: Evans-Allen

Scope of Impact: State Specific

B. *Goal 2: A safe and secure food and fiber system*

1. Overview

Under Goal 2, the following research areas are reported: foodborne illness, foodborne pathogen protection, and food safety. The following narrative describes the activities and accomplishments conducted by the Agricultural Research Program to address these areas. Information on activities and the impact of specific projects appear in the Key Theme section.

Foodborne Illness

North Carolina is a major producer of chickens and North Carolina A&T State University has faculty expertise in studying and developing ways to prevent poultry contamination with Campylobacter jejuni. One study involves the study the drug susceptibility of *Campylobacter jejuni* in broiler chickens reared on used or unused litter treated with Baytril^{R}. Another study is focusing on the developing alternatives methods to using antibiotics in treating disease in chickens.

Food borne Pathogen Protection

Several studies have focused on ways to protect food from foodborne pathogens. One study has secured a patent for the screening of antimicrobial activities of Bifidobacterium species of human isolates. This was developed through modification of an existing Bifidobacterium selective medium (BIM-25 agar).

Another study has secured a patent for treating food with spices to counter foodborne pathogens. A spice company is in the process of buying a license from the University to use the patent.

Food Safety

Two projects have addressed the food safety of special groups: African Americans and the elderly. The elderly population, in particular, is susceptible to foodborne illness.

Data from a mail survey reveal that African Americans in the southern Black Belt states are receptive to food safety messages; they perceive higher levels of risk than other ethnic groups, and report using practices to prevent cross-contamination in greater percentages than other ethnic groups.

1. African Americans within the Southeast report lower numbers for safe refrigeration and cooling practices.
2. African Americans and other ethnic groups are more likely to perceive a greater level of risk associated with food consumption and handling than whites.
3. Risk perception is significantly lower among consumers with higher levels of education.

Another study involved personal interviews of elderly persons living alone. Results described the food safety practices of independently living senior citizens (65 and older). The objectives in this study are to describe the food safety practices; identify unsafe food safety practices; determine the relationship of food safety practices among older adults in relation to selected demographic and housing characteristics (gender and kitchen facilities) and behavioral factors (meal pattern, attitudes/beliefs, and knowledge); and provide data for the development of an assessment protocol to identify elderly persons who practice unsafe food habits as well as for the development of effective training material.

Two focus groups were conducted to assist with the development of an assessment instrument and data collection protocols. Seventy personal interviews were conducted. Data analysis revealed that most of the sample routinely practiced good food safety habits with respect to preparation and cooking of raw meats, storage of leftover foods, cleaning of counter and food preparation areas, hand washing, and cleaning of food preparation areas. The sample also demonstrated correct knowledge about food safety myths and beliefs. Some differences between practices reported and recommended food-handling practices were noted and identified for inclusion in Extension program literature.

Total Expenditures: Section 1445 and State Matching Funds = $ 1,227,429

FTE's: 10.5

2. ***Key Theme – Foodborne Illness***

Project: *Assessing the ecology of Campylobacter jejuni in the production environment of broilers*

Description. Studies were completed over a two-year period to assess the drug susceptibility of *Campylobacter jejuni* in broiler chickens reared on used or unused litter treated with Baytril^{R} . Positive isolates were subjected to drug susceptibility for enrofloxacin, gentamicine, erythromycin, tetracycline, and

nalidixic acid. . The presence of *Campylobacter jejuni* in broiler chickens did not vary between treatments, but differences did exist between trials. The majority of positive isolates were resistant to all drugs except for tetracycline, which was the most active compound against *Campylobacter jejuni*, with only a few resistant isolates. The results showed that resistance is prevalent with *Campylobacter jejuni* irrespective of drug usage or method of rearing.

IMPACT – *Campylobacter jejuni* has been established as a common cause of bacterial diarrhea in humans and exhibits a high rate of resistance to many drugs. Because poultry can serve as a reservoir of *Campylobacter* organisms and antibiotic-resistant plasmids that could be transferred to humans, it is important to know the susceptibility patterns of *Campylobacter* from broilers to different antibiotics. This information can be used to recognize natural sources of antibiotic-resistant strains. This study determined the sensitivities of *Campylobacter* from broiler chickens reared repeatedly on used or unused litter treated with the controversial drug (Baytril^{R}). In view of the findings, antibiotic resistance in *Campylobacter* from broiler chickens may represent a human health concern regardless of drug use in the production of chickens.

Source of Federal Funds: Evans-Allen

Scope of Impact: State Specific

3. ***Key Theme – Foodborne Pathogen Protection***

a. Project: Use of commercial/new *Bifidobacterium isolates and organic acid salt to inhibit pathogens in poultry*

Description: Food microbiologists conducted experiments to develop a rapid procedure for screening activities of Bifidobacterium species of human isolates. A bifidobacteria selective medium BIM-25 agar was modified by the addition of 0.5 g/l Cysteine-hydrochloride 1.5 g/l lithium chloride, 1.0 g/l beef extract and 5 ml/l Tween 20. This new medium was inoculated with diluted human fecal material and overlaid into 0.1% Tween 20 BHI agar plates and incubated in an anaerobic chamber at 37C for 48 hours. Plates were then inverted to allow the two layers of agar to fall into the petri lid. BHI soft agar (0.45%) containing Micrococcus luteus (as inhibitor) was overlaid onto the other layers in the petri dish. Plates were incubated overnight and zone of growth inhibition observed.

IMPACT: The new procedure is simpler and more rapid than the cumbersome and time-consuming original methodology (procedure) used to screen antimicrobial activities of bifidobacterium. A patent has been filed for the process of using a fiber-optic biosensor for rapid detection of pathogens in poultry products. The patent describes the development of a portable biosensor for rapid monitoring of pathogen levels in foods. The first prototype system will be designed to detect

Salmonella spp. and *Campylobacter jejuni* in poultry products. The biosensor will use molecular recognition and biochemical properties of target pathogens to develop specific bio-probes. The bio-probes will be coupled with fiber-optic sensing technology for rapid/specific detection of target food pathogens. The system will be designed for near real-time detection of food pathogens from a complex mixture of competing microorganisms and interfering particles through detection of pathogen-specific signals.

The biosensor is expect to give food inspectors a reliable tool for rapid and objective early detection of common food pathogens, help safeguard public health, especially in light of recent outbreaks of foodborne illnesses in the United States, and enhance food quality/acceptability. The system has excellent commercial potential in the food industry and the military. It is also adaptable to use in non-food bioterrorism countermeasures. So far, three companies/individuals have expressed interest in licensing the technology.

An outgrown of the study of bifidobacterium has been the development of a compound that can be added to foods that acts both as an anti-oxidant and microbial retardant. Food companies can use this one compound versus using two additives. An Israelis-based company has adopted the use of the compound and is marketing the product in the United States.

Source of Federal Funds: Evans-Allen, leverage private funds

Scope of Impact: State Specific

4. Key Theme – Food Safety

Project*: Food safety and handling behavior of rural consumers in the Southern Black belt region of the United States*

Description: A research survey was conducted to ascertain differences in food safety perceptions and behavior between African Americans and other ethnic groups. The objectives of the project included conducting a survey of consumers in five Black Belt states (Virginia, North Carolina, South Carolina, Georgia and Florida) to ascertain their food safety perceptions, attitudes, and handling behavior. Furthermore, data were analyzed to identify demographic and socioeconomic determinants of food safety perceptions and behavior. The study filled an important information gap because African Americans may be more prone to foodborne illness because of certain demographic and cultural characteristics.

IMPACT: Because African Americans in the Southeast report lower numbers for safe refrigeration and cooling practices, it is desirable to target messages to this group to encourage safe cooling and refrigeration. Linkage with Extension

outreach is planned to disseminate the information in an appropriate and meaningful manner.

Source of Federal Funds: Evans-Allen

Scope of Impact: Multi-state Research (VA, NC, SC, GA, FL)

C. *Goal 3: A healthy, well-nourished population*

1. Overview

North Carolina A&T State University reports research in the area of human nutrition for Goal 3. A major project has involved the study of the fat content of reduced and altered table spreads. An additional study has begun to study health and nutrition of the Hispanic population.

Table spreads are a main source of dietary fat. Although fat is one of the major food groups, excess dietary fat or the improper types of fat may lead to adverse health conditions. Heart disease is the number one killer in the US among both men and women. Researchers, as well as leading health groups, report that it is not only the total mount of fat consumed but the composition of the fat also influences the risk of developing heart disease.

The study of commercial table spreads has yielded results from the experiments conducted this year (reported below). The expected impact is improved and informed selection of table spreads by all persons, especially those who are identified as high risk for heart disease.

The nutrition and health of the Hispanic population is the focus of a new study in the program. The results will create awareness about the health status of Hispanics in Guilford County, North Carolina, among health care providers. The baseline data acquired from this study have the potential of affecting the way that health care is delivered to the Hispanic population. The results will provide ways to tailor culturally-specific interventions for the prevention and treatment of chronic diseases.

Total Expenditures: Section 1445 and State Matching Funds = $454,957

FTE's: 3.1

2. *Key Theme – Human Nutrition*

Project: *Chemical and physical characteristics of reduced and altered fat table spreads*

Description. Work was continued on the determination of the fatty acid profile of commercial margarines, assessment of their trans fatty acid contents, and ways to minimize their health effects. Fifteen commercial brands of margarines with fat contents ranging from 0 to 80% were tested. Fatty acids were analyzed by gas chromatography. Dietary phytochemicals in green tea were tested for their effect on trans fatty acids and serum lipoproteins in animal models. Diets consisted of (regular, regular with added cholesterol or trans fats). Serum and liver were analyzed for total cholesterol, serum HDL, LDL, triglycerides, and trans fatty acids. Fatty acid profiles of commercial margarines revealed that the trans fatty acid content ranged from 0% to 26% of total fatty acids. The predominant trans fatty acid was C-18:1T followed by C18:2TT and C20:1T. Commercial margarines contained variable and sometimes high levels of total trans fats. Green tea consumption improved serum and liver lipid profiles in rats through reduction in total cholesterol, LDL cholesterol, and trans fats. Higher levels of excreted cholesterol and total lipids were observed in rats that consumed tea. This suggests that phytochemicals in green tea could be used as a safe means of improving cardiovascular health.

IMPACT: Hydrogenation of oil into margarines yields trans fatty acids and margarines could represent a significant source of dietary trans fats with potential health risks to consumers. Determination of trans fatty acids in commercial margarines for potential inclusion on product labels will enable consumers to make informed purchase decisions and limit their dietary trans fat intake thereby reducing their health risks. Furthermore, natural phytochemicals could counter the cholesterol raising effect of dietary trans fats. Providing consumers with information on trans fats and introducing safe dietary means to improve serum lipid profile will benefit consumers and the US economy through improved quality of life and savings on the cost of medical treatment and loss of productivity associated with cardiovascular diseases.

Source of Federal Funds: Evans-Allen

Scope of Impact: State Specific

D. *Goal 4: Greater harmony between agriculture and the environment*

1. Overview

Under Goal 4, North Carolina A&T State University is addressing the following research areas: agricultural waste management, soil erosion and quality, and sustainable agriculture. The overview describes the major activities and accomplishments, while the more specific information about the impact is found in the Key Theme section.

Agricultural Waste Management

Efforts in waste management through the Agricultural Research Program have been placed on two areas dealing with North Carolina issues. One issue is dealing with swine waste and the other is addressing the avoided loss of by-products of manufacturing processes.

North Carolina is second to Iowa in national swine production. Thus, a major state concern is how to manage properly the resulting waste. Accidental spills from lagoons and over application of swine wastewater on land have forced the state regulators to find alternative technologies to lagoon to treat swine wastewater. In addition, the state has place a moratorium on the construction of lagoons for swine waste disposal.

Constructed wetlands are one of the alternate cost effective technologies to treat animal wastewater. A series of N loading rates in swine waste, ranging from 5 to 50 kg/ha/day with 9 kg interval, was applied to the six different marsh-pond-marsh wetland cells. However, the actual N loading rates appeared to be 6.4, 12.8, 22.5, 26.2, 34.3, and 37.2 kg/ha/day. The marsh areas were planted with cattails (Typha latifolia L.) and bulrushes (Scirpus americanus). The total N, NH4, NO3, total P, PO4, COD, total solids, PH, and temperature continue to be monitored on a weekly basis in inlet and outlet wastewaters of wetland cells.

Manufacturing processes in the United States generate nearly 325 billion gallons of waste and by-products yearly. Whey is a by-product of cheese processing that is regularly discarded. Whey contains a high quantity of lactose and other nutrients, which can be easily utilized to produce value added products such as vitamins, amino acids, and bacteriocins (antimicrobial compounds). Researchers are using a spiral membrane and 4% MRS to immobilize Lactobacillus helveticus, a controlled ph of 6.5 and a constant temperature of 37°C, cheese whey (substrate) was converted to lactic acid at the rates of 37% and 67% over 24 and 48 hours, respectively. Positive results from this project will provide possible value-added resource from cheese manufacturing processes.

Soil Erosion and Quality

Research experiments were conducted by soil scientists to determine the effects of tillage and wheel traffic compaction in a no-till system on herbicide loss, soil loss, and runoff under a soybean-corn rotation. Treatments were conventional tillage, strip tillage, no tillage with traffic control and no tillage with a fully trafficked surface. Soil erosion subplots, similar in design to the unit plots used for runoff and soil loss data collection in the development of the universal soil loss equation, were installed within each experimental plot.

No-till practices, in the soils of the Piedmont region of North Carolina, were more effective in reducing herbicide loss, soil loss and runoff than were conventional tillage methods. This effort is a long-term project aimed as assisting farmers as well as to prevent overall soil loss.

Sustainable Agriculture

Scientists are developing farmer-participatory research to produce integrated crop/ animal systems for utilizing swine waste to enhance farm (soil) productivity and preserve water quality. Information acquired will provide various production models to present to participating farmers.

The State of North Carolina, through its Golden Leaf Foundation, has made grants to institutions and groups that are assisting the tobacco farmers in the state to shift production to alternative farming crops and animal systems. North Carolina A&T has been successful in obtaining two major grants regarding alternative farming options. One is to research and demonstrate swine production using four outside methods versus the traditional indoor swine production method in the state. The project involves not only the production, but also the marketing of higher quality pork for restaurants and food chain stores. The other study involves the production of mushrooms as well as the marketing of the product statewide and beyond. These are beginning projects reported to show evidence of activities that are expected to have significant impact to be reported in future annual reports.

Total Expenditures: Section 1445 and State Matching Funds = $1,410,642

FTE's: 9.3

2. Key Theme – Agricultural Waste Management

a. Project: Constructed wetland for swine waste disposal

Description: North Carolina A&T State University's animal waste treatment research, located at the University Farm Complex's Swine unit, is focused on the marsh-pond-marsh system of removing nitrogen from swine waste. At the Swine Unit, which houses a 100 to 150 head "farrow-to-finish" swine operation, six constructed "wetland" cells are at the heart of a waste disposal system. The wetland cells use selected aquatic vegetation to absorb nitrogen, phosphorus and ammonium from the wastewater while water in the cells converts nitrogen to nitrogen gas, which is released into the air. The wetland cells use a "marsh-pond-marsh" type of construction in which both ends of a 40-meter long cell are populated by plant life such as cattails and bulrushes, and the middle is 30-inch deep open pond. They are designed to simulate a typical wetland setting, so that research findings are applicable to natural conditions. Most swine waste disposal systems rely on lagoons to remove contaminants from waste prior to land application. The use of wetland cells represents an additional treatment to the wastewater, and when used in conjunction with solid waste separation, will conform to the standards set forth by the moratorium.

IMPACT: Innovative approaches such as the marsh-pond-marsh system will become increasingly more important as the state's swine producers adapt to the recently enacted moratorium on the construction of systems that use lagoons as the primary means to treat swine waste. The use of constructed wetlands is a feasible alternative for treating swine waste.

Source of Funds: Evans-Allen

Scope of Impact: State Specific

b. Project*: Conversion of cheese whey into value-added products*

Description: An agricultural engineer designed a research project to: a) determine the effectiveness of a spiral sheet membrane to immobilize Lactobacillus helveticus; b) evaluate the performance of the spiral sheet membrane in continuous production of lactic acid from cheese whey as a substrate; and c) separate lactic acid from the fermentation broth using a membrane separation system to evaluate the successful immobilization of L. helveticus into the spiral sheet membrane. An 11-liter bioreactor was used for fermentation experiments under a constant temperature of 37°C. Samples were collected every six hours and analyzed by high-pressure liquid chromatography.

IMPACT: The use of the by-product of cheese whey can reduce waste from agricultural processes. Through further development and use in manufacturing, waste can be reduced and additional use can be made of by-products often discarded. This will translate in increased profits, less waste and decreased negative environmental impacts

Source of Federal Funds: Evans-Allen

Scope of Impact: State Specific

2. Key Theme – Soil Erosion and Quality

Project: *Soil/water quality modeling and evaluation of management practices for grain and vegetable production*

Description: Soil erosion depletes farmland of valuable nutrients and contributes to adverse effects on the environment. Research experiments were conducted by soil scientists to determine the effects of tillage and wheel traffic compaction in a no-till system on herbicide loss, soil loss, and runoff under a soybean-corn rotation. Surface runoff was 49% less for subplots with no tillage and controlled traffic (NC) compared with strip-tillage (ST) and conventional tillage (CT) subplots under a soybean-corn crop rotation.

1. Increases in runoff volume in no tillage, fully trafficked (NF) plots relative to NC plots ranged between 10 and 109%.

2. Soil losses were lowest in NC and ST compared to CT.

Herbicide (Atrazine and Metolachlor) losses in runoff and sediment were up to three times greater when conventional tillage practices are compared to no tillage and controlled traffic and strip tillage practices

1. Plots with no tillage and fully trafficked surfaces (NF) resulted in 75% more soil loss than plots with no tillage and controlled trafficked surfaces (NC).
2. Wheel-traffic compaction in no tillage plots (NC vs. NF) increased the loss by 78%.

IMPACT: Farmers can reduce soil erosion and loss of valuable nutrients by changing their tillage and soil/water management practices. Surface runoff can be reduced by 49% on plots with no tillage, and controlled traffic. Herbicide loss is three times greater for conventional methods versus the alternative means of no tillage and controlled traffic. Change in tillage methods results in reduced soil erosion and loss of natural nutrients, more effective use of herbicides, and reduced production costs.

Source of Federal Funds: Evans-Allen

Scope of Impact: State Specific

4. Key Theme – Sustainable Agriculture

Project: *Integrated crop and sylvan systems with swine*

Description: Raising hogs in dry lots containing leaves or no leaves (two six-month rotations) resulted in an increase in NH4-N, NO3, PO4 and total-P concentrations over time. Significant decrease in concentrations of NH4, NO3, PO4, total-C, total-N, and total-P were found with the soil depth. After corn was planted, a subsequent decrease in inorganic N and P concentration was found in plots having leaves. Inorganic N and P concentrations were decreased with the depth. Significant differences were not observed among treatments for corn yields and N uptake. This trend was due to the application of fertilizers in no-pig plots. Gestating sows completed their second rotations this year in sylvan or dry lot environments. Vegetative assessment and sow impact on the environment will be examined this spring after foliage emerges. Preliminary assessment indicates that hardwoods (oaks), are not affected (girdling, rooting, etc), by sow stocking rates; softer woods (cedars/junipers, elms) may be reduced in number by sow "marking" behavior. Ninety hogs (250lbs) were marketed in September and an assessment of meat quality was made to determine possible differences due to environment raised (confinement, dry-lot or pasture) or breed group. Meat quality differences were observed for rearing environments (Minolta scores: Light and Red fraction, and % drip loss). There were no differences in meat quality across breeds or rearing environment for intra muscular fat scoring or visual appraisal of color.

IMPACT: Development of pastured-pork production systems may prove beneficial to small tobacco farmers in southeastern North Carolina seeking a source of supplemental income and/or an alternative enterprise to replace declining tobacco quotas. In the past, the confinement pork production systems have not been profitable for small farmers. However, raising hogs through outside production can possibly provide a profit margin to replace or supplement small tobacco farm incomes. Small confinement pork producers in North Carolina have a production cost of $25 to $45/cwt and sell for $15/cwt. On the other hand, researchers anticipate that raising hogs in pastures will cost $35 - $45/cwt and sell for $45 - $55/cwt. Therefore, for outside pork production, producers are expected to net from $5000/A to $7000/A, respectively. This can greatly assist small NC tobacco farmers who net about $2500/A for tobacco production.

Source of Federal Funds: Evans-Allen

Scope of Impact: State Specific

II. **Stakeholder Input Process**

A. Sources of Gathering Input

The Agricultural Research Program in the School of Agriculture and Environmental Sciences (SAES) at North Carolina Agricultural and Technical State University routinely seeks feedback from agriculturally related stakeholders through a variety of formal and informal interactions and planned activities. These contacts involve all administrative levels within the SAES including administrators, researchers, staff, and students. The stakeholders include agriculturally-related industries, agencies, community groups, and county residents.

Agricultural Research Program

The Dean of SAES serves as the Research Director and is responsible for ensuring that the School maintains routine contact with consumers of the Agricultural Research Program (ARP), which includes members of industry, alumni, community groups, and county residents. For the past two years the Dean has served on the board of the NC Agribusiness Council, the trade industry for agribusiness in the state. Agribusiness is the largest industry in North Carolina and produces almost $60 billion annually. The Dean also serves on a number of other agriculturally-related boards including the following; *Agricultural Advancement Consortium* (a consortium appointed by the Governor to develop a plan to revitalize farming in the state and to advocate for legislation at the state and national levels; *North Carolina Agribusiness Council, North Carolina Agromedicine Institute, North Carolina Coalition of Rural and Farm Families, Inc., North Carolina*

Community Development Initiative, Inc., NC Farm Bureau Federation, and the Rural Advancement Fund International (RAFI).

The Dean also annually conducts information-gathering forums throughout the state to gain input on the programs and actions of the School. In these information-sharing forums, the School's research initiatives are presented and input is sought about the value and impact of these projects. This input is used as important sources for refining and developing the program initiatives of the School.

SAES Advisory Council

An Advisory Council to SAES is composed of representatives from agriculturally-related companies as well as other stakeholders with related interests. The Council meets annually to discuss the direction and achievements of the School's academic efforts with students but also responds to the research and Cooperative Extension activities. The group's input is used by the associate deans and department chairs and is included in the strategic planning of the SAES major program initiatives.

Annual Stakeholder Events

In addition to the formal meetings involving ARP administrators and stakeholders, the program conducts several annual outreach activities as a means for gathering input from those affected by the school's research activities or who use the research results. One major event is 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 both on and off campus involving Extension and research. Through this activity, SAES is able to share information about research underway at the University and receive 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 research projects.

Feedback is also sought about research and research related activities by the researchers, their research teams, and by staff associated with ARP and the University; the input is then shared within SAES and incorporated into future research activities

Cooperative Extension Services Environmental Scan Data. North Carolina A&T's Cooperative Extension Program, in collaboration with the Cooperative Extension Service at NC State University, annually conducts an environmental scan which involves surveying county residents, advisory groups, commodity groups, government agencies, volunteers and other groups about agriculturally related issues. The respondents provide information regarding needs assessment, issues, trends and emerging issues. This information is shared with the Dean/Research Director as well as with associate deans, department chairs, and individual faculty as related to their responsibilities and interests. This information is also shared with the Strategic Planning Council, an Advisory Board to the campus (NC A&T) Cooperative Extension Service group. This advisory board is

composed of community leaders, agribusiness persons, teaching faculty, Cooperative Extension team members and individuals representing non-governmental organizations. The Strategic Planning Council along with the SAES Associate Dean for Research meet to discuss this information and use it in research project reviews and for Extension planning in response to local and state needs and changes.

Department Level Advisory Boards. Two departments in SAES have main primary advisory boards, while some departments have additional advisory boards for departmental initiatives. These boards are composed of representatives from industry, public instruction, agencies, alumni and other groups that have a stake in the activities of the department in academic, research, and/or outreach efforts. The input from these Boards is used in molding current as well as future activities of the respective department. Their feedback is documented and shared with the faculty as well as the dean, associate deans, and other department chairs.

Faculty Networking. A major source of feedback from stakeholders comes from the extensive interaction and networking by individual faculty members. Faculty members serve on agricultural interests boards, are members of agricultural related organizations, and attend meetings of groups that have a stake in the activities and projects of the Agricultural Research Program. The major concerns and issues that may develop into research studies are shared with other faculty members, the department chair, the associate deans and the Dean. This information is integrated into planning by School and is reflected in its program initiatives and efforts to address interests and concerns of the diverse audiences served by the ARP. A faculty networking that has been institutionalized is the "Industry-Agency Roundtable Breakfast" sponsored by the SAES Advisory Council.

Boards and Organizations. The administrators and faculty are represented on a broad variety of boards and organizations that provide opportunities to document issues and concerns in the state. These concerns and issues are then shared with others in the School. A representative list of the board and organizations appears below:

- Advisory Board for Carolina Farm Stewardship Association
- Agricultural Advancement Consortium (governor appointed group to revitalize farming in state)
- American Dairy Science Association
- American Society of Animal Science
- Carolina Farm Stewardship Association
- Center for Energy Research and Technology (campus based)
- Center of Turfgrass Education and Research

- City and Farm Committee, Guilford County Cooperative Extension Service
- Conservation Council of North Carolina
- Fashion Group International--Carolina Region
- Guilford County Advisory Board on Environmental Quality
- Institute of Food technologists (IFT)
- International Textiles and Apparel
- North Carolina Agribusiness Council
- North Carolina Agromedicine Institute
- North Carolina 220 Swine Regional Group
- North Carolina Association of Family and Consumer Sciences
- North Carolina Board of Landscape Architects for License
- North Carolina Cattlemen's Association
- North Carolina Community Development Initiative, Inc.
- North Carolina Coalition of Rural and Farm Families, Inc.
- North Carolina Farm Bureau Federation
- North Carolina Future Farmers of America
- North Carolina Geology Advisory Board
- North Carolina Institute of Nutrition
- North Carolina Invasive Species Advisory Committee
- North Carolina Pork Council
- North Carolina Solar Energy Society
- North Carolina Turf Grass Environmental and Education Board

- Partnership of Under-Represented Scientists United for Education (PURSUE)
- Rural Advancement Fund International (RAFI)
- Sustainable Farming Program

B. How Groups are Selected as Stakeholders

The members of campus advisory boards are selected from the stakeholder groups that either use the research results produced or can employ students from the SAES degree programs. These persons are selected because of their positions in the various agencies, industries, or communities. Their input is solicited through informal sharing as well as received from more formal contractual or written requests.

C. How Stakeholder Input is Processed into Strategic Action

As described individually under the various sections of A above, the information gathered from the stakeholders is shared with faculty and administrators mainly through verbal discussions. The information is used to mold the strategic plans of the Agricultural Research Program and guides future development and use of resources.

III. Program Review Process

There have been no significant changes in our merit review and scientific peer review processes submitted as a supplement to our 5-Year Plan of Work.

IV. Evaluation of the Success of Multi and Joint Activities

Did the planned programs address critical issues of strategic importance?
Yes, during the FY2001 reporting period, the Agricultural Research Program was engaged in multi-state research activities using Evans-Allen funds. These activities dealt with critical issues of importance. Those activities (projects) were the following:

1. **"Impacts of Trade Agreements and Economic Policies in Southern Agriculture"** - a regional research project approved by the nine Southern region experiment station directors, which dealt with an assessment of the competitiveness of U.S. agriculture, particularly in the Southern region.

2. **"Food Choices: Perceptions and Purchase Behavior of Persons in Black Belt States"** – sought to ascertain differences in food safety perceptions and behavior between African Americans and other ethnic groups in VA, NC, SC, GA and FLA.

3. **"Rural Restructuring: Causes and Consequences of Globalized Agricultural and Natural Resource Systems" –** continued to address the management needs of small woodlot owners through a needs assessment. A collaborative study also has assessed methods for enhancing the profitability and survivability of small and medium–sized farms in selected areas.

Did the planned programs address the needs of under-served and under-represented populations of the State(s)?

Yes, the project **"Food Choices: Perceptions and Purchase Behavior of Persons in Black Belt States"** dealt specifically with an issue of concern to African Americans and other ethnic minorities.

Did planned programs result in improved program effectiveness and/or efficiency?

Yes, the projects conducted were multi-state in their approach and provided results that were regional in scope and not just state specific. Through this approach, research can be strategically focused as well as save valuable resources/funds through an elimination of project and program duplication. Also, the focus is on interdisciplinary and multidisciplinary research and Extension efforts.

V. Integrated Research and Extension Activities

The School of Agriculture and Environmental Sciences has embarked on a series of intensive activities planned to bring about increased and improved interaction among the School's academic, research and Extension components. A first step has been to focus efforts on clearly defined interdisciplinary program initiatives. These six program initiatives are the following: (1) Human and Community Development, (2) Biotechnology and Biodiversity, (3) Soil and Water Quality, (4) Agromedicine, Nutrition and Food Safety, (5) Small Scale Agriculture, and (6) International Trade and Development. These six program initiatives support the University goals as well as the five USDA goals.

To enhance interaction, all faculty and Extension specialists are members of teams on at least one of the six program initiatives. Two co-leaders coordinate each team: one leader is a researchers while the other is an Extension specialist. Two school-wide summits have been held annually that are guiding the school in this collaboration. The teams have completed asset inventories of funded research and Extension programs, personnel to support the program initiatives, associated degrees, laboratories and other infrastructure. The teams also identified barriers to collaboration including personality differences, infrastructure deficiencies, evaluation mechanisms, lack of incentives to collaborate, and lack of understanding of the scope and thrusts of research and Extension. Models of interaction have been presented and workshops on team building have been held. The teams have developed concept papers to guide the teams in major areas as well as specific focus areas.

Short term results indicated is that changes are occurring in several areas:

- Increased number of proposals submitted that have both researchers and Extension with significant roles in the study.
- Required component of new Evans-Allen proposals is demonstrated involvement with Extension.
- Co-sponsored campus events such as the Small Farms Week to include integrated research and Extension field events.
- Co-sponsored off campus events including the Southern Farm Show and the NC State Fair to include integrated research and Extension exhibits and events.
- Developed a joint seminar series of researchers and Extension specialists
- Shared information between research and Extension about stakeholder needs, issues and concerns.
- Developed a joint newsletter to showcase the research and Extension programs, activities and events.
- Added two new SAES positions with split appointment between research and Extension.
- Added Collaboration with research/Extension as a line item on the faculty annual evaluation forms.
- Involved graduate students to work with Extension specialists on nutrition project.
- Arranged for Extension personnel to attend a national research symposium (Research Symposium of the Agricultural Research Directors (ARD)) and researchers to attend a national Extension meeting

Long term results is anticipated to produce coordinated research and Extension programming to assure that research is addressing the key issues of the state and that mechanisms and procedures exist to deliver the information into the hands of audiences to use the results. A systematic means of jointly tracking research and Extension program impact is being developed.